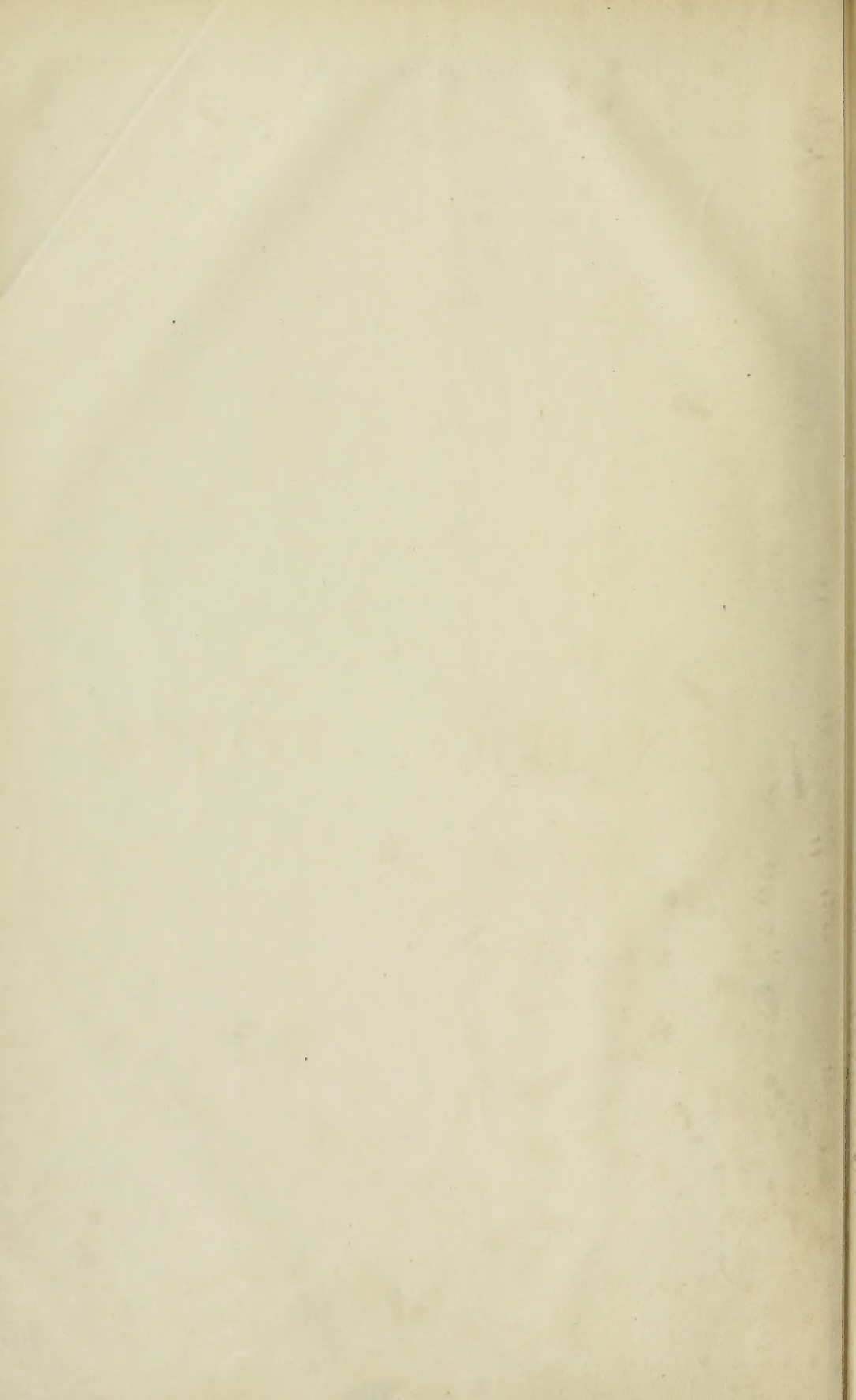


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AN AMERICAN CONVENTION.

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WHILE we on this side of the Atlantic have been com-
pelled this year to abandon summer conventions, public
dinners, and other functions which in the ordinary
course provide those opportunities for relaxation and
fraternisation which go so far to sweeten professional
and trade relations, events of this class seem to have
been taking place very much as usual in the United
States.

Indeed, from the American electrical journals lately
received we gather that the May convention of the
National Electric Light Association in Chicago was not
merely "as usual," for it is described as the greatest
convention the Association has ever held, great in point
of numbers, but greater "in point of accomplishment."
It seems that a spirit of optimism swayed the minds of
many hundreds of central-station leaders, their asso-
ciates, and affiliated interests.

We confess to something akin to envy, as we regard
the periodical doings of the N.E.L.A., and remember
our own failures to bring all similar electrical in-
terests in the United Kingdom into like fellowship.
It is but natural that the success of the Chicago con-
vention should make keener the feelings with which we
deplore the necessity for the abandonment of even the
comparatively small, but by no means unimportant,
congresses that it was hoped might have taken place
in Scotland last month.

We wonder whether the time will ever come when we
shall regularly look forward to a mid-year gathering
of men (and perhaps women!) representative of all
branches of British electrical engineering and trading—
an event by the date of which our overseas relations
might regulate their travels to the Mother Country.
That engineers are sociable beings is demonstrated by the
large support that is being given to the Engineers' Club
movement, and we believe that electrical and allied in-
terests would, under proper organisation, and with the
boosting influence of a second Commerford Martin, hold
what would be for us very big and profitable annual
congresses. Our colonial and other overseas friends
might send their special delegates, and representatives
could be elected to attend on behalf of all sorts and
conditions of electrical associations in the British Isles.
We have innumerable small bodies normally acting for
limited and specialised interests. Surely these could
all concentrate now and then for the consideration of
matters of common interest to the profession and in-
dustry—not merely for the sake of making a big
event do we advocate such a development, though
there is something to be said for the big thing
even if we are only on this side of the Atlantic. We
believe that this would result in the industry reaping
benefit internally in its own domestic relations, while
there would be external advantages, such as the impres-
sion that would be made upon the minds of millions
of people who know practically nothing about the extent
or importance of British electrical industry, as well as
upon the minds of men whose avocation calls them to
the centre of the City of London, and to whom we must
look for financial backing for the enormous expenditure
of capital that the electrical industry legitimately an-
ticipates within the next five or ten years. We will not
make comparisons between the British Association, which
exists for the advancement of all branches of science,

and one section of it, but large centres in the British Isles will be eager to show hospitality and shelter to the B.A., whose attendance sometimes runs to several thousands, might find it of equal advantage to entertain in their cities a thousand or two electrical men, especially if certain electrical organisations were to concentrate simultaneously upon making an electrical gala and exhibition demonstration in the same area.

We do not think it possible to indulge too frequently in prophecy regarding the future greatness of the electrical industry, and we observe that Mr. Samuel Insull, president of the Commonwealth Edison Co., in an address on the future expansion in the use of central station power, delivered at one of the large general sessions of the Chicago convention, was full of the spirit of progress. He referred to the troubled waters through which industrial concerns had been passing, and their consequent failure to pay dividends, and placed this state of affairs in contrast with the central-station business which was "getting back to its own," and getting ready for the time when the financial clouds would roll by and more stable conditions would prevail in business generally. The fundamental cause of this Mr. Insull describes as the inherent strength of the central-station business. "We are engaged in a business that has not yet reached a point of saturation, and are not so much governed by the ordinary laws of supply and demand as some of our friends in other forms of public utility business" (such as street railroad, water, and gas supplies). "Therefore," he added, "when hard times come along the main effect on us is a reduction in the percentage of increased business." "It would take a long period of depression to put the electric light and power industry in a position where its actual business, taking the country as a whole, would show a decrease in output, as compared with the previous year." While the difficulty of the last few years in coping with the increased business owing to lack of plant and equipment may have been such that "business-getting" departments have been practically disbanded, Mr. Insull now urges that if the present depression continues, his hearers should get busy with their business-getting departments. In the later parts of his address he dwelt upon some of the vast territorial areas in the States in which there is scope for electrical men, and the ample water power "that nobody but the Creator can interfere with." But he warned his hearers of the dangers that would follow if the heads of bureaus in Washington, in their efforts to enlarge their sphere, got such a hold on the electricity supply business as to curtail its development during the next quarter of a century. He held us up as the horrible example which should be avoided at all costs, as the following quotation will show:—

"We ought to profit somewhat by the experience of the English, who have been trying for years to get out of the situation created by the Chamberlain Bill in the '80's, which resulted in the establishing of 61 different undertakings for the supply of energy in the County of London, and resulted in the territory of 7,500,000 people using less energy than the city of Chicago with 2,500,000 people, and at a cost to the user in the County of London greater than is the bare cost of production, without interest or anything else greater than the average selling price of the same product in the city of Chicago. Those are the things we ought to guard against."

Mr. Martin J. Insull, president of the N.E.L.A., in the course of his opening address to the convention, referred to the immense amount of work that lay before the American electric supply industry. He said it was estimated that for the next five years the electric light and power industry would require, to provide for the demands that would be made upon it by the public, approximately \$1,000,000,000 per year. This sum will be spent upon the necessary steam and hydroelectric generating equipment and transmission and distribution systems with all the appurtenances necessary to give service. "Put into figures that may be more easily appreciated, approximately \$3,000,000 every day or \$125,000 every hour for the next five years must be provided and used for the public benefit." If it could not be provided the public would be the sufferer.

Mr. Insull mentioned the necessity for securing the

confidence of the public, to whom they must look to provide this capital. It must be recognised by them that the money was judiciously spent on property that could be economically and efficiently operated, and those concerned must plan to bring to the properties such different classes of business as would give the greatest return on the dollar invested. He added that on entering this period of vast money requirement they must give this question of their public relations the most careful consideration, as upon this very largely depended their ability successfully to take care of the anticipated requirements of the public. "Under present regulatory conditions the public, through their representatives, determine the class of service we shall give, the rates we shall charge, and the securities we shall issue. These representatives cannot help but have their judgment more or less affected by public opinion." The investor would be more easily attracted to our business, which is one affected by a public interest, if he knew that it had a generally favourable public opinion."

The unfortunate fact is that in this country, as Mr. Samuel Insull indicated, the industrial aspect of the business has for 40 years been subordinated to political considerations, from which it appears impossible to break loose. True, we have at last a body of Electricity Commissioners who can be trusted to do their utmost to develop the industry on sounder lines than have been followed in the past; but it is a Herculean task to burst the trammels that afflict the industry, and we see the political element constantly cropping up when electrical questions are under discussion. In passing, we must confess that we are seriously concerned for the physical welfare of the Commissioners, whose labours are almost superhuman, and who must undoubtedly be undergoing a strain upon their mental and corporeal faculties approaching the limit of endurance.

With regard to the future of the electrical industry, we are no less optimistic than Mr. Samuel Insull, whose remarks apply almost as aptly to British conditions as to those of his adopted country. Mr. Martin J. Insull quotes figures that almost leave one breathless, and cannot here be paralleled, but the principle which he puts forward—that the industry must command the confidence of the public in order to obtain the relatively immense capital sums that are essential to the due development of electricity supply—is wholly sound and equally applicable to British conditions. We recently explained at some length the functions of the Public Utility Commissioners to which he refers; similar functions will be exercised by our Electricity Commissioners and Joint Electricity Authorities, if all goes well, and on their policy it will depend whether the confidence of the investing public is gained for the industry, or not. Much might be done to enlighten the lay Press with regard to the true circumstances, in order to prevent the harmful "scares" which are periodically stirred up by those who worship "the god of things as they are." The British popular Press is not venal, but it is extraordinarily amenable to the persuasion of any wire puller who comes along with a popular cry.

Fuel Economy.

ONCE more we may recall the fact that one, if not the only, important principle at the base of the reports which led to the formulation of a national scheme for electricity supply was the necessity for economising fuel. That factor has not in the least diminished in weight, rather the contrary, though it does not appear to receive much attention nowadays. We were sharply reminded of the fact by one of the arguments put forward on behalf of linking up *versus* the erection of super-stations for the supply of the London area—namely, that, as many of the existing stations were uneconomical, the advantage of a fall in the price of coal would be greater in the case of the former than in that of the latter.

That is an argument which makes for cheapness, it is true—but at the expense of economy of fuel.

We by no means advocate the hasty erection of huge generating stations at a fabulous cost, merely to economise fuel; the engineers responsible for the schemes before the Commissioners have made the rather belated discovery, since last October, that the linking-up system will meet all present needs, and it is certainly the least costly method of dealing with the situation; but the economy of coal thereby effected is so small that the hoped-for reduction in the price of coal is actually used as an argument in its favour!

Whilst working out the most rational procedure in dealing with this complex question, let us not forget all about the main plank of our platform—*fuel economy*.

The Mining and Engineering Disputes.

On Tuesday last the Prime Minister announced in the House of Commons that as a result of the negotiations between the miners, the mine-owners, and the Government, an agreement had been reached. The men's Executive will recommend the miners to accept the terms of settlement, and if they do so will ask the men to return to work on Monday next. There will thus have been a cessation of work from April 1st until July 4th. Wages are to form a first charge on the mining industry, and a standard is to be set up below which wages will not fall. The standard is 20 per cent. above the pre-war rate of earnings. For every £100 received by the workman in respect of his standard wage, the owner is to take £17, and further proceeds are divisible in the proportion of 83 to the workman and 17 to the owner. The settlement is to be effective until September 30th, 1922, and may be terminated then or thereafter by giving three months' notice. The first reduction in wages will take place in July, and will not exceed 2s. per shift, 2s. 6d. in August, and in September 3s. per shift. After that the permanent arrangement comes into full operation. The Government subsidy of £10,000,000, which had been withdrawn, will be reinstated, and the House of Commons will be asked to vote the grant.

Everybody interested in the revival of British industry will feel relieved that the struggle is ended, and that there is a prospect of eighteen months' coal peace. The engineers who are balloting this week on the revised terms offered by the employers stand under a great responsibility. It would be deplorable if just as there was a resumption of operations in the pits a period of idleness should commence in the engineering works. The reports available at the moment are not very promising, but the case for a reduction of wages as a means of lowering the cost of production is overwhelmingly strong. We cannot imagine that the engineers will desire to resort to an endurance strike which can only be wasteful to everybody—employé, employer, the engineering industry and the nation as a whole. We trust that a way will be found for a speedier settlement to be reached than proved possible in the mining industry. It was never so urgently necessary as it is now that we should all settle down to real hard work.

The Post Office and Trade.

Mr. KELLAWAY, addressing a Prime League gathering in Bedfordshire, said he had had to begin his work as Postmaster-General by doing a most unpopular thing in raising the postal charges. We believe that he knew the seriousness of his proposals before the public heard of them; the public by its loud and unanimous condemnation of them merely confirmed what he knew already; and when he stood up in the House of Commons to make his statement the atmosphere was uncomfortably chilly. Mr. Kellaway now says that he looks forward to the time when these increased charges will be taken off. If only industrial conditions improve and trade picks up, he hopes to remove them. We hope he will. The dropping of his advisers' proposals to tax prohibitively the circulation of printed papers and catalogues abroad was a relief to all who want to see an early revival of export trade, but we would point out that what remains of the Kellaway

policy is still in restraint of trade; the increased charges are more likely to handicap British trade than to give it any chance of picking up. At the same time it seems almost certain that the aforesaid policy will not bring increased revenue or effect any saving. It may be that the postman will call at the door with one letter and one postcard, instead of two letters and two postcards. He will walk his rounds just the same, and there will be no saving in his wages. The abolition of Sunday collections and deliveries in the Provinces as well as in London, is a serious hardship, and one which places us still further back in comparison with Continental nations, who are amazed at our methods. It has been noticed in many business houses that Monday morning's mail is smaller than it used to be.

We believe that the increased charges on railway travelling are also penalising commercial travellers and the general public as well, without bringing any real help and assistance to the companies, except in the case of the tubes, and some local services, where people are obliged to travel to their business, and are, therefore, at the mercy of this method of obtaining revenue. In other cases, we believe that the reduction in travelling more than counterbalances the increased charges, and many trains are running half empty, even in these times of reduced services.

Such methods of management damage trade, and injure the travelling public, and do no one any good.

It is high time that the Government dropped the delusion that the only way to make a business pay is to charge more for the services rendered. The adoption of this as the one and only panacea for the present deplorable state of expensive inefficiency into which it has allowed our public services to fall, should be abandoned.

A New Phenomenon.

In a long and interesting letter to the *Nature* of June 23rd, Prof. ELLIOT THOMSON announces the discovery in April last of a new magneto-optical effect. His son, Mr. Malcolm Thomson, was using a resistance welder by which the current was applied intermittently, when one of the operators, Mr. Davis, drew his attention to a peculiar intermittent illumination of the space near the welder as the current went on and off. Sunlight was shining across the space, and a single-turn loop from the welding transformer, forming the connection with the work, was carrying 7,000 amperes. On investigating the conditions, Mr. Thomson found that the effect was most conspicuous when viewed at right angles to the magnetic field and to the beam of sunlight. Prof. Thomson examined the luminous effect with a Nicol prism, and found that the light was polarised. Further investigations showed that the effect was dependent upon the presence of finely divided particles from iron arcs used for welding in the building, particularly associated with a yellowish-grey fume arising from the arc, and that the polarisation was complete in the case of this fume, though the magnetic field was strongly curved. An exceedingly small amount of the material makes the whole of the air in a large room capable of showing the effect, the particles being extremely fine, remaining suspended in the air for a long time, and being quickly diffused throughout the space. Microscopic examination of the fumes suggested that the minute particles were often strung together like tiny chains.

We have not space to pursue the matter further, and we do not suggest that the phenomenon has any direct bearing on industry; whether it will lead to utilitarian results remains to be seen. But it is unquestionably of great interest from the point of view of pure science, and it affords an apt illustration of intelligent observation. Mr. Davis noticed an effect which appeared to be novel and unexpected; probably many others had seen it before him, but it had made no impression on their minds. The history of science is full of instances of phenomena thus seen but not appreciated—the man who eventually realises the fact that he is face to face with something new is called a genius, simply because his mind is on the alert.

ELECTRIC VACUUM CLEANERS.

BY ONE WHO HAS USED THEM.

THAT there is a wide demand for an effective and inexpensive cleaning machine cannot be doubted, for science has been making such strides lately, that the housewife takes it as a matter of course that some machine to lighten the labour of cleaning her house has been devised.

It has been proved, and, indeed, does not need much demonstration, that the simplest, cleanliest, and most healthy way of removing dirt, is by introducing it to a vacuum. The dirt does not stop to argue—it goes.

But, like everything else, knowledge is essential to the use of an electric vacuum cleaner—the knowledge of how to utilise it to the best advantage.

The salesman selling the machine is familiar with its demonstration points, but he will not enlarge on such common faults as clogging of the dustbag, the motor running without oil, the nozzle rubbing right into the carpet, &c.—indeed, it is doubtful if he has ever concerned himself about its working troubles at all. The luckless purchaser is left to find these out for himself, and discover the remedy by sad experience.

In view of this fact, the dealer will find it worth while to acquaint himself with the common misuses of electric vacuum cleaners, and to forearm his prospective customer by forewarning him.

As one who has witnessed many scrapes with troublesome and rebellious vacuum cleaners, I propose to discuss in the following article the various troubles and drawbacks attendant on the use of vacuum cleaners, in the hope that it may prove of some assistance to the dealer.

One of the chief reasons of a cleaner not proving effective is that the common mistake of lowering the nozzle right down on to the carpet has been made. When a vacuum cleaner is provided with adjustable wheels this is a very serious error, for instead of gaining a better suction, the suction power is diminished. The user should always see that the wheels are adjusted to keep the nozzle the correct distance from the floor or carpet to be cleaned.

What should happen is that the carpet should be lifted a short distance off the floor and held there by the suction. In addition to getting a strong suction, there is also a current of fresh air flowing through the carpet.

When cleaning felt, or some similar floor covering, this is sometimes too heavy to rise to the nozzle, and should this be the case, the latter should be lowered, but not, if possible, actually to the level of the felt. The principle of keeping the nozzle at least one-eighth of an inch off the carpet or rug should be strictly adhered to, unless the carpet is nailed down to the floor.

The prospective owner of a vacuum cleaner should be made well aware of this fact.

Any cleaner which does not provide a suction capable of lifting the carpet this distance is not worth consideration, and the dealer is strongly advised to leave it alone.

Users are often great sinners with regard to the dustbags. It is very painful to see a good vacuum cleaner rendered almost useless, because the bag has become too full or, as sometimes happens, choked at the neck.

Where there is no exit for the air there can be no suction, and it frequently happens that through the bag not being properly emptied, the inlet becomes choked, and the suction is considerably reduced.

This is particularly true of bags which are emptied at the opposite end to the inlet, and those bags which are provided with side pockets for the dust to collect in, the latter being particularly subject to the nuisance of choking.

The bag cannot be emptied too often.

Most dealers have no doubt met the old lady who, having purchased some electrical appliance, complains some months later that it won't work properly, and makes a noise, and she is getting afraid of it. And she has to be told that it won't work properly or cease making a noise—until it is oiled again.

It is extraordinary how many people will use an electric vacuum cleaner many hours a day and never think of oiling it. Needless to say, this considerably shortens the life of the motor, and makes the machine much more noisy than it should be.

There has been much controversy of late as to whether revolving brushes inside the nozzle are effective or otherwise.

From my own observations, I should prefer not to use a machine with a motor-driven brush in preference to a simple vacuum cleaner, for several reasons.

A motor-driven brush certainly takes up any fluff or nails which may be lying about, but it is also certain that it takes up the nap of the carpet. Also, should the carpet be delicate, or be of felt, the revolving brush will injure it.

It has been claimed that the vibration of the brush will loosen the embedded dirt, so that the suction can bring the dirt out of the carpet more readily. There is certainly some truth in this, but it will not, contrary to popular belief, bring dirt right through the carpet.

I have often seen a most effective demonstration where a machine with a motor-driven brush inside the nozzle has been stood upside down, and a piece of felt put over the nozzle.

Some dirt is then put on the felt, and the cleaner switched on. The beating action of the brush vibrates the felt, and the dirt is seen to disappear through it. But it is the vibration which pulls the dirt through, not the suction, for should the same piece of felt be laid on the floor, and the dirt put under it, the same cleaner will not affect it in the slightest.

Vibration under a carpet may draw the dust down, but vibration over the carpet will not draw the dirt up. A small fixed brush inside the nozzle is often met with, but, although a useful addition, it is not very effective.

Lately vacuum cleaners have been put on the market with a small revolving brush inside the nozzle, simply driven by wheels making contact with the floor, but this is not really of any material assistance to the suction, provided the suction is all that it should be.

Simplicity is an essential in any electric household appliance. The average housewife does not appreciate complicated actions. She is afraid of them. Certainly, as regards vacuum cleaners, simplicity is one of the most important features, and the dealer would do well to concentrate on the more simple type of cleaner rather than on the more complicated one.

For constant use, especially where subjected to hard wear, the fewer parts there are to get out of order the better. The vacuum cleaner is necessarily often in the hands of those who understand nothing about it, and it is subjected to sundry shocks and blows in consequence.

Switches operated automatically by a movement of the handle and other ingenious contrivances are all very well, but in actual everyday use they have their drawbacks. The most convenient form of switch is the one on the end of the handle, which, by slightly twisting, the machine is switched on or off.

Another important feature of the simpler machine is its lighter weight, a considerable advantage when the machine has to be lifted about by a woman.

And last, but not least, the simpler machine is usually cheaper. But apart from the question of price, the simpler type of machine is undoubtedly superior to the more complicated cleaner, for many reasons.

Enthusiastic salesmen should be warned that a vacuum will not do impossibilities in cleaning.

There is a popular impression that a vacuum takes up dirt in a fashion that puts all other cleaning devices to shame, but this is somewhat erroneous.

A vacuum cleaner will clean a carpet more effectively than any known form of household appliance, but very often a little work on the furniture with a duster will be more effective than the accessories of the cleaner.

Should the place to be cleaned be an out-of-the-way corner or cornice, or shelf, however, one of the attachments is very useful, and there is no doubt that for the cleaning of mattresses and upholstery the cleaner is very effective, and much more thorough than the ordinary beating and brushing.

One of the most useful attachments in actual practice is the blowing device, the strong blast of air being much more effective in moving the dust from crevices than suction.

The result of my experience with all kinds and classes of electric vacuum cleaners is to strongly recommend the simple effective suction sweeper, with no motor-driven brush, and a suction strong enough to lift the carpet 3/16 in. off the floor.

While cheap and inferior machines should be avoided, the dealer would be well advised not to harbour the ultra expensive cleaner.

Simplicity should always be the watchword of the dealer when handling electric vacuum cleaners.

UNEMPLOYMENT INSURANCE.

By JOS. J. H. STANSFIELD, F.C.I.S.

ABOUT ten months ago (August 9th, 1920, to be exact) the Unemployment Insurance Act, 1920, received Royal Assent, and due, or partly due to the exceptional circumstances of the times, two amendments of that Act have since become law, and a Bill has now been presented by Dr. Macnamara under the "ten minutes rule," to reduce as from July 4th, 1921, the benefits to be received and increase the contributions to be paid as provided by the principal Act, and the amendments above mentioned.

Under the Unemployment Insurance Act, 1921, the weekly benefits of 15s. for men and 12s. for women were increased to 20s. and 16s. respectively, and from July 3rd, 1921, the weekly rates payable by employed persons and employers were to be increased as follows:—

From the employed person	Aug., 1920	July, 1921
Men	4d.	5d.
Women	3d.	4d.
Boys under 18	2d.	2½d.
Girls under 18	1½d.	2d.

From the employer	Aug., 1920	July, 1921
For Men	4d.	6d.
Women	3½d.	5d.
Boys under 18	2d.	2½d.
Girls under 18	2d.	2d.

Should the Bill now introduced become law, the rates payable from next July will be materially increased before the Act passed last March comes into force, details of which will in due course be published.

Last March the Insurance Fund had a credit of over 22 million pounds, and the Government agreed to increase out-of-work pay as mentioned above, as they calculated that the accumulations which had been made during the war would last until July, 1922. The rapid growth of unemployment (which has reached 23 per cent. against the estimated percentage of 9½) has, however, upset all calculations, and the fund has fallen to 8½ millions, with entire exhaustion within early eight.

The Act of last March provided for Treasury advances not exceeding a total of 10 millions, but the new Bill proposes to increase these to double that amount, though

the advances are only intended to be temporary, and are repayable with interest thereon to the Unemployment Fund.

Part of the increased cost of insurance is due to the ever increasing unemployment. Many employes have been compelled to exhaust the 16 weeks' benefit allowed by the Acts, and they cannot, as matters stand, obtain any further assistance until October or November of this year, a condition which may again arise between November, 1921, and July, 1922, and although the waiting period is to be increased from three to six days, it is proposed to ameliorate the difficulty and extend the benefits by six weeks.

The Unemployment Insurance Act, 1920, provided that the increased benefits and contributions should cease on July 1st, 1923. It will be of general interest to "wait and see" whether the Bill will vary this limited period.

JOINT ELECTRICITY AUTHORITIES.

London and Home Counties Inquiry.

(Continued from page 819.)

THE CONFERENCE SCHEME.

On the conclusion of the London County Council's inquiry on Tuesday, June 21st, Mr. TURNER presented the report of the Conference of Local Authorities Concerning Electricity Undertakings in the area delimited, representing all local authorities owning electricity works except Epsom, Egham, and Watford. The scheme of the Conference, he said, in the area scheduled by the Commissioners. The Joint Electricity Authority would, under the terms of Section 6 of the Act of 1919, be representative of the authorised undertakers, and to that end, the total of 29 would constitute 12 representatives of the local authorities, 12 of the companies (of whom eight would be appointed by the purchasers), three representatives of large consumers and labour, and a chairman and vice-chairman. In that way the authorised undertakers would always be in a majority, as he contended was contemplated by Section 6 of the Act of 1919, instead of in a minority, as under the L.C.C. scheme.

Counsel went on to deal with Clause 14 of the L.C.C. scheme, which lays it down that all undertakings must be transferred to the Joint Electricity Authority. He argued that this clause was *ultra vires*, inasmuch as it was virtual compulsion, whereas by Section 6 of the Electricity (Supply) Act of 1919, the consent of the authorised undertaker must be obtained.

Sir JOHN SNELL said the Commissioners would not be satisfied with any scheme which left it doubtful whether the authorised undertakers would agree or not. If all the authorised undertakers in the whole area except four were in agreement, as he gathered they were, then he could see no objection to compulsion.

Mr. TURNER said he was bound to regard the legal position, and he would show that the Conference scheme would give the same result as the L.C.C. scheme, without the same wide measure of control as was suggested in Clause 14 of the L.C.C. scheme which, he contended, was *ultra vires*.

Mr. DUNCAN WATSON, chairman of the conference, was the first witness.

Mr. Watson, continuing his evidence on Wednesday, June 22nd, said the Conference had been fully alive to the necessity for an improvement in the control of electricity supply in the area, but it was felt that Clause 14 of the Conference scheme which made provision for voluntary arrangements or in the alternative by an order of the Authority, subject to an appeal to the Commissioners, met the case. There were at the moment 34 local authorities willing to work on a scheme voluntarily, and to use their borrowing powers. Already in the eastern and western portions of the area such voluntary linking up had been put into force.

Mr. Henderson, K.C., cross-examined on behalf of the L.C.C., and dealt first with the question of control. Mr. WATSON said the view of the conference was that the local authorities should have the right of appeal to the Commissioners, thus making the Joint Electricity Authority an effective link between the authorities and the Commissioners.

Counsel put it that the whole aim of the scheme seemed to be to cut down the powers of the Joint Authority, and that the object of the L.C.C. scheme was to give the Joint Authority absolute control as regarded generation. Under the Joint Authorities' scheme, the Joint Authority had to approve of new proposals for generating stations and apparatus, and give its own consent to stations which it proposed to erect itself, without the consent of the Commissioners. The L.C.C. scheme provided for the consent of the Commissioners.

Sir JOHN SNELL said that nothing in any of the schemes could take away from the Commissioners the powers of consent to the creation of generating stations centred on them by Parliament.

Mr. WATSON, answering questions regarding purchase, said there should be no objection on the part of the local authorities to the principle of transferring their generating stations to the Joint Authority, provided the terms were satisfactory, but the objection was to the expenditure of such a large capital sum now as would be necessary.

Sir JOHN SNELL asked the members of the Conference would object to the transference of their stations on the payment by the Joint Authority of the outstanding debt charges. Mr. WATSON said a resolution had been passed by the Conference on March 22nd, 1921, to the effect that the terms of any transfer of generating stations or transmission lines to the Joint Authority should be: (1) The taking over of the outstanding debt, or (2) payment of the capital cost less depreciation, whichever was the higher.

Another point mentioned by Mr. Henderson in cross-examination was that the Conference scheme gave the Joint Authority power to manufacture electrical machinery, and Mr. Watson thought there should be this power, if necessary, so long as the plant required was for the London scheme. The Conference scheme also provided for the payment of the chairman and vice-chairman of the Joint Authority, and also the reasonable expenses of the members, which Mr. Henderson said would increase the administrative expenses. Mr. WATSON said the idea was to get the best men.

Mr. KENNEDY, for the nine companies, put some questions with regard to purchase. He asked if for the companies' generating stations the same principle should be applied as had been suggested for the local authorities.

On the subject of control by the Joint Authority, Mr. Kennedy said the companies took the view that the Joint Authority should have a more practical control than was suggested by the Conference scheme. Bearing in mind the proposed appeal to the Commissioners referred to by Mr. Henderson in his cross-examination, he mentioned that no appeal to the Commissioners was suggested with regard to the technical scheme. Mr. WATSON said there was no need for that, as the technical scheme was agreed. So far, however, he admitted that the local authorities had not passed any resolution pledging themselves to work it. Similarly, with regard to the capital expenditure of £1,050,000 contemplated to be necessary during the first few years, no resolution had been passed, but the money would have to be raised, although he was not prepared to say whether the money would be raised on the security of the rates or only on the undertaking. If with the security of the rates that would give an advantage of 2 per cent. to the Joint Authority.

Sir JOHN SNELL asked specifically whether Mr. Watson could give a definite assurance that the money would be raised on the security of the rates of the various districts. Unless the Commissioners had some definite evidence that the scheme would be supported favourably by the Conference authorities, they could not fairly judge between the different schemes. Mr. WATSON said he could not give a definite assurance, but the estimates had been drawn up, in the engineering scheme, on the basis that the rates would be behind the raising of the capital.

Mr. KENNEDY, dealing with the representation on the Joint Authority, put it that the L.C.C. or companies, if they found the money, should have a preponderating representation, but witness would not agree to that proposition.

Answering a question by the chairman, Mr. WATSON said that the 34 authorities representing the Conference would agree to work the scheme, so that any difficulty with regard to Section 14 of the L.C.C. scheme being *ultra vires* would be got over in that way.

The L.C.C. proposal of autocratic control on the part of the Joint Authority was discussed between Mr. Donald, representing the East London scheme, and Mr. Watson, the result of which was complete agreement between them that, as in some parts of London linking-up had been carried out quite successfully on voluntary lines, there was no need to introduce an Authority with autocratic powers.

Mr. DONALD asked specifically whether the Conference would agree to an amendment of the scheme to the effect that if a number of local authorities combined, and could provide an area which would absorb the activities of one capital station, then such an area should be formed, subject to the consent of the Commissioners. Mr. WATSON replied in the negative, the reason being that it would depart from the general scheme of the proposal that there should be unification over the whole area.

Questions followed as to where economy was to come in from the work of the Joint Authority for so large an area. Mr. Watson did not agree with the figure of £40,000 or £50,000 per annum for the administrative expenses of the Joint Authority during the early years, and put the cost at nearer £20,000, because it was not proposed under the Conference scheme to set up a large administrative staff at the beginning.

Mr. DONALD's case was that separating the area into a few smaller districts would result in a cheaper supply being given to industrial London. Linking-up industrially was part of his case, but he wished to be independent financially.

Mr. WATSON said the aim of the Conference was the linking-up of the east of London, and at one time linking-up

with the west had been suggested. Mr. DONALD's retort was that this linking-up was not connected with any financial grouping; it only related to electrical linking-up. Following this up, he put it to witness that originally there was a proposal that the rates should be pledged with regard to the capital, but that it had been withdrawn in the discussions of the Conference in order to secure unanimity. Mr. WATSON said it was not felt necessary to state this definitely in the scheme, but he could not imagine how the money could be raised in any other way.

COUNSEL for the Metropolitan Electric Supply Co. suggested that the best plan would be to deal with the County of London first, and leave the surrounding districts alone.

Mr. BAGGALLAY, for the Middlesex County Council, raised the question of how much of the Conference scheme would fall to the ground if the Electricity Supply Bill (No. 2) did not go through, as many of the clauses of the scheme were taken from the Bill. Mr. WATSON said there was no reason why any part of the scheme should go. The authorities were ready to co-ordinate the demands of the area.

Sir HERBERT NIELD, K.C., then cross-examined for the Hertfordshire and Surrey County Councils on the same lines as he had previously done, pointing out that as the Conference scheme, equally with the L.C.C. scheme, did not offer any immediate benefit to Hertfordshire, that county should be left out.

Mr. KENNEDY, who had submitted a scheme, as the inquiry was closing for the day, said that after having heard what had taken place so far, the companies desired to make certain modifications in their scheme. Mr. DONALD, for the East London district scheme, asked that a certain indulgence should be extended to the other parties if they desired.

Sir JOHN SNELL said that what was allowed to one must be allowed to all.

When the inquiry opened on Thursday, June 23rd, Mr. WROTESLEY, who appeared with Mr. Baggallay, for the Middlesex County Council, explained precisely the attitude of that body. He said there were certain objections on the part of the Middlesex County Council to all the schemes, such as those dealing with representation and finance. If certain modifications were made in the scheme of the Conference of Local Authorities, it might be that the Middlesex County Council would withdraw its objection to inclusion in the area.

Mr. DUNCAN WATSON's cross-examination was then continued. Attention was given to the method of meeting the administrative expenses of the Joint Electricity Authority during the early years. According to the scheme, the expenses would be met by the authorised distributors taking a supply from the Joint Authority.

Sir HARRY HAWARD said it was not quite clear what was going to happen if none of the authorised distributors took a supply from the Joint Authority during the first year or two. Who was going to meet the administrative expenses?

After considerable discussion, Mr. WATSON stated that in his view all the parties concerned, whether taking a supply or not, should contribute, and to that extent he agreed with the proposals of the L.C.C.

Mr. BAKER, for the North Metropolitan Power Co., said that as the scheme had been deposited, no portion of the administrative expenses would fall on his company. Now, it would seem that the company would have to bear a share of the administrative expenses in proportion to its output. Thus the larger the business of the authorised distributor the larger the sum which would have to be paid towards the administrative expenses, and the North Metropolitan Power Co., as admitted, would receive no assistance from the Joint Authority for some years.

Mr. WATSON agreed, but said that the amount would be very small, as only that proportion of the administrative expenses would be levied upon the authorised distributors which was not chargeable to capital expenditure.

Mr. WATSON, in reply to Mr. Baker, said the Commissioners had put forward the area, and he assumed that it had to be adhered to. On the other hand, Mr. Rider, who had advised the local authorities as well as the L.C.C., had stated that it would not hurt the scheme to cut out certain areas, having been told during the inquiry that it was not essential to feel bound to the provisional area. In that respect, Mr. Watson and Mr. Rider did not agree, because Mr. Watson had said the North Metropolitan area was essential, whilst Mr. Rider, although desiring to have the whole area, as being a suitable one for the purposes of electricity supply, had admitted that parts of the North Metropolitan area might be left out. Mr. Baker also ascertained that the basis of company representation on the Joint Electricity Authority was that all the companies were purchasable, whereas the North Metropolitan Power Co. was not purchasable. Mr. WATSON agreed that this would require a modification of the basis of representation.

Mr. TURNER, in his re-examination, pointed to an answer by Mr. Rider in which he stated that the North Metropolitan Power Co.'s area was essential to the scheme, in that it might contribute to the general supply, as well as eventually receive assistance from the general scheme. As to the proposal of the local authorities to split the area into four separate authorities, Mr. WATSON said the idea was to have four divisional committees to collect information, but only one Joint Electricity Authority was intended all along. The Conference did not feel itself bound to adhere to the terms of the resolu-

tions already passed as to the purchase of the local authorities' generating stations.

Sir HARRY HAWARD said he still could not understand the position of the local authorities as to raising capital for the purposes of the Joint Electricity Authority. Until the Electricity Supply (No. 2) Bill was passed, the local authorities had not the power to assist the Joint Authority. Even when that was possible, he did not see how the local authorities could raise money and lend it to the Joint Authority. Usually the local authorities borrowed from the L.C.C., and the best plan would be for the L.C.C. to guarantee the interest on the Joint Electricity Authority's capital.

Mr. WATSON said the one thing he wished to emphasise was that the local authorities did intend that the money should be raised on the security of the rates.

Sir HARRY HAWARD, dealing with the proposal to give the companies and the local authorities equal representation on the Joint Authority, pointed out that the capital expenditure in the case of the companies was £20,000,000 and the local authorities £12,000,000, and therefore the representation should be as 3/5 to 2/5, instead of equal.

Mr. WATSON replied that the local authorities' interest was freehold, whereas the companies' interest was leasehold.

Sir HARRY questioned whether the companies and the purchasing authorities should be held as one and the same. Mr. WATSON thought it was right, as when the purchase took place the purchasing authorities would then have the same representation as the other local authorities. If the North Metropolitan Power Co. was taken over by the Joint Authority, he saw no reason why it should not have separate representation.

Sir HARRY said that if the local authorities did not exercise their purchase rights, the extra representation would go to the companies, and that, again, rather suggested that the principle adopted in arriving at the proportion of representation was not a sound one. Another point made by Sir Harry Howard was that the City of London Corporation was given one representative, as an authority with purchase rights, and Mr. WATSON said he would not deny that that was also done partly with the hope of financial assistance for the Joint Authority.

Mr. WATSON agreed that if separate representation was given to the Middlesex County Council, similar claims would be made by the other counties, and that that would constitute an important alteration in this part of the scheme.

Sir HARRY HAWARD, referring to the three representatives for railway companies, large consumers, and labour, elicited that this meant only one representative each, so that the railway companies and large consumers would only have the same representation as labour. He asked why labour should have any representation at all. Labour was already largely represented on local authorities.

Answering Mr. Page, witness said the absolute control of the Joint Authority was quite right in principle, but his experience of the past few years indicated that the same thing could be effected voluntarily, and at less expense. The absolute control aimed at by the L.C.C. scheme might probably come into effect later, when the capital stations were built, but during the first stage he believed the authorities would agree among themselves to do all that was necessary.

Mr. LACKIE followed up the question, and asked if, say, eight engineers in eight stations in a particular area did not agree, the result would not be better obtained with an absolute control from the beginning by the Joint Authority. Mr. WATSON said the experience was that differences did not occur in practice, but the existence of the Joint Electricity Authority to come in also, would improve the position, and was what was wanted.

Replying to the chairman, Mr. WATSON said he was in favour of perpetual tenure to the companies, if the sliding scale of prices and dividends was applied. This applied to distribution, and he considered it urgent and necessary that the whole of the generating stations should in some form pass to a central authority.

Sir JOHN SNELL suggested that if the Commissioners were able to evolve a scheme out of the first three schemes, it would be desirable that some definite principle should be inserted, upon which the stations should be acquired and the distributors controlled.

Mr. WATSON replied that if that could be done the Commissioners would amply have justified their appointment.

Sir JOHN SNELL suggested that the promoters of the three first proposals should confer on the matter. He did not, however, wish other promoters to think that the most impartial consideration would not be given to their schemes. That was a risk he ran in making such a suggestion. He added that the differences between the Conference and the L.C.C. were so small that they ought to be capable of easy solution.

Mr. C. H. WORDINGHAM, who took part, with Mr. Rider, Sir Alexander Kennedy, and Mr. G. W. Partridge, in drawing up the technical scheme, was then called. On the question of control by the Joint Authority, he said he would prefer autocratic powers. The difficulty, however, was that there was no power of compulsion under the Act of 1919, and that made it extremely difficult to draft these schemes. The clauses in the Conference scheme gave a very large measure of control nevertheless. Although there were not autocratic powers of control in the Joint Authority, the initiative came from it, and its decisions were subject to the approval of the Commissioners. On the question of the reasons for advising

the linking-up scheme as opposed to erecting capital stations at once, Mr. WORDINGHAM agreed with the views already put forward by Mr. Rider, adding that as many of the existing stations were uneconomical, the advantage of a loan in price of coal would be greater than would be the case in a capital station working under more economical conditions. Starting from the point, therefore, that the cost of supply from the linking-up scheme and from capital stations built at once, would be about the same, it followed that greater advantages would be obtained from a loan in the price of coal from the linking-up scheme in the early years. As to railway supply, Mr. WORDINGHAM said that any supply to the railways should be on the basis of a definite maximum demand, a definite annual consumption, a price which involved no loss, a contract for a period of years to enable the capital expenditure to be justified, and, finally, reasonable notice of the railway companies' demand. At the same time, he said that railway companies could supply themselves more cheaply. The combined supply would benefit from the existence of the railway load, but the railway would suffer from the combination, because it would have to bear part of the expenditure on transmission and administration not connected with the railway load.

Sir JOHN SNELL said there seemed no reason why the railway companies should be charged more than the actual costs attributable to their load, properly apportioned out. In that case, he did not see that the railway companies could generate more cheaply than a capital station for a joint supply. Indeed, he thought that by combining the two loads in one station both must benefit compared with dealing with the railway load from one station and the general supply, less railway load, from another station.

Continuing his evidence, Mr. WORDINGHAM referred to the advantage of being able to supply the outlying districts from the railway mains, as already indicated by the chairman. On the general technical details, he agreed with the scheme put forward by Mr. Rider.

Mr. CRAIG HENDERSON cross-examined to the effect that autocratic powers of control on the part of the Joint Authority were necessary.

Mr. WORDINGHAM said it would be necessary for someone to control the use of the stations in the best interests, but that was a control dealing with the needs of the moment, which was quite different from deciding a general policy.

A discussion took place as to the desirability of erecting capital stations, with a long loan repayment period. Mr. WORDINGHAM said he had very little hope that the Commissioners would grant a longer period than was usually allowed. In any case, in present conditions, he would prefer to put in new plant—much of which was already ordered—in the existing stations rather than to erect new buildings for them in the form of a capital station, involving new transmission mains.

On Friday, June 24th, Mr. DONALD continued his cross-examination of Mr. WORDINGHAM. Dealing with the powers given to the Electricity Commissioners under Section 19 of the Act of 1919, Mr. Donald said that so long as the Commissioners refrained from setting up a Joint Authority for London they could do the whole of the work proposed under Part I of the scheme under consideration. That being the case, if the new capital stations were not to be erected for ten years, he suggested that the better course for the Commissioners to take would be to refrain from setting up any Joint Authority until that work was carried out. This would result in a considerable saving in the way of administrative expenses. The chairman, however, intimated that the question of the advisability of setting up a Joint Authority or not under the powers given them was one upon which he would like the help of counsel at a later stage.

In answer to Mr. Tyndal Atkinson, who cross-examined on behalf of the Hertfordshire County Council, Mr. WORDINGHAM said that the exclusion of Hertfordshire from the area to be supplied would not affect the position of the inner districts of London very much, but Hertfordshire would benefit by coming into the scheme now. After some discussion on the subject of price, witness agreed that there would be a point in length of transmission at which the price of 1.326d. per unit, which was the price at which it would be received at the bus bars of the authorised distributors, would be increased, due to transmission losses.

Cross-examined by Mr. Szlumper, for the Surrey County Council, Mr. WORDINGHAM said that if the supply area of any particular undertaking were cut in two by the boundary of the present scheme, by all means it should be brought in. He had no sympathy with the idea of enlarging the area to a county boundary just because it was a county boundary.

Mr. WORDINGHAM assured Mr. Wrottesley, who cross-examined on behalf of the Middlesex County Council, that under the proposed scheme the Joint Authority would be able to supply at such a pressure as would enable it economically to supply at 6,000 to 10,000 volts, but in certain cases it could transform up to 33,000 volts. It could supply at a pressure of 6,000 to 10,000 volts at a distance up to ten miles. The mains would be underground, except where the country was open, when overhead mains would be adopted. In the last stage of the scheme the Middlesex area would be supplied from the Chiswick station in normal times, but,

of course, the lines at the stations would be linked-up in order to help each other in abnormal times.

In answer to the question, "Does it mean the point of zoning in connection with charges," Mr. WORDINGHAM said he would not put a price on it, but he would say that the various generating stations, within which the price differed from that in the outer areas. In his own view there would have to be a very large central zone in which the rates and charges on the lines would be uniform. He did not think they would be justified in charging the same rates anywhere in the area of the London area.

Sir HARRY HAWARD put a number of questions with regard to the future fall in prices of plant, but Mr. WORDINGHAM estimated as to the extent to which they would fall. If, as assumed by Sir Harry, the fall in prices during the next three years amounted to 25 per cent., thus reducing the estimated expenditure of 13 millions to 9½ millions, the scheme would be much more promising. The price of coal must not be left out of account. Assuming a fall of 4 per cent. on the cost of plant at 25 per cent., and a fall of 4 per cent. on capital during the next three years, there would be, said Sir Harry, a reduction in capital charges on the 13 millions of £1,000,000. Such assumptions Mr. Wordingham did not consider unreasonable.

Mr. PAGE, following up the railway load question, got from Mr. Wordingham the opinion that the cost of generation in a station supplying railways as well as general supply would be lower than in a station without the railway load, but he was not able to give a figure of the difference in cost per unit. If the Joint Authority could get the railways, said Mr. Wordingham, he would be only too glad. His evidence had been on the assumption that a railway company would have sufficient load to put up its own capital station.

Mr. PAGE: Yesterday you rather gave the impression that it would not pay a railway company to buy its energy from the Joint Authority, but now that we have examined the matter further, would you be prepared to say that in certain circumstances what you said yesterday will not hold?

Mr. WORDINGHAM said he ought to have said he was "afraid" the Joint Authority would not get the railway load. If the assumptions he had made were not sound, then his opinion would not hold. In certain events it might be worth the while of the railway companies to buy from the Joint Authority. In any case, he looked forward to inter-linking between the railway power stations.

Mr. BOOTH, in the course of his questions, said the railway companies had told the Board of Trade Electric Supply Committee that they would be prepared to purchase electrical energy if they could be assured that it would be cheap, and the supply reliable. So far there was no railway company in the area whose load would be sufficient to justify a capital station to deal with it. Moreover, he put it that a supply would be more reliable from a linked-up system than if reliance were placed on the railway company's own station.

Mr. WORDINGHAM said that it could be argued that the linked-up supply would be the more reliable. He added, however, that with the one exception of the L.B. & S.C. Railway, all the London railway companies which wanted a supply had put up their own stations.

Sir JOHN SNELL suggested that that was due to the fact that there was no other available source of supply. Sir John also brought out the point, which he said had not been mentioned, that existing undertakers, such as the power companies, might be helped considerably by assistance from the Joint Authority in enabling them to deal with districts which they had not supplied hitherto. Moreover, Sir John put it, and obtained Mr. Wordingham's acquiescence, that the mere fact of the availability of supply to the existing undertakers from the Joint Authority would go a long way to breaking down the barriers which had hitherto hampered electrical development in this country.

The promoters of the Conference scheme had intended to call Mr. Arthur Collins, the financial expert. Unfortunately, Mr. Collins had been taken ill and could not attend, and it was agreed to call him later.

Mr. RIDER was then recalled to explain further tables which he had prepared, putting in greater detail some of the tables already given, and elaborating certain figures given during his evidence.

Very few questions were put on these tables by way of cross-examination. Mr. DONALD, however, mentioned that there was an actual case of two stations, one of which was shut down for a certain period of the day, in which there had been an actual saving of £2,700 per annum in wages. On this basis, it did not seem to him that Mr. Rider, in his estimates, had allowed sufficient in respect of this saving.

Mr. RIDER said the estimates had been prepared in such a way that nobody could say that they unduly favoured the scheme.

In answer to Sir Harry Haward, he added that no provision had been made for savings in wages due to linking-up, but that the saving in wages at all there would be in respect of the coal used. The chief saving would be in wages as regarded actual generation, but for the most part the wages so saved would have to go on to distribution.

Mr. KENNEDY then opened the case for the proposal by the nine London companies which had put forward a scheme as the

London Electricity Joint Committee, 1920, Ltd. This scheme has been considerably modified since it was first drafted, and we deal with it in the words of Mr. Kennedy. The nine companies concerned, viz., the London Electric, the Charing Cross, City & West End, Metropolitan, Central, Westminster, Kensington & Knightsbridge, Brompton & Kensington, Chelsea, and St. James's & Paul Mall, have a capital of approximately £10,250,000, and the units generated in 1919 were roughly 196,500,000. The companies' capital, he continued, represented 62 per cent. of the total capital and the output 65 per cent. of the units sold by all the companies in London. The City of London Co., although not associated with the scheme, was in friendly communication with the promoters, and it was hoped to secure its co-operation eventually. Taking the area delimited by the Commissioners, the nine companies concerned in the present scheme represented 31½ per cent. of the total subscribed capital and 21½ per cent. of the units sold by both the companies and local authorities. The area served by the nine companies represented a very substantial and compact nucleus around which to build a scheme, even if the nine companies stood alone, which he did not believe they would do. After mentioning that the technical part of the scheme was the same as that already described in respect of the two previous proposals, counsel explained that during the past few years, excluding the war period, the average total increase in demand in the area had been 20,500 kW per annum, but the estimates in the engineering scheme had been based on an increase of 26,000 kW per annum during the next six years, and 36,000 kW per annum during the succeeding five years. The estimates were got out when the figures for 1919 only were known, but the subsequent figures for 1920 had shown that the estimate was within 2 per cent. of the actual. The figures did not include railway load. A calculation had been made which showed that in an area represented by a circle with a radius of ten miles, with St. Paul's as the centre, the nine companies were supplying 93 per cent. of the total load of the whole area delimited by the Commissioners. The total load inside the circle was 432,866 kW, and the bulk of the load outside was in the hands of the North Metropolitan Electric Power Co., viz., 25,000 kW out of a total of 32,400 kW. Moreover, the North Metropolitan Electric Power Co. was in friendly relationship with the nine promoting companies, and there would be no difficulty in arranging for mutual supply. It was for these reasons that in the amended scheme the area to be dealt with by the Joint Authority proposed was represented by a circle with a radius of ten miles having St. Paul's as the centre. At the same time, from the administrative point of view, it might be well that the outside districts should come under the Joint Authority in order that they might have the benefit of its advice, and in the future, be connected up to the transmission system in the inner area. If the Commissioners thought it right that the Joint Authority should have control over the outside districts, the promoters of the present scheme would have no objection, although they did not think it would make for economy for one authority to have control over so large an area. Counsel went through the figures of generating plant now available and on order, already given by Mr. Rider, leading up to the expenditure of £1,050,000 during the first five years on linking-up mains, adding that £4,500,000 capital expenditure had already been sanctioned by the Commissioners for new plant in the existing stations, and the capital charges upon it must be paid in any event. That new plant represented the additions taken into account in the estimates for the first five years, and the cost of energy when that plant was installed, and the linking-up scheme was complete, would be considerably lower than the average now. Then came the next stage, and the problem was not to be dealt with by calling the linking-up scheme parochial and the capital power station scheme visionary. There were two alternatives, either to extend the existing stations to their full possible capacity, which was estimated at 832,000 kW, which would deal with a maximum demand of 650,000 kW at a capital expenditure of £9,750,000, of which £2,500,000 would represent initial expenditure during this period in preparing for the capital stations to come later; or, to build new capital stations to deal with the load after 1925 at a capital expenditure of nearly £24,000,000. The advantage in costs of energy was estimated at 0.034d. per unit by adopting this course. On this matter, he confessed to some difference of opinion between the engineers' committee. Mr. Rider was inclined to the first course, and Sir Alexander Kennedy and Mr. Partridge were inclined to the second, viz., to build capital stations to deal with the load after 1925. At the same time, all the engineers concerned felt that now was not the proper time to settle the point, and that it might well be left for the Joint Authority to determine when it came into being.

Coming to the administrative part of the scheme, Mr. Kennedy said he had grave doubts whether it was competent for the Commissioners to give any compulsory powers to the Joint Electricity Authority for any area that might be decided upon, and even if it were, he did not believe that any scheme could be satisfactorily worked by unwilling co-operators. Therefore, the essence of the scheme must be agreement on the part of the local authorities and companies. If no other undertakers would join the scheme, the Committee of the Companies now concerned had passed a resolution pledging themselves to recommend their constituent companies to find the £1,050,000 which would be necessary in the first instance,

and to start to get something done at once. At the same time it was sincerely hoped that the other undertakers would join the scheme, which had been framed so that this could be done from time to time. That applied to the local authorities; to the companies a time limit had been given.

The constitution of the Joint Authority was next dealt with. No definite number had been assigned to the number of representatives, the basis of representation being that each authorised undertaker who entered into an agreement to take a supply, or had agreed to lend not less than £100,000, or guarantee the interest on not less than £100,000, should have one representative, the voting powers being one vote for every £100,000 so dealt with. In addition, the L.C.C. would appoint five representatives, the City Corporation one, railway companies 3, and local authorities outside the County of London from whom any purchasing rights had been transferred to the Joint Authority two. In addition, the chairman and vice-chairman would be elected from outside.

Sir HARRY HAWARD asked how many possible members there were from the authorised distributors who could enter into agreements to take a supply.

Mr. KENNEDY said the total number was 44.

Sir JOHN SNELL said it would help the Commissioners if a statement could be prepared showing under one or two possible cases, what would be the ultimate constitution of the proposed Joint Authority.

Sir HARRY HAWARD also asked for it to be explained why agreements to take a supply or to guarantee £100,000 were put on a parity as regards voting power.

The inquiry was about to close for the day when COUNSEL for the railway companies said he did not wish it to be understood that the railway companies had definitely refused to come into any scheme. They were out to buy in the cheapest market.

Sir JOHN SNELL said he hoped the railway companies would give the Commissioners all the assistance they could by putting forward a scheme showing what they hoped to do in separate generating stations.

COUNSEL for the railway companies said there were difficulties in the way of putting forward definite proposals, but all he wished to make clear now was that the railway companies would buy in the cheapest market.

On Tuesday, June 28th, Mr. KENNEDY continued his statement of the case for the proposal of the nine companies, and dealt first with a request by Sir Harry Haward on Friday for the reasons why a distributing authority entering into an agreement for supply and one guaranteeing a sum of money should be given the same representation. He confessed that there was no definite basis, but the undertakers who entered into an agreement were obviously entitled to representation. There were cases in which authorised distributors did not own generating stations, such as Bethnal Green, and such people might come in by guaranteeing a sum of money. He could not go further than to say that both classes of undertakers ought to be represented on the Joint Authority; under the Technical Committee's scheme to be dealt with later, each of the undertakers that leased their undertakings to the Joint Authority would be entitled to a representative. In order to prevent a local authority obtaining an undue proportion of votes by putting up an exceptionally large sum of money, it was proposed to limit the number of votes which any authority could have. At present, in the scheme, no number was inserted, but it was felt that five might be a fair number as a total for any particular authority.

In answer to Sir Harry Haward, Mr. KENNEDY said he could find no precedent for constituting a Joint Authority on this basis, but neither could he find any precedent for the constitution of such an authority at all, viz., by agreement.

Continuing, counsel said it was proposed to pay the chairman and vice-chairman, but not the members of the Joint Authority; in that the scheme agreed with the L.C.C. scheme, but differed from the scheme of the Conference of Local Authorities. Local authorities could come in and join the Joint Authority, with the consent of the Commissioners, but a time limit was placed upon the companies coming in.

Some questions were put by the Commissioners with regard to this proposed constitution of the Joint Authority, particularly as to when it could be regarded as complete.

Sir JOHN SNELL said it seemed to him that the broad principle was that at different stages a finite number of representatives would be arrived at, e.g., when all the authorised distributors had come in; and that thereafter their measure of voting power might increase or vary according to the degree of financial responsibility assumed.

Mr. KENNEDY agreed that that was so. For instance, it might be that the companies with a smaller number of representatives would have a larger voting power than the local authorities.

Answering further questions, Mr. KENNEDY said that the companies must enter into agreements with the Joint Authority after the making but before the confirmation of the scheme, because it was felt that it would be useless to confirm a scheme if there was no chance of there being sufficient undertakers who would transfer their generating stations and transmission lines. As an inducement to the companies, an extension of tenure as distributors was offered, which point he would deal with later.

Coming to the terms upon which the Joint Authority would acquire the generating stations and transmission lines, counsel said there would be a rent equal to 7 per cent. on the cost of the station appearing in the books of the undertaking, less such depreciation as had been allowed by the income tax authorities, with the addition of an annual sum which would wipe out the cost so arrived at in a certain number of years, so that at the end of that period the generating station and transmission lines would become the property of the Joint Authority.

Counsel confessed it was a complicated matter. In terms, this proposal applied to local authorities as well as companies. If the local authorities made other suggestions, which had the same effect, the companies would not object. Really, the proposal was a hire-purchase rather than a lease, and was suggested in order that the money should not have to be found in a lump sum. A later clause in the scheme gave an option for the undertaker to go to arbitration to determine the price to be paid.

Sir JOHN SNELL said it would be helpful if the Commissioners could be told whether the nine companies were willing to accept the principle of cost less depreciation without the option to ask for arbitration, because the former was definite, whereas the latter was very indefinite.

Mr. KENNEDY promised to confer with his clients and let the Commissioners know.

Continuing, counsel pointed out the other leading features of the scheme. Thus, the Joint Authority would have no control over any authorised distributor not taking a supply. The extension of the life of the companies as distributors was to be for 60 years from a date to be fixed. Later, it was provided that the Joint Authority must supply authorised distributors at a price not higher than that at which the authorised distributors could have generated electricity themselves.

Sir JOHN SNELL asked whether it had been considered that the terms of purchase proposed would allow the Joint Authority to supply at as low a price as that previously obtaining.

Mr. KENNEDY said the engineers considered they would if a proper scheme of co-ordinated control was adopted.

Continuing, counsel said that the Joint Authority was to appoint a Finance Committee, and no expenditure exceeding £1,000 was to be incurred without the recommendation of that committee. Further, a Technical Committee, consisting of five members, was to be appointed, three of whom were to be members of the Authority and two might, but need not, be elected from outside the Authority. As to capital, the companies had been advised by eminent counsel that it would only have powers to mortgage the undertaking but not to issue stock, until the No. 2 Electricity Bill was passed.

Dealing with the expenses of the Authority, it was provided that these should be met and defrayed out of (1) the proceeds of the sale of electrical energy; (2) grants from the Imperial Exchequer made on the recommendations of the Commissioners; (3) contributions by any bodies entitled to make them.

Sir JOHN SNELL drew attention to the proposed grants from the Imperial Exchequer, and asked how they were to be obtained.

Mr. KENNEDY replied, amidst some laughter, that he had no doubt the Imperial Exchequer would look with a kindly eye upon any recommendations by the Commissioners.

Describing the area proposed—it was originally that delimited by the Commissioners—counsel said it was now a district within a radius of ten miles from St. Paul's Cathedral, but exclusive of any parts of the respective areas of supply of the North Metropolitan Electric Power Supply Co., and the Metropolitan Electric Supply Co., that were outside the administrative County of London.

Sir JOHN SNELL said the Commissioners would have to put many questions on the subject of the area, as, according to the map, there would arise several complications as between authorities within it which were giving bulk supplies outside the area now proposed.

In his concluding remarks, Mr. KENNEDY said that both the L.C.C. and local authorities' schemes were unacceptable, because the companies were not given adequate representation on the Joint Authority. The companies did not object to a municipal scheme so long as the Authority purchased the companies' generating stations outright, and came under an agreement to give a supply, but they were not prepared to lease their generating stations to such an Authority. As to the railways, it seemed to the companies that this was largely a matter for the railways themselves. It would not pay the railway companies to erect power stations of their own, and put quite generally, it was purely an economic problem.

Mr. W. E. FLYCATE, chairman of the London Electricity Joint Committee (1920, Ltd.), and of the Charing Cross, West End & City Electricity Supply Co., said the Joint Committee had been formed to act as a Joint Electricity Authority under the Electricity Supply Act of 1919. The individual nine companies concerned would have to be consulted through their shareholders before any definite scheme was decided upon, but he had had the advantage of consulting with the nine companies, and knew their views. So far as the area was concerned, his own opinion was that the area delimited by the Commissioners was too large. The companies did not look upon a possible purchase by the L.C.C. with any particular fear. They could perfectly well meet all their statutory

obligations until 1931, and have a surplus, although there might be some difficulty in raising the necessary capital during the next few years. At the same time, it was greatly to the advantage of the purchasing authority that something should be done, otherwise the position from the public point of view in 1931 would be very unsatisfactory, because the companies, without some prospects beyond 1931, could not afford to lay out the necessary money. This was the first and a most important step. The board of the Joint Committee of the companies had passed a resolution approving of the amended scheme as now submitted to the Commissioners, and recommending that the companies should guarantee up to £1,200,000 either alone or in conjunction with the other London companies. He did not believe he would have any difficulty in obtaining the consent of the Charing Cross Co.'s shareholders to providing their share of this amount. The terms of the lease proposed were that the rent was to be ascertained by taking the cost of the station in the books of the local authority or company. As regards land and buildings, there should be no depreciation, because in the case of land, this would have appreciated, whilst buildings erected some years ago could not now be erected for three or four times the cost. As to mains, it had been suggested that they should be depreciated 3 per cent. on a diminishing value, and plant at 5 per cent. on a diminishing value. This was the income tax basis. Having arrived at the total figure, it was suggested that 7 per cent. should be the rent, although, personally, he would be content with 6 or 6½ per cent., because if too high a rate was asked, it would be cheaper for the Joint Authority to raise the money at once and pay the companies out. That he would like to avoid. In addition, there must be a percentage for paying off the cost, and that should be spread over as long a period as possible; say, 60 years, to coincide with the proposed extended tenure of the companies as distributors.

In answer to the chairman, Mr. FLAGGATE said he would recommend all the nine companies to take the purchase terms as set out without requiring the option of arbitration. If the scheme was sanctioned by the Commissioners, the nine companies would be advised by the Joint Committee to find the £1,050,000 required for the first stage as set out in the engineers' technical scheme, if, before the scheme was finally confirmed, it was made sure that there were a sufficient number of authorised distributors willing to join the scheme to make it worth while. As things stood at present, the companies were in a very unsatisfactory state, because they did not know whether they would be purchased in 1931 or not, and that was bound to be reflected in the condition which the purchasing authority would find when the time came to purchase.

Discussing the area, Mr. FLAGGATE said he was not bound by the ten miles now suggested, and he was quite willing to modify the area. The point was that the four capital stations were within the limits now proposed, and it would not be wise to extend unduly beyond the area which could be served by these stations most economically. That area was practically contained in the ten miles circle, because outside that area the load was comparatively small.

Discussing with counsel for the L.C.C., Mr. FLAGGATE said that as the scheme now stood, those companies which did not agree to come in before the scheme was confirmed would not have an opportunity of coming in afterwards. It was, however, for the Commissioners to say whether further time should be given, as in the case of the local authorities.

Mr. FLAGGATE also said that the scheme provided for absolute control by the Finance Committee of finance, and by the Technical Committee of engineering, without any supervision by the Joint Authority. He regarded the other members of the Joint Authority in the same way as shareholders who had appointed a board of directors.

Continuing, Mr. FLAGGATE said it was a difficult thing to decide what powers the Commissioners had under the Act of 1919 before such a scheme as this could be put into operation. For instance, he did not believe the Commissioners could give an extension of the companies' period of life as distributors.

Mr. TURNER, for the Conference scheme, and Sir HARRY HAWARD raised the question of how the public was to benefit by any reduction in the price of energy, and Mr. FLAGGATE said that involved the whole matter of charges which would have to be dealt with by Parliament. He was willing to accept the principle that reductions in working costs should appear in the consumer's bill.

Mr. DONALD said that if the proposed terms of purchase were applied, the consumer would suffer unless the Joint Authority was able to effect economies seeing that the 7 per cent. rental paid to the distributor by the Joint Authority must fall on the consumer eventually. The 7 per cent. would have to be charged to the distributor in the price of current if economies could not be made to enable the Joint Authority to supply at the same rates as the distributors were now generating at for themselves.

Mr. TURNER asked the emphatic opinion that the consumer would not suffer in any way. The whole object was to lighten supply, and he believed it would do this eventually. He also agreed to take in, say, Middlesex and other parts if the power stations in these areas were transferred. Otherwise he would not agree. At the same time, he preferred a small area to begin with.

(To be continued.)

LEGAL.

HURST ELECTRIC PLANT, LTD., v. CAVAN LIGHT AND POWER CO.

At Dublin recently, before Mr. Justice Gordon, plaintiffs, who carry on business at Belfast, sought to recover £335 for a switchboard which they had made and completed for the defendants. The defendants denied the contract, and pleaded that the switchboard was not supplied by plaintiffs within the time agreed upon. The plaintiffs, in their reply, stated that there was no specified time, and that if there was, it had been waived by mutual consent. Judgment was reserved.

J. P. HALL & Co. v. THE KING.

In the Court of Appeal, on June 23rd, the hearing of this case was concluded, the company having appealed from a decision of Mr. Justice Bailhache in favour of the Crown. According to the report of the case in the *Financial Times*, the appellants by Petition of Right claimed to recover the cost of providing a canteen for their workers during the war when they were a controlled establishment. In common with other controlled establishments, they were urged by the Ministry of Munitions to supply adequate facilities for the supply of food and refreshment for their workers. In response to that request the appellants expended £1,700 in erecting the canteen, and the Liquor Control Board recommended that £1,500 should be returned to the suppliants. However, when the E.P.D. Act came into force the authorities decided to deal with the matter under E.P.D., in which case appellants said they would only get 60 per cent. of their £1,500. Mr. Justice Bailhache held that the authorities had treated the matter properly, and discharged the petition.

At the conclusion of the arguments in the Court of Appeal, Lord Justice BANKES, in giving judgment, said that the agreement was that the cost of the canteen might be written off against current profits. Under that provision and the then existing legislation the whole cost would have been thrown upon the Government, but E.P.D. became applicable to suppliants' business before the time came for ascertaining how the agreement was to be carried out. Therefore, instead of the Government paying the whole of the cost, they would only have to pay a portion of it if the essential term of the agreement were complied with—namely, that the cost should be written off against current profits. The suppliants were not entitled to depart from that essential term of the contract, and the cost must be written off current profits and not against the sum payable to the Government by way of excess profits. The other members of the Court concurred, and the appeal was dismissed.

SWARREN, LTD.

MR. JUSTICE P. O. LAWRENCE, in the Companies Winding-up Court on Tuesday, made an order for the compulsory liquidation of Swarren, Ltd., upon the petition of the Electrical Supplies Co., of Tottenham Court Road. Mr. J. E. Harman appeared for the petitioners, who, he said, were judgment creditors, and the company did not appear.

New X-Ray Apparatus.—The authorities of the West London Hospital announce that they are in possession of new X-ray apparatus which makes use of rays of a wave-length not hitherto employed. The voltage is 200,000. The apparatus is the design of a Bavarian radiologist, and the equipment is the only one in England. The high claim is made, according to *The Times*, by the hospital authorities that: "Surgery as a treatment for cancer may be entirely out of date in a few years' time through the special form of X-rays now in use in the West London Hospital. A figure of cures as high as 80 per cent. of the cases thus treated is looked for by those who are by no means extravagantly hopeful." It is also stated that the rays do not injure the patient in the slightest degree. Tendency of radiologists has been to obtain tubes giving rays of higher penetration, and the tubes referred to by the West London Hospital authorities afford the "hardest" rays yet achieved. Opinion is on the whole favourable to the movement, though some authorities are of opinion that the present method of using radium with X-rays is probably as good as anything that is likely to be achieved by X-rays alone, no matter how penetrating they may be. The point in connection with cancer is that the hard rays have a selective action on cancerous tissues. They have also an action on some normal human tissues, but it is possible that when a very great degree of hardness is reached, the action may be on the malignant tissue only. In any case, Coolidge has it is said, reported favourably on the new movement. It is also stated that American makers believe they can supply tubes capable of being used with voltages of 1,000,000. It is evidently too early as yet to dogmatise. The work is in an experimental stage. We can only watch it with interest and hope.

BUSINESS NOTES.

The "Electrical Review" Index.—The Index to Vol. LXXXVIII of the ELECTRICAL REVIEW, which will shortly be printed, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 6d. post free. Any reader or advertiser, at home or abroad, who requires a copy for binding, or for other purposes, is asked to make early application therefor to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, E.C. 4.

Our Telephone Numbers.—The telephone numbers of the ELECTRICAL REVIEW have been changed, and are now both on the Central Exchange. The numbers are:—Central 8260 and 8261. We shall be glad if our readers will kindly take note.

Bankruptcy Proceedings.—WILLIAM AARON DAVIS, electrical engineer, 14, Basinghall Street, Leeds, late 3, Coronation Street, Leeds. The following are creditors herein:—

British Pure Oil, Grosvenor, and Carbide Co.	£105	Manchester Loan and Discount Co.	27 1/2
Cuthrie & Co., Chas. L.	31	Munro, A. R. B.	36
Dawson, Henry	76	Bankers	51 1/2
Denison, E. A.	13	Newby & Sons, T.	23
Endurance Cycle Co.	19	Westwood & Co., Ltd.	44 1/2
Grassham, T. & W.	21		

The public examination of this debtor was held on June 21st at the County Court House, Albion Place, Leeds. Debtor stated that the receiving order was made on May 5th last, on a creditor's petition. According to the statement of affairs the ranking liabilities were returned at £2,004, against assets £244, or a deficiency of £1,760. It appeared that he went to Leeds in 1918, after being discharged from the Army. He commenced business at 3, Coronation Street, Leeds, without capital, but borrowed £60 from a friend, and £40 from a money-lender. After a few weeks he entered into partnership with two others, who brought in £150 and £250 respectively. In December, 1919, the partnership was dissolved, debtor paying out his partners' capital, and continuing the business alone. He engaged travellers and others on the condition that they invested money in the business, being paid 10 per cent. interest and £4 10s. a week salary. In this way he obtained £3,000 capital, of which £500 had subsequently been repaid. In March, 1919, he commenced at 44, Silver Royd Hill, Wortley, Leeds, as an electrical battery maker, engaging travellers and others who put money into the concern in amounts ranging from £100 to £600. This business was incorporated as a limited company in November, 1919, and at the close of 1920 debtor sold to the same company for £1,000 cash and 2,000 shares, his Coronation Street business. The shares were allotted to him, but he stated that he did not receive the £1,000 cash. The house-hold furniture was claimed by his wife. The examination was closed.

B. T. DALE, electrical engineer, Erick Street, Newcastle-on-Tyne.—Receiving order made June 18th, on debtor's own petition. First meeting July 6th, at Official Receiver's Office, Newcastle-on-Tyne. Public examination, July 14th, at the County Court, Newcastle-on-Tyne.

A. KERSHAW and C. H. WOOD (Kershaw & Wood), electrical engineers and merchants, 9, Bradford Road, Dewsbury.—Last day for proofs for dividend, July 11th. Trustees, Mr. C. Turner, 155, Norfolk Street, Sheffield.

H. ROTHWELL, S. J. WATSON, F. C. JINKS (Vulco Magneto Co.), 11, Long Acre, W.C.—Receiving order made June 23rd on creditors' petition. First meeting, July 7th; public examination, September 27th; both at Carey Street, W.C.

Dissolution of Partnership.—"GIBSON'S" electricians, 47, Kent Street, Great Grimsby.—Mr. F. T. Habershaw and Mr. J. E. Brader have dissolved partnership. Debts will be attended to by Mr. F. T. Habershaw, who will continue the business.

Company Liquidations.—DALTON, DOWNES & CO., LTD., wholesale electrical factors, Manchester.—Pursuant to Section 188 of the Companies (Consolidation) Act, a meeting of the creditors of the above was held recently at the offices of the liquidator, Mr. Perkin S. Booth, 2, Bixteth Street, Liverpool. A statement of affairs was presented which showed unsecured liabilities £4,547, of which £4,324 was due to trade creditors, £167 to cash creditors, and £56 to the bank. There were contingent liabilities £236, not expected to rank. The assets comprised stock-in-trade, at cost, £728, estimated to realise £400; trade fixtures, fittings, utensils, &c., at cost, £250, valued at £50; and book debts £1,172, expected to produce £1,419. The total assets were, therefore, £1,869, from which £50 had to be deducted for preferential claims, leaving net assets of £1,510, or a deficiency as regarded the unsecured creditors of £2,737.

The liquidator stated that the company was registered on December 10th, 1920, to take over an existing business. The nominal capital was £5,000 made up as follows:—200 preference shares of £10 each and 3,000 ordinary shares of £1 each. The total issued share capital consisted of 10 preference shares and 1,347 ordinary shares, which were issued for cash, with the exception of 750 to the vendor of the business. No directors' fees had been paid. The rent of the premises was £52 per annum on a lease of three years from January 24th, 1920. The books had not been made up to date, but the liquidator stated that the turnover in December, 1920, amounted to £886; in January, 1921, £1,558; February, 1921, £484; and March, 1921, £447. There was an estimated loss on the trading of £780, while the balance of the deficiency was accounted for by depreciation of stock, £328; depreciation of fixtures, £200; depreciation of book debts, £354;

amount paid for goodwill, £750; premium paid for premises, £300; and preliminary expenses, £135. After discussing the position the creditors resolved to confirm the appointment of Mr. Booth as liquidator, while a committee of inspection was also appointed. The following are creditors:—

A. & A. Electrical Co.	£116	Hills, H. G.	£50
Ashworth & Smith, Ltd.	17	James's Parkes	13
Bradley, G.	41	Leathes, J.	10
Beaumont & Co., Ltd.	62	Lowth & Smith, Ltd.	121
B.E. Co.	13	Macdonald, C. J. & Son	14 1/2
B.T.T. Elec. Lamp & Access. Co.	31	Manchester City News	14
Barnes, H.	14	Guardian, Ltd.	34
O'Brien, R. & Co.	106	Niell, John, Ltd.	14
Buckland, C.	10	Newman, E. C. & Co., Ltd.	28
Orbiter Maker	67	Naper-Kimber, Ltd.	68
Chesdale & Vailsho, Ltd.	65	O'Brien Press, Ltd.	17
Claremont Johnson	32	Phoebe Co.	47
Casellian Marble Co.	254	Richards, R. & Co.	15
Dainty Modern Machines	49	Riviera, Ltd.	29
Driver, Drennan & Cooper	37	Ramshead & Lysons	40
Edison Swan Elec. Co., Ltd.	35	Read, P. O. & Co., Ltd.	47
Electric Fires, Ltd.	79	Shepherd & Hope	13
Elec. Eng. & Equip. Co.	45	Southward Lamping Co.	105
Electric Heating Co.	106	Spencer Saunders	162
Electrical Supplies Co.	111	Stella Lamp Co.	96
Electric Block Co., Ltd.	12	Stella Conduit Co., Ltd.	32
Electric Brasswares, Ltd.	30	Sloan Electrical Co., Ltd.	56
Hardware Trade Journal	34	Sirrimington & Sons	13
Holt, W. R. & Co.	18	Svenska Filter Co.	1,828

MESSRS. PETER HARVEY, LTD., general engineers and brass-founders, Victoria Bridge Engineering Works, Stockton-on-Tees.—Meeting of creditors called for July 7th. Liquidator, Mr. T. R. G. Rowland, Victoria Buildings, Stockton-on-Tees.

ANGLO-FOREIGN TRAMWAY SYNDICATE, LTD.—A meeting is called for July 27th, at Sardinia House, Sardinia Street, W.C., to hear an account of the winding-up from the liquidator, Mr. A. F. Dickin.

ARMODUCT BRITISH CO., LTD.—Winding up voluntarily. Liquidator, Mr. H. A. Pepper, 14, Temple Street, Birmingham. A meeting of creditors is called for July 14th.

DEVON HYDRO-ELECTRIC AND DEVELOPMENT CO., LTD.—Winding up voluntarily. Liquidator, Mr. T. W. W. Melhuish, the secretary of the company.

Trade Announcements.—The general offices and stores of MESSRS. A. VERRY & CO., LTD., have now been removed to 27, Buckingham Gate, Victoria Street, S.W.1. They retain only a small part of the premises at 67, Borough Road. New telephone number, "Victoria 3180."

MR. S. G. JONES has removed to 72-73, Victoria Street, London, S.W.1. Telephone number, "Victoria 3650"; telegraphic address, "Jonofed Edison, London."

THE EDISON SWAN ELECTRIC CO., LTD., announces that, having just completed considerable alterations and extensions at its City warehouse, 123-5, Queen Victoria Street, E.C. 4, large stocks of lamps, fittings, accessories, &c., will be held at that address as from to-day, and all orders, inquiries, &c., in the London area will be dealt with from there instead of from the works.

Catalogues and Lists.—MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, E.C.2.—Publication W.L.1 (40 pp.). A very comprehensive catalogue of cut-outs of many types. The list, which gives prices, and is profusely illustrated, includes 1, 2, 3, and 4-pole boxes with open, bridge and cartridge type fuses. Mounted sets consisting of cut-outs and sealing chambers are illustrated, as well as water-tight and other specially-arranged boxes.

MESSRS. RICHARD GARRETT & SONS, LTD., Leiston, Suffolk.—An illustrated card giving particulars of the Garrett power plant, which combines boiler, superheater, engine, and condenser in one unit.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—An illustrated price list of conduits, conduit fittings, lighting fixtures and appliances, including distribution boards, bowl fittings, and electric irons.

MESSRS. W. H. DORMAN & CO., LTD., Stafford.—A well illustrated brochure (68 pp.) dealing with "wave-power" tools and machinery, including rock drills, riveters, pile-driving equipment, &c. A description of this method of transmitting power is included in the publication.

THE PYNE MANUFACTURING CO., Latimer Road, Teddington.—An illustrated and priced catalogue of switchgear, fusegear, switchboards for kinemas and country houses, arc lamps for cinema projection, &c.

THE BRITISH CELLULOSE AND CHEMICAL MANUFACTURING CO., LTD., 8, Waterloo Place, S.W.1.—A pamphlet dealing with the properties and uses of "Celastoid" safety celluloid.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Supply List No. 150/12, giving numerous illustrations, prices, and descriptions of all kinds of domestic electric heating and cooking apparatus such as fires, kettles, irons, urns, hotplates, &c. Also Publication No. 4,150/3, dealing with "Cosmos" electric radiators.

MESSRS. GEORGE ELLISON, Perry Barr, Birmingham.—A publication giving eight pages of illustrations of control gear, including circuit-breakers, starters, crane-control equipment, and unit-type switchgear.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.—Installation Leaflet No. P 2479, describing and illustrating the electrical equipment of an hotel.

THE EDISON SWAN ELECTRIC CO., LTD., Ponders End, Middlesex.—List No. LL 299, giving prices of various sizes of "Fulltone" and "Daylight" gas-filled lamps.

MULLARD RADIO VALVE CO., LTD., Claybrooke Road, Hammer-smith, W. 6.—A well-produced catalogue giving details and illustrations of a number of receiving, transmitting, and rectifying valves. Fully priced.

MESSRS. GABRIEL & Co., 4 and 5, A B Row, Birmingham.—An illustrated leaflet dealing with an improved electric lantern and spares and accessories, including a charging board.

HIGHTENSITE, LTD., Normandy Works, Custom House, E.—"Improvements in Insulating Materials," a list describing the advantages and characteristics of "Hightensite," and giving illustrations of many parts and articles made of this material.

MESSRS. G. HOGG & SONS, 66, Waterloo Road, Smethwick.—Leaflet giving reduced prices of porcelain electrical goods.

THE ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, S.W. 8.—Leaflet H 42/6 illustrating and describing air-break and oil-immersed auto-transformer starters (drum type) for two and three-phase squirrel-cage motors. Fully priced.

BRITISH AND ALLIED ELECTRICAL AGENCY, LTD., Ely House, 13, Charterhouse Street, E.C. 1.—An illustrated and priced leaflet dealing with the "Lowa" dimming switch.

THE CRESSALL MANUFACTURING CO., 40 and 41, Stanforth Street, Birmingham.—List No. C.R. 1921, giving illustrated descriptions of controller resistances for cranes, lifts, hoists, &c.

MESSRS. W. ROBINSON & CO., 53, Summer Row, Birmingham.—A catalogue illustrating monorail hoists, electric lifting blocks, spur-gear winches, friction hoists, &c.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., 20, Brazennose Street, Manchester.—Special Publication No. 7,840/2.—A well-illustrated and fully descriptive brochure dealing with individual drive and control of machine tools. The illustrations show the application of electric motors to various types of machines, enclosed ventilating motors and control units.

Catalogues Wanted.—MESSRS. A. ORMROD & CO., wholesale merchants and factors, of Wigan, wish to receive trade price-lists and discount particulars from manufacturers of domestic electric labour-saving devices.

Miners' Lamps.—The Mines Department of the Board of Trade has just issued the Safety Lamps Order of April 20th, 1921 (No. 672), naming and describing in Part I five new electric safety lamps which have been approved for use in all mines to which the Coal Mines Act, 1911, applies. The first is the "Pearson No. 672" (Alkaline Miners' Lamps, Ltd.) cylindrical accumulator lamp, which gives not less than 1.15 c.p. for nine hours, its weight being 4.5 lb. The "Adams" (Adams Bros. (Loughton), Ltd.) is also a cylindrical lamp, but it possesses two lamp bulbs, fixed bulb to bulb vertically and connected in parallel, each having a current consumption of 0.8 amp. The lamp's total weight is 6.5 lb. The "G. I." type of lamp (Patterson & Co.) has a 12 amp.-hour capacity, and weighs 5.75 lb., its special feature being the locking arrangement. In the "Federation" (Federation Lamp Co.) a semi solid or dry electrolyte is used; it has a 6 amp.-hour capacity, and weighs 5 lb. 14 oz. Finally, the "Oldham" cap lamp (Oldham & Son, Ltd.) is provided with an attachment for securing the lamp to the miner's cap, and a belt for carrying the accumulator case; a protected flexible conductor connects the latter to the lamp bulb, which takes 0.7 amp., and the total weight of the outfit is 5 lb. 9 oz. Part II of the Order deals with amendments to the schedules to previous orders, and an appendix contains a list of all flame and electric safety lamps, both for general and special use, which have been approved by the department.

Private Meeting.—FREDERICK VIGERS & CHARLES HERBERT VIGERS, timber merchants (trading as Vigers Bros.), Balfour House, Finsbury Pavement, E.C.—In response to a circular letter issued by Messrs. Tribe, Clarke, Painter, Darton & Co., chartered accountants, a meeting of the creditors of the above was held on June 21st at the Institute of Chartered Accountants, London, E.C. According to the statement of affairs presented the unsecured liabilities amounted to £112,574. The assets were estimated to realise £50,121, or a deficiency of £62,453. The assets were as follows:—Cash in hand, £45; sundry debtors, £12,718; bills receivable, £852; E.P.D. recoverable, £16,638; plant at Hills Wharf, £4,900; Hills Wharf and buildings, £5,393; office furniture, £100; motor lorry, £162; and stocks, £9,309. The amount due to the sundry creditors was stated to be £71,339, but stock was held of the estimated value of £11,693, leaving an unsecured balance of £59,646. The bills payable were £98,664, but security was held, consisting of stock, £1,380; stocks accepted, but not delivered, £39,847; and contra accounts, £6,632. The securities totalled £47,859; the balance of £50,805 was included as an unsecured liability in the statement. There were also cash creditors for £9,908, but they held stock and other assets valued at £7,784, and were unsecured for £2,123. The bank were fully secured creditors for £6,954, their security consisting of a charge on a debt due by Messrs. Thornborough & Co., Ltd. With regard to the assets, the debtors on open accounts were £23,441, but a reserve had been allowed of £4,090, and there were contra accounts of £6,632. That left net assets of £12,718. The partners had a claim for the repayment of E.P.D. of £20,216, but that amount was subject to £3,577 for arrears of income-tax. The balance of the purchase price of the plant at Hills Wharf was £11,865, but it was charged to secure the bank, who were creditors for £6,954, or a balance of £4,900. The land and buildings at Hills Wharf were valued in the books at £10,060, but there was a mortgage of £4,666, leaving a free balance of £5,393. One portion

of the stocks was valued at £28,967, but a large amount was held by creditors, and there was a free balance of £9,309. There were further stocks which had not yet been delivered, to the value of £39,847. Those stocks were held as security by the parties from whom they had been purchased. The partners also held shares of the face value of £5,000 in Associated Importers, Ltd., but no value had been placed upon them at present. The sundry creditors, claims of £71,339 were made up as follows:—Trade creditors, £18,685; cash creditors, £12,274, and compensation creditors' £40,379. The latter were five in number, and were firms with whom contracts had been entered into for goods at future dates. It was possible that the figure mentioned would have to be amended. Mr. A. G. Westcott inquired what was the position when the last accounts were prepared on March 31st last, and the accountants stated that the figures were only prepared this month, and they showed a deficiency of £73,700. In those accounts, however, the amount recoverable for E.P.D. was not included, although the shares referred to were taken in at £5,000. In March, 1920, there was a surplus of over £47,000, and within the year that was converted into a deficiency of £73,700. The total amount paid in E.P.D. was £24,679, of which £4,463 had been recovered, leaving a balance of £20,216, which had been certified as repayable. Mr. Biddle, of Messrs. Biddle & Co., solicitors, who appeared for the debtors, stated that his clients desired to continue the business, but it was difficult for them to make an offer, as they could not tell what the compensation claims would finally be. Under the most favourable circumstances, however, they would make an offer of 7s. 6d. in the £, payable as to 2s. 6d. in the £ when the amount recoverable from the Government for E.P.D. had been received. The balance would be paid by two equal instalments of 2s. 6d. in the £, each on November 1st and March 1st next. No guarantee could be offered. The position disclosed was discussed at some length, and eventually it was decided that the meeting should be adjourned for 14 days. It was understood that in the meantime a copy of the statement of affairs submitted would be circulated to the creditors, and that a committee of the principal creditors would supervise the trading.

Suction Gas Plant for China.—Attention is again drawn to the demand for suction gas plant in China. Its relative cheapness appeals strongly to the Chinese. Whilst the course of exchange is just now retarding the installation of new machinery on a large scale, the demand for new plant by local electric lighting companies is becoming increasingly urgent, says the *Shanghai Times*. In these circumstances the employment of suction gas is recommended. In the centres most concerned coal is obtained locally, anthracite usually being available, and its price is not subject to the vagaries of exchange. The installations of suction gas plant at present in operation have created a very favourable impression. Several concerns in China supplying light and power are taking steps to obtain additional capital. As they must soon come into the market for machinery for extensions and renewals, it is believed that an important potential demand is developing for prime movers operating on suction gas.—*Reuter's Trade Service* (Shanghai).

Richardsons, Westgarth & Co., Ltd.—Presiding at the annual meeting of the company, Mr. D. B. Morison said that notwithstanding the exceptional difficulties of the year, due largely to the aftermath of the moulders' strike, the actual profits earned were considerably greater than in the previous year. Owing, however, to the E.P.D. being raised to 60 per cent., and to the addition of the Corporation profits tax, the retainable profit of £155,635, shown in the accounts, was £80,000 less than it would have been had the duty remained at 40 per cent. as in 1917. Last year he foretold a difficult future for the marine engineering industry. Events had proved that their conservative policy was eminently sound, and the result had been to place the company in a strong position, both financially and in its ability to produce much more cheaply relatively than in the past. The number of ships engined by the company during the year was 38, the aggregate marine h.p. of 96,300 being the highest in the Kingdom. The machinery comprised geared turbines and the latest type of "Richardsons" reciprocating engines, which embodied improvements that were very favourably affecting the coal consumption and the upkeep costs. In the land department, numerous turbines were supplied for the generation of electric power, whilst the number and size of "Contraflo" high-vacuum condensing plants and marine auxiliaries exceeded all previous records. The steel works department was normally busy, noteworthy features being the building of rolling mill engines of 20,000-h.p. for the Cargo Fleet Iron Co., and of many "Nesdram" water-tube boilers, which continued to give great satisfaction in use.

Broken Hill Plant Extensions.—According to reports in the *Industrial Australian*, in consequence of the rapid progress being made in its subsidiary industries, the Broken Hill Proprietary Co. has to make provision for increased steel production, and the following additions to the plant will be made at an early date:—A further blast furnace; a by-product plant, to be used in conjunction with the present and the new coke ovens; a Duplex steel plant; a continuous mill for the production of billets and sheet bars; a duplication of the present rod mill; and a sulphuric acid plant for the supply of acid in connection with the production of sulphate of ammonia, and also for galvanising in connection with wire-drawing, wire netting, galvanised sheets, &c. In addition, further locomotives and railway trucks, wharfage accommodation, steam shovels and railway sidings to cope with the enlarged output will be required. The estimated expenditure is £3,500,000.—*Reuter's Trade Service* (Melbourne).

The Rubber Crisis in Brazil.—A dispatch in the *Financial Times* states that the Brazilian Government has been forced to assist the people of the State of Amazon, who have been badly hit by the crisis in rubber.

Lead.—In their report, dated June 25th, MESSRS. JAMES FORSTER & Co. state that the Metal Exchange statistics for the 12 months ending May 31st last are:—Total supplies (including stock held by the Government and on wharves on May 31st, 1920, 202,336 tons; deducting exports during the 12 months and stock remaining on May 31st, 1921, 54,008 tons; apparent consumption, 148,328 tons; monthly average, 12,360 tons. To this must be added an enormous quantity of old chemical lead from dismantled war plant disposed of to consumers by the Government, and which kept many important consumers in different parts of the country entirely out of the market for six or eight months last year. The average per month of the first five months this year left for home absorption is 10,342 tons. The monthly average for April and May of imports over exports is exactly 7,000 tons. With consumption on the level of last year (which we may fairly look for after the coal strike), it is obvious that much more lead will be needed than is coming in at present.

Book Notices.—*Manual of Electrical Undertakings and Directory of Officials*, 1920-21. Vol. XXIV. E. Garcke. London: Electrical Press, Ltd. Price 30s. net.—This volume hardly needs commendation nowadays. It has long justified its existence and proved its usefulness to all who require at hand, financial, technical and other statistical and general data, respecting the electrical industry and its varied undertakings. Many changes following upon the period of reorganisation and reconstruction with regard to the industry and electricity supply are recorded. No fewer than 2,760 undertakings are reviewed. The financial analysis shows a total capital of £511,862,998 subscribed in 1,374 undertakings in all branches of the industry, an increase of approximately 47 million pounds over last year's figure. The average return on capital invested has advanced from 4.76 per cent. to 5.61 per cent. over-all. The yield per cent. in the various branches of the industry is shown in the following table, which is extracted from the statistical section of the volume:—

Class.	No. of undertakings.	Capital.	Average yield per cent.
Telegraph	22	£35,467,353	8.49
Telephone	8	4,418,002	6.76
Supply	185	60,622,295	5.58
Traction	124	166,082,679	3.47
Manufacturing	127	53,106,141	9.98
Miscellaneous	32	7,716,860	7.91
	498	£327,413,330	5.61

The "progress of the year" section provides a record of new and proposed legislation affecting the industry, together with particulars of applications for private bills, light railway and tramway orders and special orders for electricity supply. The main portions of the "Manual," as usual, comprise information relating to electricity supply, traction, telegraph, telephone, manufacturing, financial, and miscellaneous electrical undertakings in the United Kingdom and British Dominions overseas. The largest section is devoted to a financial, statistical and commercial record of electricity supply and traction undertakings in the United Kingdom: these public services are provided by nearly 700 companies and 400 local authorities. Another and smaller section deals with telegraph and telephone undertakings in the Empire, giving names of the chief officials, the capital authorised and issued, full accounts, comparative tables, dividends paid, &c. An account of electrical manufacturing and allied companies and associations is contained in a further section, while another presents particulars of electric traction, lighting and power undertakings in Canada, West Indies, Africa, Australia, India, Mauritius, and other British Possessions overseas. The Directory section combines the names and addresses, verified to date, of about 20,000 company and municipal officials engaged in the industry, including members of the I.E.E., members of tramway and lighting committees, electrical contractors, and electrical engineers in general. The supplements include about 35 maps showing the principal electric tramway systems, the electrified railways, power undertakings in the United Kingdom and the Colonies and Dominions overseas, the areas of electric supply undertakings, and routes of electric railways in and adjoining greater London. A special feature of the present volume is the series of 13 maps showing the areas of the Electricity Districts provisionally determined by the Electricity Commissioners.

"The Journal of the Institution of Electrical Engineers." Vol. LIX. No. 300. April, 1921. London: E. & F. N. Spon, Ltd. Price 10s. 6d.—The following papers are embodied in this issue:—"Some Thermal Characteristics of Electric Ovens and Hot Plates," by E. Griffiths, D.Sc., and F. H. Schofield, B.A., B.Sc.; "The Long-Distance Telephone System of the United Kingdom," by Sir W. Noble; "The Effect of Electron Emission on the Temperature of the Filament and Anode of a Thermionic Valve," by G. Stead, M.A.; "Some Thermionic Tube Circuits for Relaying and Measuring," by W. H. Eccles, D.Sc., F.R.S., and Miss W. A. Leyshon, B.Sc.; and "The Radiation Resistance of Various Types of Antenna Construction," by A. Press.

"Electrical Machinery," by F. Annett. Pp. xiv + 432; 491 figs. London: McGraw-Hill Publishing Co., Ltd. Price 18s. net.

"Motor-Coach A.B.C." No. 1. June, 1921 (100 pp.). London: E. J. Larby, Ltd. (for the British Road-Traffic Association). Price 6d.—This forms a complete guide to motor-coach and omnibus services in all parts of the country, with details of fares and times. In addition to these, particulars of river excursions

and aeroplane services are also given, as well as an alphabetical list of motor-coach proprietors.

The *Bulletin* of the Hydro-Electric Power Commission of Ontario." Vol. VIII, No. 2. March-April, 1921.—An address by Sir Adam Beck on the share of London (Ont.) in hydro-electric developments is given prominence. A report, in tabular form, showing the operation of all municipal hydro-electric stations in the province occupies several pages, and in the Technical Section methods of measuring supplies are described.

Training of Chinese Students by Other Countries.—The following are extracts from notes communicated by H.M. Commercial Counsellor at Shanghai to the Department of Overseas Trade:—

United States of America.—"The Chinese Chamber of Commerce, says the Asiatic News Agency, has been notified by some American firms in the United States that for the purpose of further promoting Sino-American Commercial relations, leading American engineering and other houses are willing to admit Chinese students to learn modern business methods after completion of their studies in American schools and colleges. The American firm promise to pay reasonable salaries to these Chinese."—*Millard's Review*.

Belgium.—"According to a Chinese paper, the Belgian Government is planning to establish a university at Brussels for Chinese students, and has approached the Chinese Minister at Brussels to obtain the views of his Government regarding the project.

Sino-French Engineering School at Shanghai.—"The foreign commissioner has been notified by the Ministry of Education to the effect that at the suggestion of the French Government, the Peking Government will reorganise the former German commercial and engineering college in the French Concession of Shanghai for the purpose of training commercial students for the development of Sino-French commerce and industry. The initial and maintenance expenses of the said college will be equally borne by the Chinese and the French Governments. The French director is a prominent French resident in Shanghai who has been canvassing subscriptions in France, while the Chinese Government will provide a sum of \$150,000. The college will be called the Sino-French Engineering and Commercial College, and its chief aim is to train Chinese engineers on French lines with the hope that in the coming industrial development of China, the French Republic may catch the lion's share of it. The civil governor of Kiangsu has been instructed by the Peking Government to make preparations so that the proposed college can be established as soon as the French promoter returns to Shanghai."—*Asiatic News Agency*, Shanghai.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries:—

Slipper. No. 412,163. Class 13. Sparking plugs. George H. Ward and Henry F. Kerney, trading in co-partnership, 114, Duncombe Road, Upper Holloway, London, N. February 4th, 1921.

Tangent Sound Signals (lettering and design). No. 413,023. Class 18. Electric and pneumatic bells, alarms, and engineering contrivances. Gent & Co., Ltd., Faraday Works, St. Saviour's Road East, Leicester. May 5th, 1921.

O O (lettering and design). No. 413,026. Class 18. Electric and pneumatic bells, alarms, and engineering contrivances. Gent and Co., Ltd., Faraday Works, St. Saviour's Road East, Leicester, May 3rd, 1921.

Fonoto. No. 412,308. Class 8. Telephone call-recorders. Jarvis Perkin & Co., 2, Drapers' Gardens, Throgmorton Street, London, E.C. February 9th, 1921.

Pinnacle. No. 413,907. Class 8. Electrical instruments and apparatus. No. 413,908. Class 13. Electrical fittings of metal. The Wholesale Electrical Co., Ltd., 54-56, Oxford Street, London, W. 1. April 1st, 1921.

Kantark. No. 404,810. Class 13. Electrical switches (ordinary), fuses, and cut-outs. Midland Electrical Manufacturing Co., Ltd., Stafford Works, Barford Street, Birmingham. June 3rd, 1920.

Lilliput. No. 413,603. Class 6. Electric dynamos, motors, fans, and blowers. Société des Moteurs et Appareils Electriques Lilliput, 4bis, Rue de Chateaudun, Paris. March 19th, 1921.

Wing Design. No. 405,158. Class 13. Sparking plugs. The Brewster Goldsmith Corporation, 33, Gold Street, New York, U.S.A. June 14th, 1920.

Delagazo. No. 410,464. Class 13. Electric lamps. Osram Gesellschaft, 11-14, Ehrenbergstrasse, Berlin, O17. December 7th, 1920.

German Machinery in Japan.—German importers of machinery are reported to be very actively canvassing hydro-electric companies for orders to supply electrical machinery.—*Reuter's Trade Service* (Tokio).

Fire.—THE CABLE ACCESSORIES CO., LTD., of Tivdale, Tipton, inform us that certain Press reports having given a very much exaggerated version of the fire at their works a few weeks ago, they wish it to be known that their main factory was in no way harmed. The fire was confined to outbuildings and a yard: production and prompt delivery of goods are not interfered with.

Australian Wages.—Fitters' wages in Australia, except in the case of Queensland, have been fixed at £6 per week of 44 hours. Labourers in the engineering trade are to receive 14s. per day. A Victorian Wages Board determination with regard to boilermakers fixes the rates of pay at from £4 6s. up to £16, the latter being payable for certain classes of night work.—*Reuter's Trade Service*.

Forthcoming Exhibitions.—The following exhibitions are being organised—

LONDON.—September 7th to 28th, Shipping, Engineering and Machinery Exhibition; September and October, Textile Industries Exhibition; October 14th to 22nd, Commercial Motor Exhibition; November 4th to 12th, Passenger Motor Exhibition; November 17th to 25th, Public Works, Roads and Transport Exhibition; 1923, British Empire Exhibition.

CARDIFF.—1922, Welsh National Exhibition.

GLASGOW.—November 1st to 10th, Shipbuilding, Engineering, and Electrical Exhibition.

LEEDS.—July 21st, Yorkshire Agricultural Show.

CANADA (Toronto).—August 27th to September 10th, Canadian National Exhibition.

AUSTRIA (Vienna).—September 11th to 17th, International Fair. CZECHO-SLOVAKIA (Pressburg).—August 6th to 15th, Czecho-Slovak Industrial Fair. (Reichenberg), August 13th to 21st, International Fair.

HOLLAND (Utrecht).—September 6th to 16th, International Industrial Fair.

ITALY (Naples).—September, Samples Fair.

LATVIA (Riga).—August 1st to 28th, International Agricultural and Industrial Exhibition.

NORWAY (Christiania).—September 4th to 11th, Norwegian Industries Fair.

POLAND (Lemberg).—September, International Fair.

SPAIN (Barcelona).—September 1st to 10th, International Samples Fair.

TRIESTE.—September 11th to 25th, International Samples Fair. ARGENTINA (Buenos Ayres).—1922, International Exhibition.

BRAZIL (Rio de Janeiro).—1922, International Centenary Exhibition.

JAVA (Bandong).—September 9th to October 19th, Netherlands East Indies Fair.

MEXICO.—September, Commercial and Industrial Fair.

JAPAN (Tokio).—March 10th to July 31st, 1922, International Exhibition.

Annual Outings.—The employees of Mr. John Walsh, electrical engineer, of Blackburn, had their annual picnic on Friday last, when they went for a motor run to Windermere.

The staff of the General Electric Co. Ltd., held their third annual sports at the London County Ground, Herne Hill, on Saturday, June 26th, in beautiful weather. A large gathering of members of the staff of Magnet House, and of the other establishments and associated companies of the G.E.C., with their friends, witnessed the proceedings. The directors were represented by Mr. Hugo Hirst and family, Mr. and Mrs. Max Railing and family, and Mr. S. D. White. A long programme was carried through with a promptness which reflected much credit on the Welfare Superintendent of the meeting. Among the more notable athletic achievements in the competitions may be mentioned the High Jump—5 ft. 7 in.—which was won by Mr. Rutherford of the Express Lift Co. Ltd., and the 100 Yards' Championship, which was carried off by Mr. Bird, of Witon Works (10¹/₂ seconds). Witon Works were also successful in winning the Quarter-Mile Championship and the Relay Race. The Express Lift Co. were successful in the Tag-of-War, easily beating teams from head office and Fraser & Chalmers' Engineering Works. A similar event for ladies was won by the staff of the Entering Room, Magnet House. In a competition for Fire Brigades, the team from Fraser & Chalmers' Engineering Works was successful. At the conclusion of the sports the prizes were distributed by Mrs. Hugo Hirst, who was introduced by Mr. Hirst. An excellent military band was in attendance the whole afternoon, and provided music for dancing on the green until late in the evening.

The Derby Royal Show.—Among the many exhibits at the Royal Show, Derby, held from June 28th to July 2nd, are a number of agricultural appliances made by member-firms of AGRICULTURAL AND GENERAL ENGINEERS, LTD. In addition to many machines suitable for electric-motor drive, and electric motors and parts, the "Bull" electric lighting and power plant was shown. This is a very robust set designed for farms of various sizes. The engine is suitable for operating upon gas or petrol. MESSRS. RICHARD GARRETT & SONS, LTD., displayed a 24-ton electric vehicle.

Development in the Federated Malay States.—The Federated Malay States Government is losing no opportunity of securing expert advice on the development of the country. The services of Mr. C. O. Reade, of the Town Planning Department of South Australia, have been requisitioned for a year to give general guidance on town planning. Prof. Gilbert J. Fowler, D.Sc., of the Indian Institute of Science, Bangalore, is at present occupied with the question of sewage disposal in the four largest towns in the Federated Malay States, namely, Kuala Lumpur, Ipoh, Seremban, and Klang. Mr. F. Bolton has also recently visited the country to give advice on the provision of electric power and light in the larger towns. Apart from town development, the question of irrigation has been receiving attention. Mr. C. E. Dupuis having recently spent six months in the country reporting on existent and proposed systems of drainage and irrigation.

A Disclaimer.—MESSRS. C. A. VANDERVELL & CO. LTD., who have extended the field of their industrial activities, inform us that there is no truth in certain rumours that they intend to associate themselves with the manufacture of a motor-car. Such a policy would be against their own interests as manufacturers of electrical equipments for motor-cars.

A Norwegian Buying-in Association.—The members of the Norwegian Electricity Supply Works Association (Norske Elektricitets Verkers Landsforening) met in annual conference at Christiania recently, when the question, among others, of establishing a central buying-in department for the purchase of all the plant and materials required by the works was discussed. It was decided to authorise the council further to consider the problem.

Norwegian Electro-Chemical Industry.—The directors of Det Norske Aktieselskat vor Elektrokemisk Industri, reporting on the year ended March 31st, 1921, state that considerable losses have been incurred through subsidiary companies, and the necessity for writing down shares and undertakings. It is proposed to meet these losses by appropriating the reserve fund of 522,740 kr., and by writing down the share capital from 28,000,000 kr. to 5,760,000 kr., leaving 2,278,000 kr. to be placed to the equalisation fund.

For Sale.—Morley Corporation Electricity Committee has for sale one boiler feed-pump and injector, two horizontal cross-compound Corliss valve engines with alternators, one vertical Bellis & Morcom high-speed engine, direct-coupled to alternator and exciter, piping, shafting, &c.

Birmingham Corporation Electricity Department has for disposal a steam-driven electrical generating plant.

Walsall Corporation Electricity Department invites offers for two natural-draught cooling towers, each with an approximate capacity of 100,000 gallons per hour. For particulars see our advertisement columns to-day.

American Electrical Activity in Italy.—A financial contemporary quotes an Exchange telegram from Milan, stating that a persistent report is current there that the Galileo Ferraris Electric Co. has passed under the control of the American General Electric Co.

Unemployment.—The returns of the Ministry of Labour for the week ended June 17th, show that the number of persons registered as unemployed was 2,178,294, a slight decrease from the previous week's total. The number of men increased, the reduction being in the number of women, boys, and girls unemployed.

Cast-Iron Research Association.—We have received from the British Cast-Iron Research Association a copy of a booklet setting forth the constitution, objects, and activities of the Association. Complete lists of members of Council, and the personnel of Committees are given. Details of subscriptions are included, and much information as to the Association's methods and capabilities is embodied in the 24 pages of the publication.

Electric Furnaces in the Argentine.—There are three important steel foundries in the Argentine—Pedro Vasena e Hijos, Cia, Industrial de Electricidad, and Juan Pinoges. The first and last operate on the Siemens-Martin principle, while the other uses two three-phase electric-arc furnaces of 1½-ton capacity each. The Vasena installation consists of one oven holding 20 tons at a charge and a second holding 35 tons, preparations being in progress for a third one of 100 tons. The Pinoges plant has five 20-ton ovens. The electrodes for all these plants have to be imported.

LIGHTING AND POWER NOTES.

Accrington.—PRICE INCREASE.—The Electricity Committee has revised its scale of charges from July 1st following the loss of £12,000 on the undertaking last year. It is estimated the increased charges will produce an additional revenue of £12,000 per annum. The scale includes:—Lighting, flat rate 8d. per unit; heating and domestic purposes other than lighting through separate meter, 3d.; with a minimum charge of 5s. per quarter during the summer, and 10s. per quarter during winter. Rateable value basis (alternative tariff for domestic lighting, heating, and power), a fixed charge of 15 per cent. per annum on the rateable value of the house occupied, plus a charge of 2½d. per unit for all units consumed. Consumers electing to take a minimum of 15,000 units per month for a year will be charged on the following scale:—From 15,000 to 40,000 per month, 1½d.; 40,001 to 80,000, 1½d.; 80,001 to 160,000, 1½d.; over 160,000, 1½d., subject to fluctuation with the cost of fuel.

Australia.—MELBOURNE.—During the first quarter of the present year the Sydney City Council lost £39,260 in operating its electricity department. Generating costs increased by £14,000, as compared with the same period in 1920.—*Reuter's Trade Service* (Melbourne).

Sydney.—It was reported in May that a serious position had arisen with regard to the finances of the electricity undertaking. Owing to the department's overdraft on the Commonwealth Bank, amounting to about £670,000, the bank intimated that further cheques on capital account could not be honoured. The city electrical engineer stated that he would require in the ensuing nine weeks no less than £246,800 to meet necessary capital expenditure, wages, and commitments. It was resolved to ask the bank to honour cheques for capital expenditure, as the overdraft would be reduced by the rates and by the proceeds of a local loan of £250,000.

ELECTRICAL DEVELOPMENTS.—A *Reuter's Trade Service* communication, dated Melbourne, May 19th, states that throughout the length and breadth of Australia and New Zealand the expansion of electricity is nowhere more marked than in the smaller type of township. A scheme of some magnitude has been under-

taken in connection with the supply of power to Wellington, N.Z. The power from the River Mangahao will be derived by damming two small rivers about one mile apart, and connecting them by a tunnel 7 ft. in diameter, cut through a hill. Approximately 24,000 h.p. will be generated, 12,000 of which will supply Wellington City. Outside Wellington itself the town of Lower Hutt is discussing a plan to provide a special hydro-electric supply by utilising the Mangaroa River.

The city of Christchurch, N.Z., has been authorised to borrow £98,000 for the distribution of electricity, and the Commonwealth Bank of Australia has agreed to advance £10,000 to the Stephens Shire Council, in Queensland, for the purpose of installing an electric light service in the shire.

The residents of the Grafton district in northern New South Wales are urging the authorities responsible to push on with the Nymboida hydro-electric proposal. The acceptance of tenders received in January last for a portion of the plant was held up owing to the financial stringency.

The committee which was appointed some time ago by the Brisbane Metropolitan Water and Sewerage Board to consider the most efficient and economical scheme for supplying electrical energy in bulk for sewerage purposes, has reported in favour of the acceptance of the recommendation of the Government electrical engineer, that transmission mains be erected to transmit 700 kW, the mains be erected in such a manner that they will be suitable, without alteration, to carry a pressure of 22,000 V, instead of the proposed 5,000.

The capital of the Electric Energy Supply Co. Ltd., Warwick (Q.), is to be increased from £12,000 to £20,000, to provide for additions to the power plant.

Bingley.—**YEAR'S WORKING.**—At a meeting of the District Council it was stated by the chairman of the Electricity Committee that the loss on the past year's working was £2,500, of which £1,000 was due to the policy of meeting the cost of new services out of revenue account instead of borrowing and adding to the capital account. The Council approved an advance in the price of electricity by 1d. per unit for heating, and to small power users, and by 3d. to large power users and for lighting, the new charges running from 4d. to 4½d. and 7d. per unit.

Birkenhead.—**ELECTRICITY FAILURE.**—On June 27th, owing to the inferior quality of coal, there was a failure of the electricity supply, due to the impossibility of maintaining a sufficient head of steam to drive the turbines. For an hour and a half the municipal electric tramway service was at a standstill.

Budleigh Salterton.—**ORDER REVOKED.**—The Minister of Transport has revoked the Budleigh Salterton Electric Lighting Order, 1911, as confirmed by the Electric Lighting Orders Confirmation (No. 1) Act, 1911, as to the whole of the area of supply, as from June 20th, 1921.

Burnley.—**NEW PLANT DELAYED.**—Industrial disputes have made it unlikely that the additional plant at Burnley will be completed in time for the winter load. The Committee has, therefore, decided not to sanction further extensions of mains for the present.

PRICE INCREASE.—The Electricity Committee has decided to revise the scale of charges as follows:—For power purposes, for the first 39 hours used per quarter of maximum demand, from 2.57d. to 2.90d. per unit, and for all units above from 1.75d. to 2.08d.; for heating and domestic purposes, from 2.2d. to 2.53d. per unit; lighting, from 5½d. to 6d. per unit; for traction, from 1.9d. to 2.1d. per unit. The new scale will come into operation as from the next reading of the meters.

Canada.—**NOVA SCOTIA.**—A plant is under construction at St. Margaret's Bay, about 15 miles from Halifax, which is expected to furnish sufficient light and power for the city, according to the American Consul-General. This is under the direction of the Nova Scotia Commission, and will mark the partial completion of its first important development. The question is yet to be decided whether the Halifax municipality or the tramway company will receive and distribute the power. Other private interests are constructing plant which will utilise the large river power of Nova Scotia.

ONTARIO'S FINANCIAL RESULTS.—A recent issue of the *Bulletin* of the Hydro-Electric Power Commission, gives financial details of working for the year ended December 31st last. The figures refer only to municipalities. In the Niagara system, which includes the greater part of the province, out of 125 undertakings only 12 showed a deficit, the net surplus amounting to \$651,719 and a net accumulated surplus of \$2,697,968. The other parts of the province, embraced by the Thunder Bay, Severn, St. Lawrence, Wasell's, Eugenia, Ottawa, Muskoka, Rideau, and Trent Systems, include 59 undertakings. Of these only 21 showed surpluses. In spite of this, however, there was a net surplus of \$51,815, making the total for the province \$703,534.

Coventry.—**TEMPORARY PRICE INCREASE.**—The electricity department is making a temporary increase in charges owing to the heavy additional expenditure incurred during the present coal shortage. The flat rate for lighting is to be 8d. per unit, and maximum demand rates are also increased. The lamp rate is increased by 1d. per house per week. The rate for bulk supplies is increased by 0.5d. per unit, low-pressure power is 2½d. per unit, while for domestic purposes, other than lighting, the price is 3d. per unit. It is notified that the temporary increases will be removed immediately the department has recouped the additional expenditure incurred during the crisis.

Dominican Republic.—**PLANT SHUT DOWN.**—According to an American Consular report, the towns of Santiago and Puerto Plata have not been able to reach an agreement for the purchase of the local electric plant, and at present it is uncertain when the plant will resume operations.

Dundee.—**PRICE INCREASE.**—Owing to a loss of £8,068 upon the past year's working, an increase of 20 per cent. in the charges for electricity has been put into force; the new rates are retrospective to May.

Folkestone.—**APPLICATION FOR ORDER.**—The Electricity Supply Co. Ltd., has applied for a special order to enable it to supply electricity in the Urban District of Cheriton, and in the parishes of Saltwood, Newington, and Hawkinge, in the area of the Elham Rural District Council.

Guildford.—**MUNICIPALISATION OF UNDERTAKING.**—It was stated at the annual meeting of the Guildford Electricity Supply Co. that an agreement had been entered into for the sale of the undertaking to the Corporation, but the date of handing over had not been settled.

Haslingden.—**LOAN.**—The Town Council is applying to the Electricity Commissioners for sanction to borrow £10,000, the amount being made up as follows:—Mains, £5,000; services, £2,000; sub-station, £3,000.

Hove.—**PRICE INCREASE.**—The Town Council has raised the price of electricity for power purposes from 2½d. to 3d. per unit. This increase is necessitated by the financial position of the undertaking.

Keighley.—**CURTAILMENT OF SUPPLY.**—Owing to the continued fuel shortage, the Corporation electricity department has now had to curtail supplies, and consequently two of the largest engineering shops in the town, hitherto working full time, have had to go on short time, and one or two smaller firms are similarly affected. The position is unfortunate, as all the engineering firms have sufficient work to keep their employes working full time.

Kingussie.—**PROPOSED WATER-POWER SCHEME.**—Having secured the permission of Mr. Fletcher to utilise the water power of Loch Guynack for generating electricity, the Town Council is convening a special meeting to discuss the scheme.

London.—**ST. PANCRAS.**—A profit of £34,896 was made by the electricity undertaking during the year ended March 31st last. Of this balance £20,000 is being devoted to rate relief.

Lyme Regis.—**APPLICATION FOR ORDER.**—The Town Council proposes to apply for an Order to authorise it to supply electricity within the borough and the parish of Uplyme, and to acquire the undertaking of the Lyme Regis Electric Light and Power Co., Ltd., for this purpose.

Medhurst and District.—**ORDER REVOKED.**—The Minister of Transport has revoked the Medhurst and District Electric Lighting Orders Confirmation (No. 4) Act, 1914, as to the whole of the area of supply, as from June 20th, 1921.

Philippines.—**HYDRO-ELECTRIC POWER.**—What promises to be the most extensive private venture of the kind in the Philippines is now well under way in the form of a hydro-electric project designed to furnish lighting and electric power to the Provinces of Bataan and Pampanga, comprising a population of approximately 48,000. The Abo-Abo and Tiawir rivers, believed to be able to yield a capacity of some 200 h.p. each, will be utilised for the project. Field explorations of the district from which the company will develop electric power has revealed the existence of large deposits of magnetic iron ore. The iron is known to stand a high degree of temperature, and is very suitable for internal-combustion engines. Its electrical treatment has proved quite successful, and the company expects to be able to exploit it to a maximum degree. —*Commerce Reports.*

Rhyl.—**LOAN.**—The Urban District Council is applying to the Electricity Commissioners for sanction to borrow £2,400 in connection with the electricity undertaking, £1,900 being for additional feeders, and £500 for strengthening the cable at the Marine Lake.

Southend-on-Sea.—**LOAN.**—The Town Council has applied for sanction to a loan for the cost of over-hauling, adjusting, and setting up a Diesel engine plant, the provision of spare parts and accessories, &c., in excess of a sum already sanctioned.

Stirling.—**EXTENSIONS.**—The Town Council is applying for sanction to borrow £4,000 for the purchase of two generating sets, and £3,700 for building extensions. It has been decided to purchase immediately a second-hand 300-kW generator from Hereford at a cost of £2,000.

Wellingtonborough.—**BULK SUPPLY.**—The Urban District Council has decided to support the application of the Northampton Electric Light and Power Co. to the Electricity Commissioners for an order for the supply of electricity in bulk to Wellingtonborough.

Wimbledon.—**ELECTRICITY FOR HOUSES.**—In spite of the ruling of the Ministry of Health that only the cost of installing gas in the new houses would be considered for subsidy, the Borough Council has decided that electricity shall also be provided, any additional cost being defrayed by the Council.

TRAMWAY AND RAILWAY NOTES.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—**TOOWOOMBA.**—At a recent meeting of the City Council, Messrs. F. A. McCarty & Co., consulting engineers, Sydney, submitted a revised estimate for a power house and a sub-station for the proposed tramway scheme, in accordance with up-to-date prices. The estimated cost of the complete generating station is £58,700, and of the sub-station £14,000, a total of £72,700. It was decided to ask the Government to provide an expert to go into the whole matter.—*Tenders.*

MELBOURNE.—The City Council's engineer, who has recently returned from a tour of America and Europe, has expressed his opinion, in a report presented to the Council, that two electric vehicles should be purchased for the collection of street refuse. The engineer estimates the cost of the chassis at £1,300. While he thinks that, generally speaking, motor or electric haulage will not prove cheaper in Melbourne, owing to the comparative reasonableness of horse feed prices, he is of opinion that eventually the rising cost of wages and feed must turn the scale in favour of the electric vehicle.—*Reuter's Trade Service (Melbourne).*

Croydon.—**YEAR'S WORKING.**—The annual report of the tramways manager for the year ended March 31st last, shows that the total income of the department was £178,772, as compared with £163,037 in 1919-20. Working expenses, &c., amounted to £183,387, as against £159,306, making a gross deficit of £4,615, as compared with a gross profit of £3,731 in the previous year. The payment of loan interest and other capital charges, resulted in a net deficit of £19,611, which is greater than last year's debtor balance of £17,253. The unsatisfactory result is attributed to the increased cost of labour, materials, and electricity; the increased fares have only been in operation since July 29th, 1920. The number of miles run (2,632,605) is smaller than the pre-war figure (2,801,302), but the number of passengers carried has increased by 39 per cent.

Glasgow.—**YEAR'S WORKING.**—The annual report of the Tramways Committee for the year ended March 31st last, shows total receipts of £2,392,854, a large increase on the previous year's figure—£1,721,578. Working expenses (in which are included allowances to dependents of employes serving with the Forces), amounted to £1,937,665, as against £1,558,161, leaving a gross surplus of £455,189 (£163,417). This, with interest on investments, made an available total of £470,430. Capital charges absorbed £364,834, leaving a net profit of £105,790, which compared very favourably with a deficit of £103,531 on the working of the previous year.

Halifax.—**FARE REDUCTION.**—The Tramways Committee, after hearing a deputation from the Stainland District Council, has decided, in respect of the newly-established tramway service to Stainland, to reduce the fare from 7d. to 6d.

Leeds.—**TRAMWAY SERVICES ENDANGERED.**—A great fire at the motor works of Messrs. W. Appleyard & Co., and of other concerns in Park Row, in the centre of Leeds, last week, doing damage amounting to between £70,000 and £80,000, has left the walls in such a dangerous condition, that the tramway service along Park Row is being run only on the outside set of rails for half-a-mile, a factor which has dislocated the service materially.

London.—**L.C.C. TRAMWAYS.**—The recently-published accounts of the L.C.C. tramways for the year ended March 31st last disclose another heavy loss. The total receipts amounted to £4,904,427, as compared with £4,295,846 in the previous year. Working expenses (including special charges) totalled £4,623,654, as against £3,680,899 in 1919-20, leaving a gross surplus of £280,773 (£614,947). Of this surplus £215,639 was absorbed by renewals, leaving a balance of £65,134 to meet capital charges. Deducting these, and crediting other items amounting to £69,481, left a net deficit of £590,680. The number of car-miles run rose from 53,156,060 to 57,488,232, and the number of passengers from 685,124,166 to 689,452,036. The estimates for the current financial year provide for a deficit of £7,117.

Japan.—**NEW ELECTRIC LINES.**—According to "Commerce Reports," a company has been formed for the construction and operation of a new electric line from Tokio to Yokohama, running approximately 14 miles inland from the present railroad. The Musashi Electric Tramway Co., as the newly-organised firm is called, will also furnish electricity to the villages en route. Plans are being made for the construction of a railroad 61 miles long between Nagoya and Yamada for the accommodation of visitors to the Great Shrines of Ise. Power is to be supplied by the Ibugawa Electric Power Co. Another line, 30 miles long, around the Chita Peninsula, is planned by a company to be capitalised at from 4,000,000 to 5,000,000 yen. There is also a project for the construction of an electric railway between Nagoya and Gifu, as the traffic between these two places is very heavy. It is proposed to construct a double-track line paralleling the present steam railway, at an estimated cost of 7,000,000 yen. A line between Gifu and Okaki is also planned.

Southend.—**ABOLITION OF PENNY FARES.**—Owing to a loss of £22,000 brought about by cutmeters rendered necessary by the coal dispute, the Town Council has decided to abolish penny fares except on one small section of the system.

France.—**INTERNATIONAL WIRELESS CONFERENCE.**—M. Paul Lafont, Under Secretary of State for Posts, Telegraphs, and Telephones, presided over the inaugural sitting of the International Technical Committee on Wireless Telegraphy, on June 21st, at Paris. The Committee comprises representatives of the Governments of Great Britain, France, Italy, Japan, and the U.S.A., who have been called together by the French Government in order to carry out the decisions arrived at by the Communications Conference which met at Washington at the end of last year. The delegates' labours will, in all probability, occupy the next two months.—*Reuter's Trade Service (Paris).*

Germany.—**WIRELESS TELEPHONY.**—The Nauen Telefunken station claims to have established wireless telephonic communication over distances of 2,700 miles. The experiment was carried out with the Argentine Government steamer *Bahia Blanca*, which was on the return voyage to South America, and on board which messages were distinctly heard. Beyond the distance named the vessel entered an area of the Atlantic where atmospheric disturbances interfered with the experiments. Before long it is hoped to establish wireless telephonic communication between Berlin and New York.—*Daily Telegraph.*

Italy.—**STRIKE ENDING.**—While the widespread postal and telegraph operators' strike has partially collapsed, and the majority of the employes have returned to work, great delays and innumerable losses in handling correspondence continue, and it will be some time before normality can be restored. The telegraphs are fast being restored to their ordinary service, and foreign messages are now being accepted, subject to possible delay and interruption.—*Reuter's Trade Service (Rome).*

India.—**WIRELESS TELEGRAPHY.**—According to the report of the Post and Telegraph Department of India for the year ending March 31st, 1920, it was decided during the year to form a separate wireless branch of the Telegraph Department to deal with all matters connected with civil wireless telegraphy in India. Communication was carried on between Bombay and Aden, Bombay and Ceylon, the bay stations and Penang and Karachi and the Persian Gulf. New apparatus was imported which considerably improved the efficiency of the several stations, particularly as regards receptivity during unfavourable conditions, and certain modern transmitting apparatus was also tested for use in India. It was found necessary to form a combined civil and military school at Karachi as a temporary measure to meet a serious shortage of operators for both civil and military requirements.

Indo-China.—**WIRELESS TELEGRAPHY.**—Wireless telegraphy is to be used as a means of communication between Saigon and Hanoi. The submarine cable which connects Cochin-China and Tonkin is subject to frequent breakage, the cost of repairing which entails greater expense than the credits allowed, and for lack of credits it has been impossible to repair a breakage which occurred in October, 1919. However, in order to assure continuity, permanence, and the regular service of telegraphic communication, the Governor-General of Indo-China considers the employment of the coast cable still necessary, and he proposes to assure all the expenditures entailed for the latter out of the Budget of the Colony. This decision would place Indo-China in possession of a submarine cable which connects its two most important points—Saigon and Haiphong.—*Commerce Reports.*

The Telephone Service.—**NEW TRUNK CABLE.**—The new telephone trunk cable between Liverpool and Chester, which has just been completed, contains 108 wires, each weighing 70 lb. per mile, and provides 54 new circuits, having a speaking efficiency six times as great as a standard cable with wires weighing 20 lb. per mile.

Philippines.—**WIRELESS TELEGRAPHY.**—According to the *Bulletin* of the Philippine Government Commercial Agency in New York, recent improvements in the naval wireless telegraph station at Cavite now enable the transmission of messages from the Philippines to San Francisco without relay. A large increase in electrical power, and the construction of telegraph lines between Cavite and Los Baños, are responsible for this direct Pacific wireless service, covering some 7,000 miles. Formerly dispatches from the islands to points in the United States were copied at Honolulu and relayed to the mainland. This meant unnecessary delay in transmission. The improvements will treble the capacity of the naval wireless service to and from the Philippines.

An Automatic Telephone Receiver.—It is reported that the Vozel Telegraph Wire Co., of Berlin, has sold through a Dutch company a patent in England for an automatic receiving apparatus for telephone conversations, termed the "telegraphon." The proceeds of the transaction are estimated at £1,000,000 (?), although ultimately depending on the use made of the invention.

The Poulsen "telegraphone," which receives and records telephone messages on a steel wire by electromagnetism, was fully described in the *ELECTRICAL REVIEW* of October 12th, 1900, and May 10th, 1901. Whether the receiver mentioned above is identical with the Poulsen instrument or not, we do not know; but the name is the same.

Danzig.—**TELEGRAPH RATES.**—It is announced that the rate for telegrams to the Danzig area is now 3d. per word.

London. — HAMMERSMITH. — Electricity Committee.
Recommended:—

Steel pipes, Ac., in connection with the installation of the first 10,000-KV. machine. Foster Bros., £200.

Cable in connection with the supply of electricity to the Wormald estate. —

Steel pipes, Ac., in connection with the installation of the first 10,000-KV. machine. Foster Bros., £200.

New Zealand. — The New Zealand Public Works Department has accepted the tender of S. Green, Ltd., of Sydney, amounting to £26,377, for the supply of copper cable in connection with the Waikato hydro-electric power undertaking. — *Reuter's Radio Service* (Melbourne).

FORTHCOMING EVENTS.

Institution of Civil Engineers. —July 1st. At the Institution of Civil Engineers, Great George Street, Westminster. Engineering Conference.

Institution of Mechanical Engineers. —Friday, July 1st. At the Institution, Murray's Gate, S.W. At 10.30 a.m. London Summer Meeting.

London Fair and Market, at the Royal Agricultural Hall, Islington, N. July 4th to July 16th.

Institution of Railway Signal Engineers. —Thursday, July 7th. At the Midland Grand Hotel, London. At 8 p.m. Paper on "Problems of Automatic Train Control," by Mr. W. J. Thorborough.

NOTES.

A Gift for Scientific Research. —The *Times* Paris correspondent says that Baron Edmond de Rothschild, member of the French Institute, has announced to the Académie des Sciences his intention to devote the sum of 10,000,000 fr. (£200,000) to the foundation of a laboratory of scientific research. The proposed institute will be chiefly devoted to the development of physical and chemical science, and its application to industry and agriculture.

Service Notes. —Commissioned Telegraphist W. G. Pulleyblank has been appointed to the battleship *Conqueror*, and Commissioned Telegraphist A. Boniface to the *Victory* (Nelson's old flagship), at Portsmouth, for Signal School duties, from the 27th inst. Warrant Telegraphist T. F. Perrow has been appointed to the *Virid*, for Signal School; Warrant Telegraphist E. W. Penny to the battle cruiser *Queen Elizabeth*; Warrant Telegraphist W. Small to *Ganges II*, for Shotley Training Establishment; Warrant Telegraphist H. Shirley to the destroyer *Malcolm*; and Warrant Telegraphist F. Burnish to the light cruiser *Coventry*. Recruiting for the electrical departments of the Navy and Army is improving. Wireless men are still wanted, and the Royal Air Service is taking likely mechanics. There does not seem to be any immediate prospect of a reduction in the Air Force.

Church Lighting. —CORRECTION. — In an illustrated "Note" published in our issue of June 17th, under the above heading, the contractors were stated to be Messrs. Stanley Gaynor & Co., of Cardiff. This was an error, due to the fact that we received, at the same time, an illustration of the interior of a church wired by this firm. St. Saviour's Church, Bath, which we illustrated, was wired by Messrs. J. Lambert & Sons, of Bath.

Fire. —A fire in the Leven Creosote Works of Messrs. Alex. Bruce & Co., Ltd., Glasgow, destroyed valuable machinery and electrical plant recently installed.

The Manchester Electro-Harmonic Society. —We are pleased to learn from Mr. J. Hill, the Hon. Sec. of this Society, that it has been decided to resume the concerts this year. Some of our readers will remember that the Society was formed in 1912, and after two seasons operations were suspended owing to the war. Arrangements have been made for six concerts, and these will be held on the last Fridays of October, November, and December, 1921, and January, February, and March, 1922, in the Marble Hall, Albion Hotel, Piccadilly, Manchester. The hon. musical director, Mr. W. J. Smith, has consented to act for the season, and it is his intention to maintain the high quality of the programmes.

Appointments Vacant. —Electrical foreman, also electrical inspector (salary 500 Rs. per month in each case) for the East Indian Railway Co.; station superintendent (£556) for the Coventry Corporation Electricity Department. See our advertisement pages to-day.

The Electrical Trades Benevolent Institution. —At a general meeting, held on Monday last, the alterations in the rules passed at the annual general meeting were confirmed. These alterations extend the powers of Local Advisory Committees with regard to the grant of relief in urgent cases.

Educational. —IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY. — On Friday last Mr. A. J. Balfour opened a new chemistry laboratory presented by Mr. G. W. Whiffen, in which apparatus is installed reproducing on a smaller scale the plant of industrial works, to enable the student to work under conditions approximating to those met with in actual practice. He said that the new laboratory had no parallel in any part of the world.

The Paris Underground Railways. —As a consequence of the great changes wrought by the war, and particularly by the subsequent enormous increase in the sale prices of all kinds of materials and the large advances in wages, the companies which render service to the public in the French capital have found it necessary to seek a rearrangement of the terms of their original concessions which were granted to them by the Paris City Council. As was mentioned some time ago, the first to undergo reorganisation were the surface transport undertakings (tramsways and omnibuses), which were expropriated by the City Council and formed into an amalgamated leasing company as from January 1st, 1921. The turn of the *Compagnie Parisienne de Distribution d'Electricité* has now arrived for the conclusion of a supplementary agreement with the City Council in order to meet the general changes in conditions, and a similar observation also applies to the Paris Gas Co. and the Metropolitan and Nord-Sud Railway Companies. It is estimated that the City Council has incurred an expenditure of 620,000,000 fr. on the construction of the tunnels, &c., for the Metropolitan railway and on incidental expenses, while the company's combined share and loan capital amounts to 200,000,000 fr.

The fact may be recorded that according to the law passed authorising the City of Paris to raise loans for the establishment of the Metropolitan Railway, all the expenditure for the construction of the underground earthworks (tunnels, &c.) and the station platforms, was placed to the charge of the city, whilst the other expenditure (the construction of the tracks and electrical transmission, the provision of access to the stations, the generating stations, rolling stock, &c.) had to be borne by the concessionaire company, and represented nearly one-third of the total outlay on the entire railway undertaking. In order to provide for the annual interest upon the loans contracted by the city, the obligation was placed upon the company to pay to the city a royalty per passenger carried, the amount increasing in accordance with the number of tickets issued beyond a specified total, but in case the yield from this source should be inadequate to meet the service of the loans, the deficiency would be defrayed out of the general resources of the municipal Budget. But the Metropolitan Co. before the war, together with the gas undertaking, was said to represent the best financial transaction which the city had ever made, since it was always remunerative.

A new agreement has now been provisionally concluded between the company and the City Council under which the concession will definitely terminate in 1955 under what is termed "postponed redemption." The compensation to be paid for the purchase has been fixed by the operation of a system of premiums which represent both payment for the services of the company and the compensation for expropriation, and which are based upon the number of tickets issued and the economies effected in management. It is calculated that the premiums will produce an annuity of about 11,500,000 fr. at the beginning and 13,000,000 fr. subsequently, but if the amount should exceed the latter sum a large part of the excess would devolve upon the city. The new convention also makes provision for the possible expropriation of the railway as from the year 1931.

The situation of the *Société du Nord-Sud Co.* is materially different from that of the Metropolitan Co., as the former constructed its railway without any financial participation by the City of Paris, and its concession will expire at the end of 1955. In this case also the city receives a royalty per ticket issued and to some extent shares in the financial charges of the company.

Power from a Water Main. —The *Electrical News* recently published a description of a unique water power plant which is being installed at Port Alberni, B.C. The water supply station of this town was built on a scale of permanence, the supply being taken from China Creek, seven miles distant, and a main capable of maintaining a flow of water sufficient for a population of 20,000 people was installed. The first five miles of the main are of 16-in. wood-stave pipe. At the end of the 16-in. main is a 12-in. Crane pressure reducer, followed by 14 miles of 12-in. welded steel pipe, with a second pressure reducer about midway of its length. The size again changes at the head of the main street of the town to 10-in. steel, continuing to the end of this street at tide level, and serving the various laterals. A third pressure reducer is installed on this line, making the final pressure in the lower portion of the town usually about 160 lb. per sq. in. under present conditions of consumption—a rather excessive working pressure for a town supply system.

Investigations showed that absolute minimum flow in the main was 4 cu. ft. per second, whereas the requirement of a population double the size of that of the town was only .5 cu. ft. per second. It was decided, therefore, to utilise the surplus for generating electricity for the town. Consideration of alternative methods led to the decision that the best method of employing the surplus was to tap into the 10-in. section of the main and install 2,600 ft. of 10-in. wood-stave pipe leading to a power house.

The elevation of the dam being 610 feet, and that of the power house 25 ft. above sea level, the total head on the main at the power house was 585 ft., of which 252 ft. was lost in friction head, &c., leaving an effective head of 333 ft. Using 4 second foot of water at 80 per cent. efficiency, this head

represented an available power of 121 h.p., sufficient to carry the lighting plant load for some time to come at the existing rate of increase.

It has been decided to install a 30-in. McKinnon special impulse waterwheel, fitted with hand-operated stream-deflector, needle nozzle, cast-iron lower and steel upper casing, overhung on a 3/7/16-in. shaft. The shaft will run in ring-enclosed bearings on special adjustable pedestals, and a 36-in. flywheel of 800 lb. rim weight will be mounted on it, with a 26-in. diameter by 15-in. face driving pulley, provided with a disengaging spiral jaw clutch. The wheel will run at a normal speed of 475 r.p.m.

Training Dominion Students in British Technical Colleges.—The Department of Overseas Trade informs us that His Majesty's Trade Commissioners in South Africa have recently been considering the question of attracting young South Africans to British engineering and other technical colleges and training establishments in the United Kingdom, and in this connection Major Guy Fetherston, D.S.O., M.C., Trade Commissioner at Cape Town, has received from Prof. McMillan, of the Cape Town University, some remarks on the commercial advantages of the system, from which the following notes are extracted: It is known that the United States is most anxious to attract students, and especially post-graduate students, to its universities. No better method of increasing trade between the two countries exists. The South African goes to America as a student, he works with American machinery, and becomes acquainted with American methods and American standards, and he forms friendships there which probably last throughout his life. In due course the ex-student returns to South Africa to embark on a business career, still thinking in American measures, and even if he is inclined to deal in the products of other countries, in nine cases out of ten the American products remain as his standard for comparison of all other goods.

It is, of course, known that a large number of young South Africans proceed to England to complete their education, even more than go to America, but the greater proportion of these go to study medicine and law, or else they take a course for Bachelor of Arts at Oxford or Cambridge. America appears to be attracting the bulk of the agricultural students, the engineers, and the science men. The case of Germany before the war is interesting in this connection. Germany attracted the post-graduate student from all over the world, and there would appear to be little doubt that America is eventually to take her place unless Great Britain makes greater efforts than in the past.

It is, of course, understood that British universities are very full, and that there would be difficulty in accommodating more students from overseas. However, it would pay in the long run to attract overseas students, even if further accommodation had to be provided.

It is felt strongly that the manufacturers of the United Kingdom should do everything in their power to attract the future leaders of colonial industries to the British research laboratories, and even if they had to offer a number of maintenance scholarships to accomplish this, there could be no better capital investment for the future.

Then there is the question of the equipment of the universities and technical schools in South Africa. While a proportion of graduates proceed to America or to Europe for their practical training after their college course, a still greater number are absorbed direct from college into business. It is, therefore, in the interests of the United Kingdom that such men should handle British apparatus in the laboratories during their training, and every effort should be made by the representatives of the manufacturers to see that the testing plant and equipment is British. Before the war if a British firm and a German firm were asked to quote for some piece of apparatus or machine for use in a university, the German firm generally offered to supply it for less than the British firm, no matter how low the British tender was.

In connection with the above, it may be stated that the American Consul-General in Cape Town has recently given publicity to the fact that he has literature dealing with over one hundred American universities, agricultural, engineering, and other technical colleges, which may be consulted at the American Consulate-General. Information concerning entrance requirements, cost of tuition, cost of living, and the general opportunities for South African students existing at State and other institutions is offered. It is desirable that similar facilities with regard to British institutions should also be available, not only at Cape Town, but at other centres of population throughout the Empire. British educational institutions or firms supplying educational apparatus who are interested in the above statement, and who are prepared to supply information or apparatus, should communicate with the Department of Overseas Trade, referring to D.O.T. 5556/E.D.

Ventilation Scheme for Polyphase Motors.—To prevent the accumulation of oil on motor windings and the resulting collection of dirt, a line of polyphase induction motors has been brought out recently in which an unusual method of ventilation is used. The scheme is to screen the ventilating air before it enters the windings and so to direct this air that it opposes the entrance of oil into the windings from the waste-packed bearings. The waste-packed oiling method has

been adopted also to overcome any tendency toward the spinning of a rotor when vibration is particularly severe.

While the motors are ventilated or air-cooled, they are virtually enclosed from a mechanical standpoint. Air enters at the periphery of the machine and is discharged at each end, the direction of air flow being exactly opposite to that found in most motors. It is claimed that oil leakage caused by careless filling cannot occasion bad results, because such oil is expelled from the ends of the motor instead of being driven into it.

These motors are provided with a novel frame or casing consisting of a series of corrugations formed from a single piece of sheet steel. These corrugations are equidistantly spaced and in intimate mechanical contact with the stator core, so that most of the heat generated in this core and its winding is conducted to this casing, which therefore forms an efficient means for transferring heat to the ventilated air by radiation. Air entering at any point along the surface of the screen travels over the outside of the corrugations through holes provided at the centre of these corrugations, then through the lateral ducts between the casing and core, then over the windings at the end, and finally is discharged at each end of the motor. This corrugated casing, therefore, contributes to the efficiency of the ventilating system to a marked degree and at the same time forms an exceedingly rigid and accurate frame for the stator core.

Fans are provided at the ends of the rotor for the purpose of drawing the cooling air through the machine. They are said to be of unique design and construction in that a stream of air is drawn directly over the bearing housings and immediately expelled without entering the motor, while another stream is drawn through the machine and expelled at the same points. These fans are made of a single piece of sheet steel and welded to the thrust collars.

The rotor windings have bars and end rings made of one piece of metal, entirely eliminating mechanical or electrical joints, the windings being moulded or cast on the magnetic core.

These motors are now built in sizes up to 30 h.p. at 1,800 r.p.m. for 60-cycle polyphase circuits, with corresponding capacities at other standard speeds and frequencies.—*Electrical World.*

The Stability of Atoms.—Prof. Sir E. Rutherford, F.R.S., commenced his lecture on the above subject to the members of the Physical Society of London, on June 10th, by referring to the earlier work in which attempts at the disintegration of atoms had been made. Traces of hydrogen and helium had been found in discharge tubes believed to be initially free from these gases; but it was clearly impossible to establish that no source of contamination was available, and that the results were due to disintegration of the atoms of other substances. The properties of the nucleus atom were then recalled and the method of attack most likely to succeed in breaking it up was discussed. It is easy to remove electrons, but these are replaced almost immediately and the atom remains as before. It is necessary therefore to attack the nucleus, and to do this successfully requires extremely swift particles.

Slides were shown illustrating the effects produced when ex-particles fired through hydrogen collide with an atom, and experiments were illustrated and described from which the conclusion has been drawn that when an ex-particle collides with a nitrogen atom, a hydrogen atom is expelled from the nucleus. The speed of these is in excess of what can be obtained by collisions in hydrogen gas itself, so that the result cannot be accounted for by contamination of the nitrogen with hydrogen, but must be due to the disintegration of the nitrogen nucleus. Recent results on the disintegration of aluminium and other elements were briefly indicated.

The Engineering Wages Dispute.—The result of the ballot in the engineering trades, upon the new schedule of wages proposed by the employers, was a decisive majority against acceptance. The figures were as follows:—Against acceptance, 257,532; for acceptance, 125,014; majority against acceptance, 132,518. In spite of these figures, however, it was announced early yesterday morning that a provisional agreement had been reached between the two parties to the dispute; no details are available up to the time of our going to press.

Little more than one-third of the membership of the unions concerned took part in the voting.

INSTITUTION NOTES.

Institution of Mechanical Engineers.—LONDON SUMMER MEETING.—A conference of an informal nature was commenced yesterday, and ends to-day, at the Institution building, dealing with means of improving the thermal efficiency of heat power plant; there was also an exhibition of boiler-house appliances and a short meeting of the F.B.I. Fuel Economy Technical Sub-Committee was to be held to-day. Yesterday morning the general meeting took place, at which the president of the Institution, Capt. H. Riall Sankey, made his opening remarks, after which the deputation of American engineers, which is on a visit to this

country, was received. Visits of inspection were also to be paid to the following electricity generating stations:—Boroughs of Hammersmith and Stepney, Corporation of Kingston-upon-Thames, Underground Electric Railways Co., Ltd., Westminster Electric Supply Corporation, Ltd., and the Charing Cross, West-End, and City Electricity Supply Co., Ltd.; the laboratories at H.M. Fuel Research Station, Imperial College of Science and Technology, City and Guilds (Engineering) College, and the Department of Chemical Technology were also inspected. The papers read at the Conference dealt with the following subjects:—“Theory of Internal-combustion Engines with Relation to Thermal Efficiency,” by Mr. H. E. Wimperis; “High Steam-pressure and Other Means of Increasing Economy of Steam Engines,” by Mr. F. Samuelson, who suggested that the addition of a mercury boiler and turbine to an ordinary steam plant would give a considerable increase in the range of temperature, and would result in a large gain in efficiency; he also gave practical results obtained from h.p. and high-temperature steam-turbine plant. Mr. E. V. Evans discussed the “Chemistry of Combustion,” including the mode of combustion in producer and furnace-gas reactions and the cause of smoke production. A paper by Messrs. A. Hutchinson and F. Bainbridge on “Blast-Furnace Gases,” indicated the future lines of development in the use of a mixture of blast-furnace and coke-oven gases and the saving of coal thereby. “Boiler-house Management: General Causes of Boiler Inefficiency,” was dealt with by Mr. D. Wilson, while the “Low-Temperature Carbonisation of Coal” was Prof. W. A. Bone’s subject, and that of “Engine-house Management” Mr. H. Dunell’s. The subject of “Super Compression and Other Means for Improving the Economy of Internal-Combustion Engines” was considered by Mr. A. E. L. Chorlton; and that of “Waste Heat Utilisation,” by Mr. R. Nelson, whose final conclusion was that “radical changes are better than limited and tentative reforms which tend merely to perpetuate the old order.” “Superheating” was discussed by Sir H. Fowler, and “Liquid, Powdered, and Colloidal Fuels,” by Dr. W. R. Ormandy, who enumerated their advantages and limitations, and compared their costs of adoption and relative prices. “Liquid Fuel for Internal-Combustion Engines” was Mr. H. Moore’s subject, and Mr. A. W. Bennis dealt with “Automatic Stokers”; Mr. W. H. Patchell, with “Air Heaters”; Mr. C. E. Stromeyer, with “Feed Heating and Economisers”; and Prof. W. E. Dalby, with the “Indicator as an Aid to Economy.”

Royal Society of Arts.—On June 27th the Council attended at Clarence House, when the Duke of Connaught, President of the Society, presented to Prof. J. A. Fleming, D.Sc., F.R.S., the Albert Medal of the Society awarded to him in recognition of his many valuable contributions to electrical science and its applications, and especially of his original invention of the thermionic valve.

Municipal Tramways Association.—In connection with the private meeting at Huddersfield, on June 22nd, of the Association (Managers’ Section), Mr. R. H. Wilkinson, general manager of the Bradford tramways, read a paper on “Railless Trolley Traction,” and on the following day the delegates proceeded to Bradford to see the latest type of railless vehicle in use there, produced from Mr. Wilkinson’s designs.

The Roentgen Society.—The officers and Council elected for the 1920-21 session are as follows:—President, Prof. J. W. Nicholson, F.R.S.; Vice-Presidents, Mr. C. H. Rodman, M.D., Prof. Sir Ernest Rutherford, F.R.S., Prof. Sir William Bragg, K.B.E., F.R.S.; Hon. Treasurer, Mr. Geoffrey Pearce; Hon. Secretaries, Messrs. E. A. Owen, D.Sc., and J. Russell Reynolds, B.S., M.B.; Hon. Editor, Major G. W. C. Kaye, O.B.E., D.Sc.; [Council, Mr. Cuthbert Andrews, Mr. Harold Black, M.D., Mr. A. E. Dean, Major Kenelm Edgumbe, Mr. N. S. Finzi, M.B., Mr. F. L. Hopwood, D.Sc., Mr. F. H. Hearnman Johnson, M.D., Mr. Reginald Morton, M.D., Mr. C. E. S. Phillips, O.B.E., F.R.S.E., Prof. A. W. Porter, F.R.S., Prof. A. O. Rankine, O.B.E., D.Sc., Sir Archibald D. Reid, K.B.E., C.M.G.]

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

SIR SAMUEL C. DAVIDSON, K.B.E.—Sir Samuel Davidson, K.B.E., M.I.Mech.E., chairman and managing director of the “Sirocco” Engineering Works, Belfast, upon whom the King conferred the honour of a Knighthood of the British Empire, is both a successful inventor and one of the oldest living representatives of the tea planting community. He took a keen interest in science and engineering from his earliest days. After he had spent several years in the office of Mr. Wm. Hastings, a Belfast civil engineer, his father sent him out to India to manage his tea estate. During his sojourn in the East he realised the inadequacy of the primitive methods then employed for tea manufacture, and practical experience, combined with his inventive genius, suggested to him the possibility of using mechanical apparatus for drying the tea leaf at the plantations. The result of his study of this subject promised so well that he subsequently gave up tea planting and returned to Ireland, where he founded the “Sirocco” Engineering Works. From these works he introduced to a sceptical community the first tea-drying machines, which met with great success. Sir Samuel Davidson has taken out a very large number of patents, and in

addition to “Sirocco” machinery for every process in the manufacture of tea, his inventions include the “Sirocco” fan, so much used in factories and mines, and on board ship. Sir Samuel Davidson started the “Sirocco” Engineering Works in 1881 with one small workshop and seven workmen. The works are now very extensive and well equipped, and employ about 1,000 hands. There are also branches and representatives of the works in all parts of the world. Sir Samuel Davidson’s latest invention consists of a new process for the manufacture of raw rubber, and of machines specially designed for the purpose. This process was shown for the first time at the recent Rubber Exhibition in London



SIR SAMUEL C. DAVIDSON, K.B.E.

Among other matters now receiving his attention is the manufacture of peat into briquette form. We offer Sir Samuel our congratulations upon the honour now conferred upon him. We regret to learn that owing to indisposition, he was unable to be present at the investiture ceremony and receive the honour personally.

MR. ALFRED S. E. ACKERMANN has removed to 17, Victoria Street, Westminster. His telephone number is still “Victoria, 24.”

Over 100 applications have been received by the Wallasey Electricity Committee for the vacant position of electrical engineer to the Corporation. Seven candidates are to be interviewed by the Committee.

It is announced that **DR. WALTHER RATHENAU**, consequent upon his appointment as Minister for Reconstruction, has retired from the presidency of the A.E.G., and from the boards of other companies with which he was associated.

Obituary.—**SIR H. B. ROWELL.**—We regret to record that Sir Herbert Babington Rowell, K.B.E., chairman of Messrs. R. and W. Hawthorn, Leslie & Co., died suddenly on June 23rd, aged 61 years. Sir Herbert was a vice-president of the Federation of British Industries.

Our American namesake states that **KARL G. ROEBLING**, head of the John A. Roebling’s Sons Co., Trenton, N.J., manufacturers of wire rope, insulated wire and cable, &c., died recently.

WILL.—The late **BARON MOULTON** left £162,500.

NEW COMPANIES REGISTERED.

Pneumatic Power Users Co., Ltd.—Private company. Registered June 17th. Capital, £500 in 25 shares. To carry on as agents, distributors and manufacturers of power producing machinery, &c. The first directors are: A. L. Bate, 27, Lower Leeson Street, Dublin; K. Beresford, 23, Leinster Road, Dublin; Mrs. S. M. Beresford, 23, Leinster Road, Dublin. Registered office: 27, Lower Leeson Street, Dublin.

Colley & Co., Ltd. (175,304). Private company. Registered June 21st. Capital, £2,500 in 25 shares. To carry on the business of electrical and general engineers and contractors, importers, exporters, manufacturers and dealers in all kinds of electrical apparatus and lighting goods and accessories, &c. The subscribers (each with one share) are: H. A. Woodman, 51, Great Ormond Street, W.C.1, electrical engineer; G. McFarlane, 51, Great Ormond Street, W.C.1, electrical engineer. The subscribers are to appoint the first directors. Solicitor: H. Crafter, 7, Southampton Street, Bloomsbury Square, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Insulated & Helsby Cables, Ltd. (52,285).—Return dated April 4th, 1921. Capital, £2,500,000 in £1 shares (500,000 preference, 1,000,000 ordinary and 500,000 unissued). 1,500,000 shares taken up, £1,072,375 paid on 372,350 preference and 700,325 ordinary shares. £427,325 considered as paid on 127,550 preference and 299,675 ordinary. Mortgages and charges, £700,000.

Chiswick Electricity Supply Corporation, Ltd. (38,854).—Return dated June 1st, 1921. Capital, £100,000 in £1 shares. 92,800 shares taken up. £62,800 paid. Mortgages and charges, £76,000.

Heads (Electrical), Ltd.—Debtenture dated June 1st, 1921, to secure £900, charged on the company's property, present and future, including uncalled capital. Holder, Mrs. L. B. Head, 20, Grosvenor Road, Brighton.

Hill Bros. (Magneto), Ltd.—Satisfaction in full on June 1st, 1921, of charge dated April 25th, 1918, securing all moneys due or to become due from company to bankers.

Mansfield and District Tramways, Ltd.—Trust deed dated June 6th, 1921, to secure £40,000 debentures, charged on 15,000 5 per cent. preference and 45,000 ordinary shares of £1 and £15,000 mortgage debenture and £10,000 mortgage debenture stock of the Mansfield and District Light Railway Co., Ltd., and the company's undertaking and assets, present and future, including uncalled capital. Trustees: Utilities and General Trust, Ltd., Edinburgh.

Albert Lee & Co., Ltd.—Issues of June 7th of £700 and on June 17th, 1921, of £300 debentures, parts of a series already registered.

F. J. Shenton & Co., Ltd.—Particulars of £6,500 debentures authorised June 18th, 1921; whole amount issued; charged on the company's property, present and future, including uncalled capital.

Leadless White Manufacturing Co., Ltd.—Particulars of a series of debentures for an amount not exceeding the issued capital for the time being of the company, authorised June 10th, 1921, amount of present issue being £3,000, charged on (a) a specific charge on the company's freehold property in Yate, Glos., and buildings, plant, machinery, fixtures and fittings thereon, and (b) as a floating charge on the company's undertaking and property, present and future, including uncalled capital.

Stanton & Co., Ltd.—Mortgage on certain land and premises in Hinkley, Leicestershire, dated June 10th, 1921, to secure all moneys due or to become due from company to London Joint City and Midland Bank, Ltd.

F. Patrick, Ltd.—Particulars of £4,000 debentures authorised June 14th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital. The company may mortgage any freehold or leasehold hereditaments subsequently acquired in priority to these debentures to the extent of £3,000.

CITY NOTES.

West India and Panama Telegraph Co., Ltd.

The report for the year 1920 submitted at the annual meeting held on Wednesday, states that the amount to credit of revenue was £50,177, but the expenses were £138,325, resulting in a loss for the year of £58,148. The balance brought forward was £10,433, and interest on investments was £2,104, and the result was a net deficiency of £16,611 at December, 1920. The balance of the cost of the third survey of the company's cable ship, amounting to £38,579, also fell to be dealt with. Inasmuch as the total cost was £74,253, of which a part, £55,674, was dealt with in the 1919 accounts, the directors have added the £38,579 to the original cost of the ship, being satisfied that the increased amount at which she thus stands in the company's books is within her present commercial value. The unfortunate position of the company disclosed by these figures is due mainly to the cumulative results of entrusting the cable ship *Henry Holmes* to the Government Dock at Trinidad for her third survey repairs, and, in a lesser degree, to the increases in working expenses. As regards the main cause, it will be remembered that the *Henry Holmes* went to Trinidad in January, 1919. Before going there she had put the company's communications in good order, and for some period in the first half of that year her absence was not seriously felt and the traffic receipts were comparatively large. But in a cable system like that of this company breaks must occur from time to time, and as it was only occasionally possible to secure the services of other repairing ships, the conditions gradually became worse and worse, so much so that in the spring of 1920, when it was found possible to charter a ship for five months, there were as many as 16 of the cables interrupted. Although the chartered ship worked well, some sections were still interrupted when the *Henry Holmes* was released from Trinidad, early in October last. It is a matter of experience that telegraph traffic, when lost, is recovered but slowly, and, although by the end of 1920 it was steadily moving towards recovery, the traffic receipts during the year were over £30,000 below those of 1919. Another consequence of the interruptions was the loss of over £10,000 of the Imperial, Canadian, and Colonial subsidies. The hiring of cable ships in the nine months cost at least £28,000 more than the expenses of the *Henry Holmes* would have amounted to; and there was also an expenditure of £2,109 in the hire of sloops for inter-colony communications. Of the increases in expenses an important one was in respect of cable. With such an accumulation of interruptions a large

quantity of cable had to be used in repairs, of which the cost was £19,683, as compared with an average of £4,254 for each of the three preceding years. Another large increase was in respect of the *Henry Holmes*, the wages of the sailors and firemen had to be increased by over 10 per cent., the cost of victualling increased 100 per cent., and the price of coal had been at least 60 per cent. higher than in 1918. There had also been some increase in the expenses at the stations, and it is probable that the high prices still prevailing in the West Indies may necessitate further increases this year. To meet the general heavy expenses in 1920, coupled with loss of revenue, it was necessary during the year to sell the bulk of the company's investments. Owing to the state of the money market the sales realised only £66,027 for securities which had cost £96,582. The investments now stand at £12,885, as against £109,471 at the end of 1919. The position of the company at the end of 1920 was so difficult that the directors decided to approach the Lords Commissioners of His Majesty's Treasury and ask for financial help. Their Lordships were unable to accede to the request for a loan of £200,000, but before the end of their financial year, they obtained the sanction of the House of Commons to the waiving of Clause 14 of the agreement of 1914, under which clause the company could have been called on to repay as much as £25,000 of the Imperial and Canadian subsidies, in respect of the year to September 30th, 1919. In consideration of this relief the directors agreed that whenever the cable between British Guiana and Trinidad is interrupted (as it is at present) the subsidy payable by British Guiana shall be reduced by three-fourths. For the first four months of this year the traffic receipts, although not as large as in 1919, show a considerable increase over 1920; and, now that the cable ship is available for repairs, it is hoped that will be no check on the growth of traffic. But in any event, in view of the debit balance of £76,566, there can be no question of any dividends for the year 1920; and the directors regret that, in their opinion, this debit balance must be completely disposed of before any dividends can be declared.

The annual meeting was held on Friday last at the Holborn restaurant, Mr. J. S. Austen presiding. In proposing the adoption of the report, the chairman said it was not his intention to emulate Mr. Garcke, who usually gave a general résumé of the position of the electrical industry at that meeting. A year ago Mr. Garcke pointed out how the nature of the business done by the company had changed. In the past it had consisted in the construction of electrical undertakings, usually of a public utility nature, with the object of either selling or running them at a profit. To-day it was doubtful whether any electrical undertaking could be constructed with any prospect either of selling it or running it at a profit. It was true that electrical undertakings built before the war could now be operated at a profit, because, speaking generally, the fares and rates had been raised, but were similar undertakings to be built to-day, although it might be possible to run them without a loss, they would not be able to run them with any prospect of securing a fair return on the capital expenditure. That department of their business, therefore, had gone for the time being and they were now engaged in managing those companies of which they held control and in financing them. He need not tell them that every company needed more money to carry on its business as compared with the days before the war, and when it came to extensions of power companies, they had to be made at double pre-war costs. Those extensions were rendered necessary because the operative side of the board informed him that there was distinct evidence that the use of electricity was increasing. The coal strike had taught manufacturers the value of electrical power, and they had also found that it was cheaper to buy their power from a central station than to erect installations of their own. Proceeding to refer in detail to some of the undertakings in which the company had a large stake, he said that the Rio Grandense Light & Power Syndicate, Ltd., which supplied the city of Pelotas, in Brazil, was started before the war, but the tramways were not completed. Increased working costs rendered it necessary to apply to the city authorities for leave to increase the rates, and that permission was only obtained upon the condition that they completed a further portion of the tramway. The company was earning money, but it had been difficult to find the additional capital which was necessary for the extensions. With regard to the Brush Co., in order to maintain its business it was necessary for the board to extend its plant, and the B.E.T. Co. had, therefore, largely increased its interest in the company; it returned them 15 per cent. last year, so it was a profitable investment, and he hoped it would continue to be so. Then they had had to find the money for their calls upon the Stoll Film Co.'s shares. The necessary money had been found, chiefly by the sale of Northern Ontario Light & Power debenture and preference stock, war stock, and from the redemption of the debentures which they held in the Yorkshire Electric Tramways, Ltd. Referring to the omnibus business, he said that for a considerable time before the war the directors appreciated the value of motor buses in rural districts, and they formed the British Automobile Traction Co. Prior to the war, that company was earning a handsome rate of dividend, but when the war came most of its buses were taken from it, and although

it had continued to pay dividends, they were not of an important character. Since the war had been over the business had prospered in a remarkable manner, and the returns were again of a very substantial character. But the late of earnings had not existed that year, as was explained before the war. As to the results of the B.E.T. for the past year, there had been a small increase in the profit over that of the previous 12 months, but not sufficient to justify an increase in the dividend. Looking to the current year, they could not get rid of the fact that they were in the middle of a coal strike which had existed for many weeks. It was not so much the strike itself, but the fact, treated as its results which might continue to cause themselves for years after it was settled. He did not feel that he could in any way forecast the future, but regarding the company as a trust company, he was convinced that it was all right, and that it would be a really successful and prosperous concern in the future.

Mr. E. Garcke seconded the motion, which was agreed to after a brief discussion.

New General Traction Co., Ltd.

The revenue for the year ended March, 1921, amounted to £74,180 and the expenditure, including debenture interest and income tax, to £8,591. The profit is thus £65,589, and £20,000 was brought forward, making £20,290. £10,180 is to be appropriated for the payment of a dividend of 4 per cent., less income tax, and £9,813 carried forward. The reports and accounts of the Norwich Electric Tramways Co. for the year ended June, 1920, and the Douglas Southern Electric Tramways, Ltd., for the year ended October, 1920, are annexed to the report. Notwithstanding the continued satisfactory expansion of the Norwich Electric Tramways traffic, the expenditure still further increased, mainly in wages, which were beyond the control of the management, resulting in a decrease of the net revenue. In view of the large amounts required for reconstruction of the track and renewal of equipment, the directors of that company considered it wise to pass the dividend and transfer the whole balance of profit to reserve for the above-mentioned purposes. On the other hand, the Douglas Tramways Co. has resumed payment of dividends on both classes of its shares. There is no change in the position of the guaranteed investment in the Philadelphia undertaking (the Darby, Media & Chester Street Railway Co.), but the course of sterling exchange has again further materially benefited the company in its remittances to this country of the dollar interest and dividend.

Imperial Tramways Co., Ltd.

In their report for 1920, the directors give details of the operations of the subsidiary companies. The gross receipts of the Middlesbrough, Stockton & Thornaby Electric Tramways amounted to £140,447, £111,200, an increase of £26,188. The total number of passengers carried was 15,626,562, an increase of 667,061. The net profit for the year was £19,466, as compared with £14,498 for the corresponding period. In connection with the acquisition of the undertaking by the Corporations of Middlesbrough, Stockton, and Thornaby, in accordance with the provisions of Section 43 of the Tramways Act, 1870, the arbitrator, Sir Robert Elliott-Cooper, K.C.B., awarded the company sums which, including the item of consumable stores, amounted in the total to £415,380, and also directed that the Corporations should pay the costs of the arbitration. The Corporations took steps to submit to the Court certain questions arising on the award, but ultimately discontinued the proceedings. The settlement of the purchase was, therefore, duly completed, and the undertaking transferred to the Corporations on April 2nd of the present year. The Corris Railway Co. showed an increase in receipts of £1,065, while the working expenses increased by £1,473. The holding of the Imperial Co. in the London & Suburban Co. remains the same, viz., 125,000 5 per cent. cumulative preference shares of £1 each, and 122,120 ordinary shares of £1 each. For the year 1920 the revenue of the latter company was again insufficient to enable the payment of any dividend on either preference or ordinary capital. The Imperial Co.'s net revenue account for the year shows an available balance of £21,411, and after payment of debenture stock interest and 4 per cent. preference dividend (less tax) for the year, 4 per cent. for the year is to be paid on the ordinary capital, leaving £11,391 to carry forward.

Globe Telegraph and Trust Co., Ltd.

Sir John Denison-Pender, G.B.E., (chairman), presided at the annual meeting on June 21st. He said that the year had been a successful one, but, in order to pay full dividends, £10,000 had been transferred to reserve account, and, respectively, reducing the latter to £75,000; 52 1/2 % of the 50,000 preference shares had been taken up by the ordinary shareholders, and the Eastern Telegraph Co. took over £1,750, the balance remaining unused. The total cost of reconstruction in the Eastern, Eastern Extension, and Western Telegraph Companies was £2,000,000. Of this amount, the new shares issued and the new South American Telegraph Co.'s shares brought in £748,715, leaving £254,701 to be provided on capital account. The amount of £200,000 had been borrowed. The chairman referred to the sale of the interests of the United States Cable Co. to the British Government, and stated that the company was at present paying a dividend of 4 per cent. per annum. Increased receipts were obtained

from the Eastern, Eastern Extension and Western Telegraph Co.'s owing to the allotment of new shares, but the full 10 per cent. had not been received on the holdings. The Great Northern Telegraph Co. had increased its dividend from 22 to 24 per cent. The return of shares temporarily held by the Government, which paid an added interest of 3 per cent., represented a loss of £950 to the company. The appreciation of the company's securities over the original capital invested was about £1,500,000.

Brishane Electric Tramways In- vestment Co., Ltd.

The twentieth annual general meeting was held on June 15th, Mr. H. R. Beeton, the chairman of the company, presiding. The chairman said that the total receipts of the Brishane Tramways Co. were £361,265, as compared with £476,385 for 1919; the total expenditure was £448,965, as compared with £361,985 for the previous year, and the net profit was £112,300, which, with £34,161 brought in from 1919, left an available balance of £146,461. Of this amount £8,000 had been credited to depreciation of investments fund, bringing that fund up to £15,500, and £145,000 had been applied in payment of a dividend, leaving £23,461 to be carried forward. The net balance of revenue account of the Investment Co. available was £147,543. After allocating £8,000 to the depreciation of investments fund, bringing it up to £11,500, and £20,000 to the reserve fund, bringing it up to £160,000, and providing for debenture stock interest and preference dividend, and 8 per cent. on the ordinary shares, there remained to carry forward £42,837, subject to corporation profits tax. Owing to the Queensland Government not acquiring the tramways, as they announced they would do in October last, the board had to come to an arrangement with the debenture stockholders postponing the redemption of the debenture stock, which became due on January 1st, 1921, until January 1st, 1924, raising the rate of interest from 4 1/2 per cent. to 8 per cent. per annum, and stipulating that a premium of 2 per cent. should be payable in the event of the debenture stock being redeemed before expiry. The bulk of the increased expenditure was due to continuous increases in wages. The Government had passed an Act, entitled the Profiteering Prevention Act, enabling them to depreciate the tramways by fixing fares at their absolute discretion regardless of the rights of the company. In March last year the Tramways Purchase Act, which had been twice rejected by the Legislative Council, was passed. The directors had had several interviews with Mr. Theodore, at which they conveyed to him that the company in no way demurred to the principle of expropriation, but only claimed to be fairly treated, and that they relied on him to apply the provisions of the Purchase Act in a manner which would do justice to the company and redound to the credit of Queensland. Mr. Theodore expressed his desire to protect investors to the best of his ability, promising, among other things, that the debentures, in which payment might have to be made, would be taken at their market price at the date of settlement, that whatever might be necessary to constitute them trustee securities would be done, and that interest at 6 per cent. per annum on the purchase price, as ultimately settled, would be paid from the date of taking over the undertaking until the date of payment. The Government, however, found themselves confronted with the prospect of not only having to issue 6 per cent. debentures at market price to an unexpected amount, but also of raising a large amount of new capital at a time when their exiguous financial resources were strained to the utmost to meet their pressing liabilities. In these circumstances, a policy of postponement was obviously indicated, and after some delay the State Treasurer announced that the Government would only acquire the tramways "at their convenience." The so-called Profiteering Prevention Act did not define profiteering and was administered at the absolute discretion of the Executive Government. The directors had entered a strong protest against this abridgment of the company's rights conferred by the General Acts of 1882 and 1890, under which it was constituted, and confirmed by the Government under the special Act of 1913.

Lisbon Electric Tramways, Ltd.

The directors have issued their report covering the years 1919 and 1920, together with balance sheets for both years. For 1919 there was a net profit of £74,505, but for 1920 a net loss of £120,006, the net loss on the two years' working being £45,500. The balance to the credit of profit and loss account brought forward from 1918 was £11,229, and the balance to the credit of the exchange reserve £15,000, thus leaving to be carried forward to the debit of next year's profit and loss account £19,271. The passengers carried during 1919 were 92,143,345, and the receipts Esc. 4,454,174; in 1920 they were 80,567,940, and the receipts Esc. 6,088,286; while in 1918 they were 80,806,364 and the receipts Esc. 3,523,069. The decrease in passengers in 1920 was due to the strike, from the end of July until the beginning of September, when the service was entirely suspended, and also to some small falling off from the increased fares. Expenditure has again considerably increased, viz.: 1918, Esc. 3,002,598; 1919, Esc. 3,204,941; 1920, Esc. 8,808,594. The rate of exchange which stood at 34d. on January 1st, 1919, had fallen to 20d. on December 31st, 1919, and by December 31st, 1920, to 62d. The heavy increase in the expenses in 1920 was not only brought about by the higher wages paid and the increased cost of all local supplies; it was particularly accen-

tuated by the cost of all those supplies which had to be purchased outside of Portugal at enhanced prices, this cost having to be ultimately borne in the very depreciated currency of that country. On account of the disastrous collapse in exchange during the period under review, it had been necessary to make applications to the Camara from time to time for increases of the tariff, with the result that only partial relief had been granted, and this after the greatest difficulty and prolonged negotiations. The last increase of fares obtained was put into force in December last, but as this was totally inadequate to meet the expenditure, an application had been made to the Camara for a further advance, which it was hoped would soon be granted. "The granting of the application by the Camara is one of urgent necessity, and permits of no delay if the public is to continue to receive tramway facilities as heretofore, it being self-evident that the service cannot continue to be run at a loss."

United Electric Tramways of Montevideo, Ltd.

The seventeenth ordinary general meeting was held on June 16th, Sir George A. Touche, Bart. (chairman), presiding. The chairman, in moving the adoption of the report and accounts and the payment of the dividends, said that receipts again showed an increase. Unfortunately, expenses had increased too, and had absorbed 72.45 per cent. of the gross increase. The increase was due mainly to higher wages, and there was little prospect of this item being reduced. Another important factor was the serious fall in the value of the dollar. Uruguayan currency had a remarkable record for stability. Being on a gold basis, for many years before the war it hardly varied at all. The normal rate of exchange was \$4.7 to the pound, or 51d. to the dollar. During the past year it fell as low as 39d. to the dollar, and was now only 42d. This depreciation had naturally affected remittances. In spite of additional burdens, the company had not yet received permission from the Government to increase its tariffs. This had been granted to tramway and transport companies by other countries—all over the world, in fact—but not by Uruguay. Throughout the year every endeavour had been made to obtain a settlement of this all-important question, but without any result, although it had been before the Chambers for discussion many times. The poverty of the returns to the shareholders showed how irresistible was the company's claim to a revision of tariffs. The directors had every sympathy with the desire of the men for a better wage. It was in their best interests that an increase in fares was necessary, as the fares provided the only fund from which wages could be paid. The more restricted the fund the less must be the wage increase. The speaker took the opportunity of saying how admirably legitimate British interests were watched by Sir Claude Mallet, the British Minister, without in any way trespassing on territory which was not his or doing anything to antagonise local rights and susceptibilities. The profit and loss account showed a balance of £74,906. The balance brought forward was £7,032, making a total credit balance of £81,938. £5,961 had been set aside for the redemption of debenture stock and £2,500 for the preference and ordinary share capital redemption fund. This fund was invested separately, and the cost of investments was shown in the balance sheet at £23,424. These investments were chiefly in British Government Bonds, and present quotations showed a depreciation of 10 per cent. The sum of £30,000 had been placed to the renewals and contingency account. The dividends were a poor yield in a year of record takings, but the legalised impositions, for which, as yet, the company had had no compensation, were responsible.

The motion was carried unanimously.

A meeting of the first debenture stockholders was then held, at which the appointment of Mr. George Norman Touche as trustee was confirmed.

The Australian English Electric Co.

According to the *Sydney Morning Herald* a net profit of £25,750 was shown by the English Electric Co., Ltd. (formerly Standard Waygood Hercules), for the year ended March 31st, and with £3,539 brought forward from the old company £30,300 was available. In view of the large amount of money required to complete the company's new workshops and equip them with plant, and the cost of financing current business, no dividend was recommended while the financial stringency continued. To conserve the goodwill of the lift business a company has been registered under the name of Standard, Waygood, Ltd., with a nominal capital of £100,000. The stock belonging to the department will be represented by shares which will belong to the English Electric Co. G. Weymouth Pty., Ltd., has been reconstructed under the name of Weymouths, Ltd. Out of the funds provided for the purpose by the debenture issue (£108,000 plus £5,600 since issued, £113,600) the English Electric Co. had spent in workshops and equipment at date of balance £110,728. It was, therefore, proposed to issue the balance of the debentures created, viz., £36,400. The directors stated that they passed the dividend with the greatest reluctance. A good profit had been made and the company had the money. But the board did not know how its proposals for fresh capital might be received or whether assets which were liquid a few months ago were now saleable even at much reduced prices. Hence the board had decided upon a conservative policy, although, as some of the board were the largest shareholders in the company, their own interests were affected.

Barcelona Traction, Light and Power Co.

The report for 1920 states that the net revenue was \$2,734,703. Interest payable in cash on bonds for 1920 amounted to \$1,303,485. This provision was made for amortisation of underlying bonds, and in addition reserves for depreciation were made by chief operating companies as follows: Light and power companies, \$655,820; railway company, \$253,364. In December, 1920, £1,050,000 of 8 per cent. secured debentures were sold in London, and with the proceeds £1,915,500 of outstanding 6 per cent. prior lien "B" bonds were acquired. The difference in the nominal amount of 8 per cent. secured debentures sold and "B" bonds acquired, £865,500, has been placed to capital reserve, as "B" bonds acquired are held as security for 8 per cent. secured debentures. The board during 1920 was able to liquidate all loans, which at December, 1919, amounted to \$1,094,706. There was an increase of 6,128,683 pesetas in gross earnings of combined enterprises of companies operating in Spain, and net earnings increased 5,944,321 pesetas. With the completion of new hydro-electric installation at Camarasa, the major construction projects of Ebro company may be regarded as realised.

Swedish Telephone Undertakings Abroad.

The reports for 1920 have been issued by the three telephone companies which are incorporated in the Swedish-Danish-Russian Telephone Co., which owns the telephone system in Moscow, the Cederger Telephone Co., in whose hands the Warsaw network is vested, and the Mexican Ericsson Telephone Co., which carries on the exchange system in the city of Mexico.

The report of the Mexican company states that operations proceeded in a satisfactory manner, and the number of subscribers increased from 12,680 in 1919 to 13,892 last year, and a further augmentation has taken place in the current year notwithstanding the higher rentals which were sanctioned by the Government last autumn. As in the immediately preceding years, so in 1920 was the circulating medium formed of metallic currency, and the still prevailing advantageous conditions between the Mexican and Swedish exchange yielded considerable profits in exchange in connection with the remittances. The net profits amounted to 361,576 gold pesos, as compared with 260,925 pesos in 1919, and the directors propose to pay a dividend at the rate of 7 per cent., as contrasted with 6 per cent., and an addition of 4 per cent. (2 per cent. in 1919) for profits arising from exchange.

Concerning the Svensko-Dansk-Ryska Telephone Co., the report states that it was naturally impossible to carry on any business whatever in Russia last year, and it was still impossible for the directors to enter into direct negotiations with the Russian authorities for the regulation of payment for the company's assets in Moscow, which were taken over by the Imperial Government in the year of 1917. The development of circumstances, however, were being followed by the directors in order to be able to put the matter forward on the first possible opportunity. On this basis a loss of 1,365,613 kr. was incurred last year, as compared with 1,294,074 kr. in 1919, chiefly on account of interest payments on the company's loan. The telephone system at Moscow is still entered in the company's books at its original cost of installation of 51,400,000 kr. The balance sheet of the Moscow department closes at 65,500,000 kr., as against 61,800,000 kr. in 1919, with a balanced loss of 4,100,000 kr. for the years 1917 to 1920, while the Stockholm department closes at 16,900,000 kr., as compared with 29,400,000 kr., with a loss of 3,374 kr. for 1920.

As to the Warsaw system, the report states that the activity of the Cederger Telephone Co. suffered from the uncertain and depressed political and economic conditions which prevailed in Poland last year. The working expenses greatly increased as a consequence of the increasing fall in Polish currency—wages alone were five times greater at the end than at the beginning of the year—while the considerable increases in the subscription rates which were made every quarter were only able to defray the working expenses, but were insufficient to cover the interest on the company's loan. As a result the year showed a loss of 903,000 kr., as compared with a loss of 1,889,000 kr. in 1919, the total losses for the years 1916 to 1920 consequently rising to 6,378,000 kr.

The Austrian Siemens- Schuckert Works.

The directors of the Austrian Siemens-Schuckert Works Co., of Vienna, report that as a result of the better food supplies and the improvement in the willingness to work, the efficiency of the individual workman in 1920 was raised a considerable degree nearer to the pre-war level. Notwithstanding many critical events it was possible adequately to occupy the work shops; and the decline in Austrian orders and in orders from the Succession States was equalised by the cultivation of new business connections abroad. The first contracts, although of small extent, were received for the electrification of individual Austrian State railways. Sufficient orders, particularly for export, were on hand in the new financial year, so that it was expected that the shops would be occupied to the same extent as in 1920. A power station and 20 main line locomotives had been ordered by the Austrian State railways, although these would only be executed next year on the completion of the preparatory works. Sale prices had now reached the parity of the world's market prices, and had consequently to follow those of keen foreign competitors.

While privacy was expected further to increase owing to the increased purchasing power of customers. The number of workmen and clerks employed was 5,292 at the end of 1920, as compared with 4,141 at the close of the preceding year. After deducting 1,000,000 kr. to reserve fund, as against 1,000,000 kr. in 1919, the accounts indicate net profits of 8,016,000 kr., as contrasted with 3,061,000 kr., and a dividend at the rate of 8 per cent. has been declared, comparing with a per cent. in 1919. It has now been decided to increase the share capital by 75,000,000 kr. to 200,000,000 kr., to provide the funds necessary for the undistributed maintenance of working and the acquisition of stocks.

The Swedish Ericsson Telephone Co.

The report of the directors of the Allmänna Telefon Aktiebolag L. M. Ericsson for 1920 states that as in the immediately preceding years, the high costs of production which were increased by the law introducing an eight-hour day, placed the company in an unfavourable position in competing in the world's markets. In order to maintain its position in these markets and retain the old circle of customers, the company was compelled to keep its sale prices on a lower level than was warranted by the costs of production. The result was that the volume of sales was satisfactory. At the beginning of 1920 the orders on hand represented about 10,000,000 kr., and at the close of the year they reached 17,000,000 kr. A reduction in the cost of production, however, was indispensable if these circumstances were to continue in the new financial year, and some steps in this direction had already been taken. The number of workmen at the Stockholm shops increased from 1,359 to 1,644 during the year. The value of the turnover was 14,843,000 kr., as compared with 15,775,000 kr. in 1919, the exports included in these totals having comprised 10,655,000 kr. (72 per cent.) and 10,843,000 kr. (68.7 per cent.) in the two years respectively.

Concerning the subsidiary manufacturing companies, the report states that the Petrograd workshops of the Russian Ericsson company continued to be immune from damage, and work was being still carried on for the account of the Soviet Government under the management of its delegate. The English company was well occupied in 1920 and the dividend on the ordinary shares was at the rate of 8 per cent. The Austrian and Hungarian companies were fully and profitably occupied, although the prevailing exchange conditions occasioned difficulties and rendered it impossible for remittances to be made to the parent company; their dividends would be at least 20 per cent. for 1920. The activity of the French company developed satisfactorily in the first nine months, but towards the close of the year the company was affected by the general depression, and no profits were realised. The stocks of raw and semi-finished materials held by the Swedish company at the end of the year were entered at such values that they could be secure even if a further fall in prices took place. As to the shares held in certain other companies, the report states that these must now be considered as of no value, and the holdings in the Swedish Air Traffic Co., the Svenska Radio Co., the Elektrolite Works, the Triton Co., and the American subsidiary company had each been written down to one krona. The accounts for 1920 show a loss of 3,322,000 kr., as contrasted with net profits of 3,753,000 kr. in 1919. The loss is due to the necessity for writing off 1,429,000 kr. on the company's stocks in Russia and of 3,695,000 kr. on shares, as just mentioned, chiefly in the American company.

The directors add to the report a supplementary statement relating to the reconstruction of the company consequent upon the situation of the Russian subsidiary. It was necessary, they say, to write off these shares, while debts owing by the latter would remain in the books at the amount at which they stood at present. On the other hand, by relying upon the reserve fund and one-half of the share capital, a guarantee fund would be formed sufficient to cover the amount of these claims. The total sum consequently written off the various Russian share interests is 6,594,000 kr., which is covered by the reserve fund, leaving 38,264 kr. to be carried to the guarantee fund in question which, including one-half of the share capital, will then reach 36,938,000 kr. The Russian credits to be covered by this fund are claims against bills of the Swedish-Russian Telephone Co. for 10,663,000 kr. and 15,084,000 kr. in other claims against the Russian subsidiary; the bank debts 85,803 kr., and claims for telephone works 2,106,000 kr. If approved by the shareholders the result of these operations will be a reduction in the ordinary share capital from 73,800,000 kr. to 36,900,000 kr., and the formation of a guarantee fund for 36,940,000 kr.

French Companies.

The Société Appareillage Electrique Geniteur has decided to raise its capital from 1,000,000 to 3,000,000 fr., and to issue on a suitable date bonds to a total of 200,000 fr. *Electricité et Gaz du Nord.* The profits of the working year closing September 30th last, which totalled 2,620,295 fr., after allotting 617,685 fr. to the sinking fund, and allowing of a distribution of 12.50 fr. per share and 19.28 fr. per part, were obtained solely by means of the Jeumont station and the gas works. The outcome of the present year will be much larger, for, besides the enlargements to meet existing demands of the Jeumont works, other productive elements will yield their quota. The Lille station, for instance, started at the end of January, and the Maubeuge station was to be available

in April. As to shares in other concerns, the Société d'Electricité de la Région de Valenciennes-Anzin obtained results in its financial year closing with December 31st last, which permitted it to enter a dividend-paying period; and the Société Gaz et Electricité du Hainaut was in an extremely favourable situation owing to the increased tariffs sanctioned, and the starting in August last of the Ville-sur-Haine works, and the improvements and extensions of its plants at its several stations.

Compagnie Centrale d'Énergie Électrique. The report presented at the ordinary meeting showed that the output of electricity of the stations serving the Rouen district had advanced from 42,944,400 kWh in 1919 to 46,057,950 kWh in 1920. The increase would have been greater but for the rise in the price of coal and the crisis in various industries shown towards the end of the year. The management had devoted all its energies to realise the plans laid down in 1918, and revised in 1920, including the erection of four new boilers at the Grand Quevilly station, of four groups of 6,000-kW turbo-alternators, of two groups, 10,000 kW each, of Schneider-Thomson, and the establishment of two main lines—one from Grand Quevilly to Monville and the other from Grand Quevilly to Elbeuf. The meeting fixed the dividend payable at 20 fr. per share. The profit and loss account showed a balance of 850,086 fr.; receipts 36,984,462 fr., and expenditure 21,744,465 fr.

Compagnie Réunies de Gaz et d'Électricité.—The ordinary meeting of this society, held at Lyons on April 5th, voted a dividend of 7 fr. per share, and authorised its board to issue bonds to the extent of 14,000,000 fr.

Italian Companies.

Società anonima Eletticità Alta Italia.—(Turin).—After reference to the regularly-effected increase of the capital of the company, which now stands at 48,000,000 lire, the report set forth the steady expansion of the company's business, its network now extending throughout the province of Piedmont either directly or through the medium of controlled companies. Thanks to suitable agreements with the Swiss group, the company had conveniently systematised its obligations. The financial year closing with December 31st had given a useful net balance of 3,788,957 lire, which allowed of a dividend of 6.80 per cent., or 17 lire per share.

Società idroelettrica Piemonte (Turin).—The yearly report of this company, after allusion to the exaggerated price of raw materials and the increase in staff wages, which had affected the balance, referred to the large share which the company had taken in the Società Idroelettrica Monviso and the Società Idroelettrica Piemontese-Lombarda Ernesta Breda, which assured to them a further 150,000 h.p. or over half a milliard kWh. The accounts closed with an available balance of 3,269,556 lire, which enabled a distribution of 7 per cent., or 8.75 lire per share.

Società Ligure Toscana di Eletticità (Leghorn).—The last report of this company, whose capital is 100,000,000 lire, shows that notwithstanding the hindrances of many kinds encountered, especially the agitations of the workmen, the production of 1920 exceeded that of the preceding year by 7,500,000 kWh. The erection of new plant was proceeding actively despite the scarcity of material, difficulties of transport, &c. The accounts closed to December 31st last with a net balance of 5,454,410 lire, which allowed of a distribution of 8 per cent.

German Companies.

The Kabelwerk Wilhelmshaven, of Berlin, which belongs to the Felten & Guilleaume group, reports net profits of 1,860,000 marks for 1920, as compared with 580,000 marks in the previous years.

The Dr. Paul Meyer A.G., of Berlin, proposes to pay a dividend at the rate of 12 per cent. for 1920 on share capital of 12,000,000 marks, this comparing with 10 per cent. in the previous year. The share capital is now to be increased to 24,000,000 marks.

The A.G. für Elektrotechnische Unternehmen, of Munich, reports net profits of 171,000 marks for 1920, as compared with 26,000 marks in the preceding year, and a dividend at the rate of 4 per cent. on the ordinary shares, which received no distribution for 1919.

The accounts of the *Treuhand Bank für die Elektrische Industrie A.G.*, of Berlin, indicate net profits of 1,684,000 marks, as contrasted with 948,000 marks in 1919, which sum was reached after extinguishing the deficit of 1,139,000 marks brought forward from the previous year. It is intended to pay a dividend at the rate of 6 per cent. on share capital of 25,000,000 marks, as compared with the same rate on about half this capital in 1919.

The report of *Hartmann & Braun A.G.*, of Frankfurt-on-Main, states that the degree of activity in 1920 showed a considerable improvement over the preceding year, but it was much less than in the pre-war period. Besides the exports to neutral countries, the operations of the Electro-Installation Material Co., a subsidiary of the company, contributed towards the better results. After making provision for depreciation, the accounts show net profits of 1,223,000 marks, as against 267,000 marks, and the directors recommend a dividend at the rate of 10 per cent., this contrasting with 6 per cent. in 1919.

The report of the *Bergmann Elektrizitätswerke A.G.*, of Berlin, states that the central station department obtained considerable orders in 1920 through participation in schemes for the electrification of the States and provinces, and the

railway department was fully occupied both for main line and light railway work. A tube rolling mill was added to the metal works and was developing satisfactorily, orders being on hand until the end of 1921. After writing off 4,828,000 marks for depreciation, as against 1,337,000 marks in 1919, the accounts show net profits of 13,135,000 marks, as compared with 8,488,000 marks in the preceding year, and the dividend is increased from 12 per cent. in 1919 to 15 per cent. in 1920. At the recent annual meeting, when it was decided to increase the ordinary share capital from 80,000,000 to 100,000,000 marks, it was mentioned that the prospects for the new financial year were very favourable, and the existing orders would provide activity for months forward. The foreign engineering and sales offices have been extended so as to promote the export trade.

Belgian Companies.

The Société d'Electricité et de Mécanique (Procédés Thomson-Houston et Carels), of Ghent, an amalgamation of the Belgian Thomson-Houston electrical engineering business with the engineering undertaking of Carels Frères, last week invited applications for 24,500 shares of 500 francs, representing an increase of capital of 12,250,000 francs, the shares being offered at 530 francs each. Since the war the works of the company in Ghent have been remodelled and largely extended. At the commencement of the present year the company was turning out large numbers of electric motors, transformers, and other electrical apparatus, while in the engineering shops extensive orders were in progress for Diesel and steam engines. Over 90 per cent. of the work in hand in this department was for foreign countries. The company has a board of 26 directors, among them being Mr. Howard C. Levis, the managing director of the British Thomson-Houston Co., Ltd., London.

The report of the Société d'Electricité du Bassin de Charleroi for last year shows a profit of 511,718 francs, as compared with 400,489 francs in the preceding 12 months.

Aldrich Electric Supply Co., Ltd.—During 1920 169 new installations were connected, making the total 2,128. After providing for debenture interest, putting £500 to depreciation, writing £1,537 off the expenses of the ordinary share issue, a final dividend of 7½ per cent. per annum for the December half-year is paid of the ordinary shares, and 10s. for the year on the deferred shares, leaving £1,034 to be carried forward. In spite of many adverse circumstances, the profits continue to increase. The additional plant will be ready in the course of the next few months, and should effect further economies in generating costs. The above results were secured in spite of the falling off in demand for power due to industrial conditions. The outlook for the future is favourable. The times are not propitious for making a new issue of capital, but this will have to be seen to when conditions improve. Mr. C. E. Hunter has resigned from the board.

Waygood-Otis, Ltd.—At the annual meeting, held on June 22nd, the chairman (Mr. Henry C. Walker) said that, although the profit made would seem to allow of the payment of a higher dividend, 9 per cent. would be paid on the ordinary shares, as, owing to the falling off in business, it was considered wise to conserve their resources. The company had many important contracts in hand, including orders from Selfridge & Co., and John Barker & Co., and a contract for installing passenger lifts in the new County Hall of the L.C.C.

Manaos Tramways & Light Co., Ltd.—The receiver and manager who was appointed on June 10th, announces that owing to the unprecedented fall in the sterling value of the Brazilian currency it is not possible for the interest due July 1st on the 5 per cent. debentures to be paid.—*Financial News*.

Victoria Falls & Transvaal Power Co.—The "Financial Times" states that the net earnings, including those of the Rand Mines Power Supply Co., for the quarter ended March 31st amounted to £172,390, before providing for taxation in South Africa and the United Kingdom.

Argentine Tramways & Power Co. The accounts for the year ended September, 1920, show that after payment of interest and sinking fund on debenture stock, and transferring £4,000 to reserve for renewals, there is a profit of £9,569, increasing the credit balance carried forward to £18,324, subject to corporation tax, if any.

Montreal Power Companies.—The Montreal Light, Heat and Power Co. is paying a dividend on the common shares of \$2., and the Montreal Light, Heat & Power Consolidated Co. one of \$14.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Interim dividend, for the three months ended March 31st last, of 5s. per share, free of income tax.

Tramways & Light Railways Estates, Ltd.—Dividend at the rate of 3 per cent. per annum; carried forward £213.

Stock Exchange Notice.—Dealings in the following securities have been specially allowed by the Committee under Temporary Regulation 4 (3):—

Pernambuco Tramways & Power Co.—£500,000 8 per cent. prior lien debentures to bearer, of £100 each, issued at 96 per cent., of which £30 is paid and fully paid, Nos. 1 to 5,000.

Edgar Allen & Co., Ltd.—Final dividend of 1s. per share, free of tax, making 2s. per share. £30,246 carried forward.

Companies Struck off the Register. The following, it is officially announced, have been struck off the Register and are dissolved:—

A.B. Vibro & Domestic Electrics, Ltd.
Feltham & District Electric Lighting Co., Ltd.
Non-conductors, Ltd.
Snayder Electric Lamp Co., Ltd.
Wholesale Battery Co., Ltd.
Carbonite, Ltd.

Major & Co., Ltd. Final dividend of 4½ per cent. on the preferred ordinary shares, making 8 per cent. for the year, 10 per cent. on the ordinary shares for the year, £6,173 carried forward.

STOCKS AND SHARES.

TUESDAY EVENING.

The unexpected lowering of the Bank rate to 6 per cent. came as an agreeable shock to the Stock Exchange and its markets. At the same time there arose a fresh breath of hope for settlement of the coal dispute. The two factors, coming together, exercised a strengthening effect upon prices, although Stock Exchange men are apt to complain that they have been followed by very little increase in business. The fact is that the public are not in a speculative mood. The end of the half-year is close at hand, and the usual inclination to indulge in window-dressing will certainly not be less at the present time than it is in days when funds are more liquid, and there is more money about. The purely investment stocks are very firm, but apart from this, neither the Bank Rate nor the coal settlement has affected prices to any noticeable extent.

The London & Suburban Traction Co., Ltd., is inviting tenders for the redemption of a portion of the 5 per cent. "A" debenture stock under the sinking fund provisions contained in the trust deed. The price of the stock in the market is 66-70, but in a letter to the stockholders, the company pointed out that the price of the stock was 61 in the last transaction recorded, according to the official list of the London Stock Exchange. This particular transaction was effected in August, 1920, so it is not surprising that some exception should have been taken to the quotation of this price, at a time when the actual value is 66 upwards. Naturally the company wants to buy the stock as cheaply as possible, but, equally naturally, the debenture holders have the right to be told what is the current market price, as well as that which ruled last August. Therefore the announcement that the company is about to send out another letter to the stockholders, informing them of the higher prices which are quoted in the Stock Exchange official list, has given satisfaction. The secretary explains that the statement in his previous letter overlooked the recent markings of the price of the stock.

There are no changes to record in the list of home electricity shares. The market is very quiet, and settlement of the coal strike has had no effect so far. The tone of the market is described as being rather harder. Metropolitan Electric 7½ per cent. debenture stock has further risen to 4½ premium. The issue of North Metropolitan 7½ per cent. debenture at 95, to which reference was made here two or three weeks ago, is on the point of emission. There was a keen demand for the underwriting, and it may be reasonable to expect a prompt subscription of the stock.

General Electric new debenture has been down to 4 discount, but rallied to 3½ discount. The company's 6½ per cent. preference shares are easier at 16s., and the ordinary dropped to 1/1-3/4. English Electric preference at 15s. are 6d. harder, and the manufacturing group as a whole is steady. Some of the armament shares improved on bear covering, induced by the forthcoming resumption of work in the coal mines. Vickers ordinary picked up to 13s. 6d., and the 5 per cent. tax free preference hardened to 13s. 9d. Armstrongs also are better. Babcock & Wilcox remain at 24.

Underground Electric Income Bonds at 82½ are a couple of points to the good; otherwise the Underground market is dull. With Districts and Metropolitan both ½ down on the week. There is a steady demand for the incomes, which has extended also to the company's 4½ per cent. bonds, the price of which is quoted higher at 95 middle.

Cable stocks are a trifle easier, in spite of the fall to 6 per cent. in the Bank Rate. Eastern Telegraph, Eastern Extensions, Great Northern and Indo-Européens are all lower, the last named shedding 5 points to 30. It may be that stock has come in from people who require money for business purposes at the end of the half-year, while the July demands of the tax collector tend to force into the market a certain amount of the good class securities. The West India & Panama Co. shows a loss in its report of £58,000 on the year. To meet heavy general expenses, coupled with loss of revenue, the company sold securities for £66,000, which had cost £96,500. The investments now stand at £12,900, as against £104,400 at the end of 1919. On this lugubrious showing, the ordinary shares have dropped to 7s. 6d., and both classes of preference are quoted at 50s. middle.

British Electric Traction at 35½ is quietly steady, the meeting having no influence upon the price. The 6 per cent. preference stock changed hands the other day at 59. Brush ordinary

shares are 17s. 6d., and the 5 per cent. prior lien stock remains at 10s., it has not altered this year.

Markets have been down to 24, before rallying to 24½. Dividend estimates have been put considerably since the prospects were only fair, last April, of 15 to 20 per cent. The wild state of Brazil has had something to do with the recent neglect of a market which, as a rule, offers peculiar attractions to investors in the sister isle.

Brazilian Tractions have lost a further 1½ points, owing to the movements in the exchange. It is said in the Stock Exchange market that the company is pursuing the policy of putting large sums into the "road," instead of attempting to remit funds at the present unfavourable rate of exchange. If this is correct, its good effect will be felt, of course, in the future. Mexicans keep their prices, and other foreign descriptions show no variations worth mentioning. The stocks influenced by the American rate of exchange are mostly lower on the week.

There was a lunch given on the Wednesday of this week to the Mayor of the City of Vancouver, who is in England on a visit just now, and who was asked to meet a number of London bankers, Stock Exchange men and others with interests in British Columbia. In the past, there have arisen occasions when those on this side who own stock in the British Columbia Electric Railway have not been able to see eye-to-eye with the local authorities. The lunch should have helped to clear the air on various minor points of uncertainty that might disturb a cordiality of relationship which both sides are sincerely anxious to maintain for their mutual advantage. The gathering itself was a purely informal affair, but it will doubtless create a personal touch which will serve to assist maintenance of better fellowship in the future.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.				
	Dividend	Price	Rise or fall.	Yield.
	1919, 1920.	June 28, 1921.		1920.
Brompton Ordinary	12 12	6	—	210 0 0
Charing Cross Ordinary ..	7 8	8½	—	7 10 6
do. do. do. ½ Prof. ..	4½ 4½	8	—	9 4 8
Chelsea	4 4	9½	—	11 5 0
City of London	18 14	1½	—	7 1 2
do. do. 5 per cent. Prof. ..	6 8	17½	—	9 17 0
County of London	8 8	8	—	7 7 6
do. do. 6 per cent. Prof. ..	6 6	8½	—	10 18 2
Kensington Ordinary ..	7 9	2½	—	7 10 0
London Electric	2½ 2½	1	—	10 18 2
do. do. 5 per cent. Prof. ..	6 6	2½	—	10 0 0
Metropolitan	6 7	2½	—	7 13 2
do. ½ per cent. Prof. ..	4½ 4½	2½	—	10 0 0
St. James' and Pall Mall ..	12 12	6	—	9 2 10
South London	6 7	2½	—	8 10 0
South Metropolitan Prof. ..	6 7	15½	—	9 10 0
Westminster Ordinary ..	10 10	5½	—	

TELEGRAPHS AND TELEPHONES.

	Dividend	Price	Rise or fall.	Yield.
	1919, 1920.	June 28, 1921.		1920.
Anglo-Am. Tel. Prof. ..	6 6	58½	—	7 3 9
do. Def. ..	1½ 1½	16½	—	8 13 0
Chile Telephone	6 6	5	—	6 0 0
Cuba Sub. Ord.	7 7	7½	—	9 6 8
Eastern Extension	10 10	16½	—	6 1 3
Globe Tel. and T. Ord. ..	10 10	16½	—	6 0 4
do. do. Prof.	6 6	8½	—	6 9 9
Great Northern Tel. ..	22 24	2½	—	8 11 6
Indo-European	10 10	80	—	6 6 8
Marconi	25 —	2½	—	
Oriental Telephone Ord. ..	12 12	2½	—	5 13 0
United R. Plate Tel. ..	8 8	1½	—	Nil
West India and Panama ..	Nil Nil	2	—	Nil
Western Telegraph	10 10	16½	—	6 0 4

HOME RAILS.

	Dividend	Price	Rise or fall.	Yield.
	1919, 1920.	June 28, 1921.		1920.
Central London Ord. Assented ..	4 4	48½	—	8 15 10
Metropolitan	12 1½	26½	—	5 17 8
do. Districts	Nil Nil	18	—	Nil
Underground Electric Ordinary ..	Nil Nil	24	—	Nil
do. do. "A"	Nil Nil	7½	—	Nil
do. do. Income	4 2	82½	+2	2 4 4

FOREIGN TRAMS, &c.

	Dividend	Price	Rise or fall.	Yield.
	1919, 1920.	June 28, 1921.		1920.
Anglo-Arg. Trams, First Prof. ..	5½ 12½	2½	—	10 0 0
do. do. 2nd Prof. ..	Nil 5½	2½	—	9 11 4
do. do. 5% Deb. ..	5 5	66½	—	7 12 8
Brazil Tractions	Nil Nil	81	—	Nil
British Columbia Elec. Ry. Ptoe. ..	5 5	86	—	8 13 6
do. do. Preferred ..	5 5	63½	—	8 15 0
do. do. Deferred ..	3 8	61½	—	11 17 6
do. do. Deb.	4½ 4½	60½	—	7 2 10
Mexico Trams 5 per cent. Bonds ..	Nil Nil	52½	—	Nil
do. do. 6 per cent. Bonds ..	Nil Nil	28½	—	Nil
Mexican Light Common	Nil Nil	11½	—	Nil
do. do. Pref.	Nil Nil	18½	—	Nil
do. do. 1st Bonds	Nil Nil	76½	—	Nil

MANUFACTURING COMPANIES.

	Dividend	Price	Rise or fall.	Yield.
	1919, 1920.	June 28, 1921.		1920.
Babcock & Wilcox	15 16	2½	—	8 14 6
British Aluminium Ord. ..	10 10	15½	—	12 14 0
British Insulated Ord. ..	15 15	12½	—	9 13 0
Callenders	15 16	1½	—	10 0 0
do. 6½ Prof.	6½ 6½	17½	—	7 8 7
Crompton Ord.	10 10	16½	—	12 6
Edison-Swan	10 —	10½	—	7 2 10
do. do. 5 per cent. Deb. ..	5 5	70	—	12 4 2
Electric Construction ..	10 10	16½	—	13 6 8
English Electric	8 8	12½	—	9 13 0
Gen. Elec. Prof.	6½ 6½	16½	+6½	8 2 6
do. Ord.	10 10	1½	—	9 18 8
Henry	15 16	12½	—	10 18 2
do. 4½ Prof.	4½ 4½	86	—	6 18 6
India Rubber	10 10	1½	—	8 16 10
Met.-Vickers Prof.	8 8	11½	—	10 0 0
Siemens Ord.	10 10	1	—	6 17 0
Telegraph Con.	30 30	30½	—	

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, June 28th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb. 91d.	Ad. dec.
a Ammoniac Sal	per ton 475	..
a Ammonia, Mariate (large crystal) ..	265	..
a Bisulphide of Carbon	" 494	..
a Borax	281	42 dec.
a Copper Sulphate	per lb. 7d.	..
a Potash, Chlorate	8d.	..
a Perchlorate	217	23 108. dec.
a Shellac	per cwt. 218	..
a Sulphur, Sublimed Flowers	" 416	..
a Lump	per lb. 4d.	1d. dec.
a Soda, Chlorate	per ton 27	..
a Soda Crystals	per lb. 7d.	1d. dec.
a Sodium Bichromate, cakes ..	per lb. 7d.	..
METALS, &c.		
p Babbitt's Metal Ingots	per ton £95 to £900	..
c Brass (rolled metal 2" to 12" basis) ..	per lb. 11½d.	1d. dec.
c " Tubes (solid drawn)	" 1/12 to 1/2	..
c " Wire, basis	" 11½d.	1d. dec.
c Copper Tubes (solid drawn) ..	178	..
c " Bars (best selected)	per ton 212	24 dec.
c " Sheet	" 212	24 dec.
c " Rod	" 212	24 dec.
c " (Electrolytic) Bars	276	23 dec.
d " Sheets	2145	..
d " Wire Rods	292	23 dec.
d " H.C. Wire	per lb. 11½d.	1d. dec.
f Ebonite Rod	" 8½	..
f " Sheet	" 2/9	..
n German Silver Wire	" 10/12 to 16/12	..
p India-rubber, Para fine	14½	1d. dec.
l Iron Pig (Cleveland Warrants) ..	per ton Nom.	..
l " Wire, galv. No. 5, P.O. qual. ..	240	25½-iac.
g Mercury	per pot. £10 15 to £11	..
e Mica (in original cases) small ..	per lb. 4d. to 4½	..
e " " large	" 5½ to 10½	..
p Phosphor Bronze, plain castings ..	" 13/6 to 25½ & up	..
p " " rolled bars and rods ..	" 2/1 to 2/6	..
p " " rolled strip & sheet ..	" 2/2 to 2/7	..
d Silicon Bronze Wire	per lb. 1/8	..
r Steel Magnet, in bars	per lb. 1/8	..
n " Block (English)	per ton £166 nom.	..
n " Wire, Nos. 1 to 16	per lb. 4½	..
p White Anti-friction Metals ..	per ton £78 to £800	..

Quotations supplied by—

a G. Boor & Co.	James & Shakespeare,
c Thos. Bolton & Sons, Ltd.	Edwards Till & Co.
d Frederick Smith & Co.	Rolling & Lowe.
e F. Wiggins & Sons.	Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	P. Ormiston & Sons.
l Telegraph Works Co., Ltd.	
p R. W. F. Dennis & Co.	

Birmingham District Power & Traction Co., Ltd.—The general meeting was held on June 22nd, Mr. C. S. B. Hilton (chairman and managing director) presiding. The chairman said that there was a small falling off in net receipts of £867. The gross traffic receipts were about £12,000 more than in the previous year, but dividends and interest on investments had fallen by almost a corresponding figure. The business of the Shropshire Power Co. had been prejudicially affected by industrial unrest, and the result of that company's operations for the year had therefore not come up to expectations. The Birmingham & Midland Motor Omnibus Co. had, however, steadily progressed, and had again paid the substantial dividend of 10 per cent. Power and running expenses showed an increase of £10,000, but repairs and maintenance had cost £9,000 less, while administration expenses had gone up from £9,775 to £14,351. The net result was that they had an available balance of £71,140 compared with £73,953 in 1919, and the directors recommended the payment of a dividend on the ordinary shares at the rate of 6 per cent.

Germany.—According to the "Frankfurter Zeitung" a limited company is about to be founded called the Elvise, with its seat in Berlin and a capital of 11,250,000 marks. The big wireless station of Elvise will be brought into this company by its owners, the Hochfrequenz Aktien Gesellschaft, who, with the Telefunken group, will form the ownership of the new company. The compensation for the transfer of the station is 10,000,000 marks. These arrangements place long-distance transmission in one hand, and render competition impossible. The position of the Hochfrequenz shareholders is now as follows: Their company is now only a "holding company," which possesses the 40 per cent. with 7 per cent. guaranteed minority share in the Elvise Co.; the claims to the 40,000 Marconi shares; a remainder of their title in the Compagnie Universelle de Télégraphie sans Fil; and, lastly, claims in America on the Tuckerton, N.J., station, estimated before the war at 1,810,000 marks. There may also be patent rights and plans, but no manufacturing works.

B.T.H. ELECTRIC SHUNTING LOCOMOTIVES.

The advantages and economies that result from the introduction of electric locomotives into shunting yards were amply proved some considerable time ago, and are well known to those interested in the subject. Nevertheless, progress in this country has been slow, not because of the lack of suitable material, but rather owing to a reluctance to part with a system with which all parties are familiar. Further, the actual costs of shunting operations were seldom kept separately and, in consequence, the possibilities of economy were not appreciated. However, the present high prices of fuel, materials, and labour have served to draw attention to every

With regard to driving, the electric locomotive is very simple and easily handled. One man only is required per locomotive and, owing to the fact that there are no parts of the apparatus which require his attention while running, he can concentrate altogether on the control of the locomotive and its load. The locomotive is always ready in the shed first thing in the morning, and there are no additional labour charges for lighting up the furnace and raising steam. Shed cleaning charges will also be considerably lower, and it may be pointed out that the locomotive may be housed in any convenient shed without any danger of fire.

With regard to maintenance, the electric locomotive has proved itself definitely superior to the steam locomotive. Against boiler renewals and the upkeep of a complicated, if familiar, system of cranks and valves involving many bearings, rubbing surfaces, glands, and joints, we have to set the maintenance of two simple motors and gears, a controller, a current collector, and one or two switches; the renewable parts for these are small and inexpensive. The cost of maintenance of an electric locomotive has been found not to exceed one-third of that of a steam locomotive of equal capacity, and the prospective user of electric shunting locomotives need have no fears as to the reliability of the material.

The British Thomson-Houston Co., Ltd., of Rugby, supplied in 1906 to one of the home railway companies two shunting locomotives which weigh 56 tons each, and are handling the quayside traffic at Newcastle-on-Tyne. Each locomotive is fitted with four 90-h.p. motors, which can start a train weighing 160 tons on a grade of 1 in 27 and haul it on that grade at 10 miles per hour. They operate at 550 volts, the supply being collected from either a third rail or overhead conductor. Air brakes are fitted, which are supplied with air by a motor-driven compressor controlled by an automatic governor. Fig. 1 shows a 22-ton locomotive supplied to a large firm of steel makers in 1914. It is operated at 500 volts from an overhead conductor, and is fitted with two 85-h.p. motors. It is employed in hauling slag on a grade

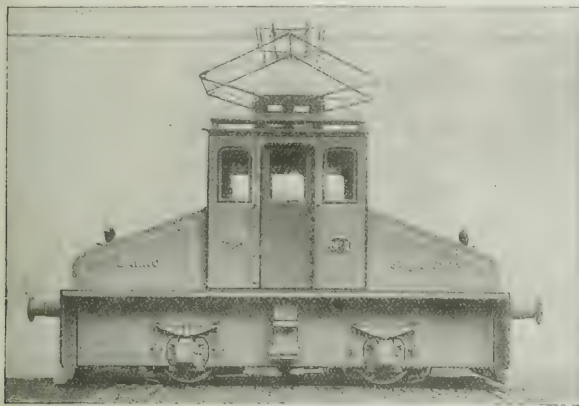


FIG. 1.—A 22-TON B.T.H. ELECTRIC LOCOMOTIVE.

channel of expenditure and, as a result, the cost of railway goods-yard operations has been realised in many cases for the first time.

Apart from the question of fuel and maintenance charges, the electric locomotive has certain inherent advantages for this class of work. It is simple in operation; the actual machinery requires none of the driver's attention; it is instantly ready for work at all times; requires the minimum of attention outside working hours; and is not subject to the periodical lie-offs for boiler cleaning and repairs which are necessary with the steam locomotive. Add to this the fact that, due to its uniform torque, the electric locomotive is more powerful, weight for weight, than a steam locomotive, and it becomes evident why in all electrification schemes it has been found possible to do more work with fewer locomotives. In recent experiments in this country it was shown that the average working speed of a steam shunting locomotive was approximately 2.5 miles per hour, whereas an electric locomotive would do the same work at an average speed of over 5 m.p.h., and that under by no means ideal conditions.

The steam shunting locomotive is notoriously inefficient. Considered purely on its merits as a steam engine and without reference to the work on which it is engaged, the fact that it is non-condensing tells heavily against it. Even under the best conditions of continuous full load it burns at least twice as much coal per horse-power-hour as is required for a turbo-generator of moderate size. It must be remembered, however, that a shunting locomotive usually work under very poor conditions. Even a hard worked shunting locomotive stands idle for approximately half its time, although it must always keep up steam pressure for full load. Further, the service is so intermittent that at each start, steam is admitted to cylinders which have had time to cool; also, in order to obtain a sustained tractive effort at low speed the valves must be set for a late cut off. It is not generally realised how very little useful work is done by a shunting locomotive, but it is doubtful if its average horse power output over the day exceeds 10 per cent. of its nominal rating.

In the case of the electric locomotive, it may be said that there are no stand-by losses. Power taken by any one locomotive will always be a small part of the total load on the generator; also, owing to the diversity of the load, the temporary overloads on any part of the system will not overload the generator as they will not all occur at the same time.



FIG. 2.—A 10-TON POWER STATION LOCOMOTIVE.

of 1 in 20, and is equipped with the same system of air brakes as the locomotive described above. A duplicate was supplied in 1916. Fig. 2 shows a smaller locomotive in use at a power station for hauling and shunting coal trucks. It weighs 10 tons and is fitted with two 26-h.p. motors.

With regard to the system of distribution, there can be little doubt that d.c. power at 500/600 volts collected from an overhead conductor or trolley line is the best for a private shunting yard electrification system, and this voltage is usually obtainable without the necessity of laying down converting plant. Further, this pressure being a standard for tramway and railway work, there is a big selection of standard and well-tried apparatus from which to choose. The overhead system is the most generally suitable, although it may be necessary in certain circumstances to leave gaps in the line for the passage of cranes, &c. If the arrangement of the track is such that the gap would seriously interfere with the efficient working of the locomotive, it would be possible to arrange a short length of third rail at such points which would only be alive when the train was passing over it. Failing this, a small battery could be carried on the locomotive of sufficient capacity to carry it over the dead section.

An aspect of the matter upon which there is some misconception is the application of storage batteries to electric locomotives. Electric battery locomotives have shown very real economies in some specialised fields—for instance, in the case of mines where a trolley wire is sometimes inadmissible, or for handling contractors' railways where the run of the track is being altered from day to day. In these instances the locomotives have been extremely successful, and there is every reason to believe that at an early date they will completely supersede the costly system of haulage by man power or animals. They have also been used to a considerable extent in workshops for the same reason. In some cases, too, where the traffic is very light and the yard extensive, it may not be economical to install an overhead conductor line, but such conditions do not often occur in ordinary shunting practice, and in the majority of cases it is certain that the battery system cannot compete with a system drawing its power from an overhead line. Apart from the disadvantages which are inherent in storage batteries, enough has been said to show that in cases where it is impossible to fix an overhead or third rail, the battery locomotive may be able to show a considerable saving on haulage by steam locomotives, but that it cannot compete with an overhead conductor system as regards maintenance costs or convenience of operation.

In conclusion, it would appear that under the conditions obtaining to-day, when it is so necessary to prevent any waste of either labour or material, users of steam shunting locomotives would find it to their advantage to consider very carefully the conversion to electric working.

ELECTRICAL CONDITIONS IN NORWAY.

SINCE referring in our issue of May 27th to the question of German competition in Norway, information has been published in Christiania with the object of throwing light on electrical conditions in that country. The information, which appeared in the Norwegian contemporary referred to on the previous occasion, consists of a statement made by Mr. Bruun, director of the Norwegian A.E.G., and a reply by the Industrial Union of Norway on behalf of the native manufacturing industry.

Mr. Bruun first recalled the fact that many Norwegian municipal authorities were compelled to suspend the work of establishing hydro-electric works in 1920, owing to the unusually high prices brought about by the war-time events. There was no question of proceeding with new works, because high prices excluded the possibility of such works becoming profitable unless the charges for electrical energy were to be fixed on a level which could not be reached by thousands of small consumers in town and country districts. Now when prices had fallen somewhat it must have a disconcerting effect for cries to be raised that foreign competition was too strong. In his opinion the fall in prices had not taken place to the extent which must occur if prices were to stand in proportion to what installations cost before the war. At present Norwegian prices were at least two and a half times greater than the former peace quotations, and they were not in proportion to the cost of the most important raw materials. If, therefore, the German prices lately had fallen to about double the pre-war prices, complaints could not be made that the Germans were dumping or that the installations were too cheap. The question must, therefore, involuntarily arise as to which factor was the more important in the economy of Norway—either the few electrical engineering works, of which some were financed during the favourable trade situation of the war, or the hundreds of thousands of consumers who have an interest in obtaining cheap power at the present time when labour is so costly. When cheap, electricity contributed towards the furtherance of Norwegian industry by rendering it able to compete, and not the least the export industry.

Dealing with the many newspaper articles recently published on the subject, Mr. Bruun stated that he was struck by the partiality and the extraordinary lack of knowledge displayed in them. People spoke of orders for electrical plant just as if the question concerned a sack of coffee or a bag of sugar. Yet everyone familiar with the orders knew that a large part of the machines must be supplied from abroad, because (1) the machinery was too large to be constructed by the Norwegian works, and (2) it was frequently the case that even if the plant could be built in the country it would be disproportionately dear owing to the fact that the works concerned were not laid out for such manufactures. In individual instances there was no Norwegian production of the plant ordered abroad.

Mr. Bruun proceeded to remark that he was in complete agreement with the idea that Norwegian industry should have reasonable protection in the case of orders for the State and the municipal authorities if the matter concerned something within their competency and their experience. The amount of the protection was a matter of opinion. Besides the prevailing import duties, the State had protected Norwegian industry up to 15 per cent., and had also stipulated that

Norwegian plant should be protected for works built under State concessions, when equally good, by 10 per cent. In his opinion, these rates were proper if the protection was given only on goods in a tender which actually was of advantage to Norwegian industry. But it was quite obvious that if foreign firms were to place their technical knowledge and experience at their disposal in the submission of tenders, they must in fairness be able to demand to be previously informed of the amount of protection to be granted to native works. Otherwise foreign firms would naturally say that they would not incur the large expenses incidental to the preparation of all these schemes merely to exercise a controlling or regulating influence on Norwegian prices. The result would then be that all competition from abroad, both technical and commercial, would cease, and that would surely not be in the interests of the Norwegian community. Much was said of preventing unemployment and that, to that end, orders must only be placed with native works whatever the cost. But when there was a great difference in price, could not the local authorities order the plant from the lowest tenderer, and employ the amount of the economy effected for the starting of other works so that the difference would wholly be of profit to Norwegian labour? In this connection the director remarked that as a consequence of the changed conditions of the world since the war, Germany could become a fairly good customer of Norway as a consumer of iron ore, pyrites, carbide, fish, &c. It was, however, to be feared that under present circumstances Germany would be unable to pay for these products in any other way than by exports.

The Industrial Union of Norway (Norges Industrie Forbund), referring to the assertion of Mr. Bruun that the level of prices had not by far fallen so as to be in proportion to what machinery cost before the war, states that this is a matter which has nothing whatever to do with the present question, which exclusively concerns competition due to exchange conditions. Norwegian industry does not complain if Germany is able to deliver cheaper under otherwise equal monetary conditions. As to the statement that the question concerns the few electrical manufacturing works on the one hand and the consumers on the other, the Union remarks that this is not quite correct. German exchange dumping threatens to destroy the whole of the country's economy through increasing unemployment, diminished taxation revenue, and fall in the Norwegian exchange owing to larger imports and demoralisation as a consequence of unemployment. Concerning the charges made of inadequate productive capacity of native works, the Union states that the works are equipped so as to be able advantageously to turn out the largest types of machines in normal times. The protection of 10 per cent. granted to Norwegian industry was fixed by Parliament in 1894. But such protection is quite problematical when firms have to contend with an exchange like the German, which is about one-ninth part of the par value in relation to the Norwegian kroner; and there is, therefore, no question of competition when it takes place on such a difficult basis. The difference in exchange must first be eliminated before a protection of 10 or 15 per cent. can be of any practical importance. The Union dismises as not being serious the suggestion that economies effected by local authorities in placing orders abroad should be utilised for providing employment; it states that the trained workmen can only be advantageously employed in their particular branches, and that it is doubtful whether the authorities would adopt such a proposal. As to the remark that Germany can only pay for imports by means of exports, the Union observes that this does not concern Norway, but that it can be taken for granted that Germany will not buy more than she absolutely needs from Norway just as the latter cannot import more than the absolute minimum.

MAGNETOS FOR INTERNAL-COMBUSTION ENGINES.

DISCUSSION AT MANCHESTER.

MR. E. A. WATSON'S paper, which was abstracted in our issues of May 6th and 13th, was discussed by members of the NORTH-WESTERN CENTRE of the INSTITUTION of ELECTRICAL ENGINEERS on February 22nd, when Mr. J. Frith presided.

Prof. E. H. CRAPPER said he came from Sheffield, and the part it had played in the magneto business had been to supply magnet steel. The University of Sheffield was the only institution which demanded that its graduates for the degree of metallurgy should pass a written examination and a practical test in the magnetic properties of iron and steel. He was responsible for that particular section, and it had taken on in the engineering side rather than the metallurgical side. He soon found that there seemed to be a necessity to formulate some kind of analysis of the magnetic elements, and a good deal of work had been done. There were the working constants which had been referred to by Mr. Watson, and there were also constants relating to the nature of the material. Many of the constants they had to deal with, as regarded magnetic substances, were hyperbolic func-

tions of the magnetising force; that opened up a field of research which was bound to be productive of a good deal when they were endeavouring to see what was the actual nature of the material. The saturation value of the material was the most critical constant they had of it. The saturation value for B was an important constant, and if they were going to judge a material it must be taken up to a point sufficiently high to enable them to get the saturation value. He was quite convinced, as Sir Robert Hadfield and Prof. Hopkinson said in the paper that they read on the magnetic properties of iron and steel, that there were many cases in which if they once got the magnetic properties, they could actually tell the amount of carbon which was present in the steel. The better the steel the better the magnet, the greater the value of B, and the less would be the saturation value. With regard to cobalt steel, or Japanese steel, the first reference to the beneficial influence of cobalt on iron was by Prof. Weiss, of Zurich, who gave the results of his tests which were conducted at almost zero, and they were remarkable. Cobalt steel which was made in Sheffield during the last 12 months brought out very prominently the fact that if they wanted to know its real quality they must take the magnetising forces up to their highest value. With three curves (one corresponding to 400 units, another to 600 units, and finally one of 1,500), in the case of the 400 one, the magnetising force was about 175, and when H (by substitution) was 100 it gave, practically speaking, 200 units of magnetising force. The maximum values corresponding to the 1,500 units of H gave the value 714,000, whereas tungsten steel went approximately up to 300,000, which showed the influence of cobalt steel on the design of the magneto. It was also important to take the magnetising force up to the maximum value, because there was a difference of 214,000 between the points of 400 units and 1,500 units. Of the truth of the statement that "whatever changes take place in a magnet in consequence of external influences occur because the elastic limit of the material is such as to permit the movement of the molecules of the magnet to take place slowly or quickly as the case may be," he was perfectly convinced in his own mind, although he could not give a definite proof of it. There was no doubt about it, magnetically it was truly elastic, and he was convinced that for permanent magnet steel B could not be used logically, but intensity of magnetisation should be used. Not the permeability of a magnet steel, but its susceptibility, was the root of the matter. It was closely associated with elastic material from the mechanical point of view. The rate of change in the susceptibility was equal to E constant multiplied by the square of the susceptibility at that point, and E was a quantity associated with, or in some measure, the elastic limit of material. Prof. Crapper exhibited lantern slides, curves, formulae, and tables illustrating the properties of various steels.

Mr. T. T. KAYSER explained that it was easy to get the wrong magnet to do the job quite satisfactorily if they did not trouble about the amount of steel they were using and the shape of it. But if they desired to have an economical design they must apply Mr. Watson's reasoning. The usual view had been that they were required a certain remanence in order to give the working flux, and a coercive force of about 60 or 70 to give permanence. Such a view was absolutely ridiculous; in the first place, coercive force did not give permanence. If two steels with the same remanence and the same coercive force were allowed to age, one would lose its properties very rapidly, and the other would keep them. What they really wanted to know was the maximum demagnetising force that steel would lose and the flux it would retain, and that was very clearly shown by the B H line. Really the remanence of steel was of little use to any designer; it was simply a property of a closed magnetic circuit, and so of very little use, because it could not be used with any external available energy. Referring to cobalt steel, he confirmed the figures given by Mr. Watson, and mentioned the figure 900,000. Working with such a steel he had obtained a figure as high as a million, but steels with such a high efficiency were not commercial possibilities at the present moment. But there were steels containing chromium cobalt giving about 700,000 which were already being commercially produced. He hoped that Sheffield University would not burden them with any more constants, they had got quite enough, and those interested in the development of magnet steel were not at all interested in the rate of change of susceptibility when they were making a permanent magnet.

Mr. G. A. CHEETHAM pointed out that finality in magneto design could not be attained until the problems relating to the function which magnetos had to perform were definitely solved. The electrical ignition of explosive mixtures must, therefore, be carried towards a conclusion before they could hope to see finality in magneto design. There was usually a tendency for factors of safety to be high when knowledge of the problem to be solved was incomplete. When war broke out the main problem was to fulfil a performance specification by all the machines completed with as little difficulty as possible, and without radical departure from fairly well-defined designs. That was quite a different problem from that which Mr. Watson and his colleagues now had before them, but the investigations undertaken in the solution of the first problem must have been invaluable when design itself began to evolve along scientific lines. A committee of the British Engineering Standards Association was at present sitting to

standardise the commercial measurements of permanent magnets for all purposes. A further requirement in addition to the remanent induction and coercive force was essential for magneto work. This additional figure usually specified was the maximum product of B and H obtained on the design, which approximated to the maximum energy available. Experiments regarding the effect of increasing the air gap of a magneto showed that, in some cases, it was possible to obtain higher open-circuit voltage values across the primary winding of the magneto at a given speed with a larger air gap, provided the magneto was running under short-circuit conditions for a short period before the tests were carried out, although the voltage curves obtained before running under short-circuit conditions showed reduced values with increasing air gap in every case as expected; and it was felt that the very fine tolerance allowed in the air gap could be widened considerably without seriously reducing the ability of the machine to meet its requirements. The bearing in the magneto contact-breaker should be capable of operating satisfactorily without lubrication, and to obtain that object a fibre bush had been used for some time, but unless the material was well treated before it was put into position in the contact breaker considerable trouble was experienced due to seizing and packing.

Mr. J. D. PATON explained, with reference to that function of steel which practically had to be destroyed before they got the full zero, that Prof. Bragg's paper on molecular structure indicated an internal relation between the individual atoms, and a study of what took place in the Laval furnace explained the inherent property in any composite material, which was cited as existent in steel before the normal zero was defined. In steel which was a composite material there were numerous thermocouples, and there was a relationship between them which had to be destroyed. It was also a material fact that iron taken from the lowest normal temperature to the fluid state exhibited utility effects due to the different constituents which produced those internal currents. The reaction of those currents upon the iron was the destroying power of magnetism and, therefore, all magnetism disappeared at the red point.

Mr. SILLS was surprised to hear the remark made by Mr. Watson that "as long as you get a spark you get ignition." All ordinary magnetos should have a sort of fixed starting device, fitted so that one could start the engine with the absolute minimum amount of cam trouble.

The CHAIRMAN pointed out that they had heard a lot about the expense of cobalt-steel alloy, but in view of the reduction of the size of the magnet to get the same amount of work, how many pence would it amount to in the cost of a magnet? He felt sure it was not correct to say that "if there was a spark it was all right"; there were sparks and sparks. It was a very poor example of battery-coil firing that was represented in the paper. He had a car that had done 25,000 miles on battery firing, and he was rather glad he had not got a magneto. He had never had the slightest trouble.

Mr. E. A. WATSON, in reply, said that what an average man called a "fat" spark was very often simply a spark followed by a long flame, which was no good. He referred to the magnetic equation for steels, and the importance of saturation value, saying that there were three different quantities to represent the steel, and one could easily reconstruct the B H loop from them and calculate the flux of the machine for any definite conditions. Highest saturation value meant a better steel. The increased permeability was nothing like so wonderful as the increased coercive force; a 35 per cent. alloy of iron and cobalt had a saturation intensity about 25 per cent. higher than that of pure iron. The material had about from 3½ to 4 times the coercive force of the best tungsten steel, and about five or six times the coercive force of ordinary carbon steel. That was not pointed out by Weiss, whose paper only dealt with the carbon-free alloys, with the saturation density, and the permeability, not with the coercive force. In manufacturing cobalt steels, British manufacturers were taking the lead; Sheffield had produced many high-speed steels, and had now taken up the manufacture of those new magnet steels. The only thing that really mattered to the British manufacturer was the B H maximum of the steel; but at the same time one liked to know a bit more about what one was using than the bare facts of what it would do. Cobalt-chromium steels were certainly interesting, and they promised to give very good results with a smaller amount of cobalt. In view of the high price of cobalt that was very important; 35 per cent. cobalt, at its present price, was quite out of the question. The present price of cobalt steel per magnetic unit was certainly higher than the price of tungsten steel. On the other hand, it enabled other savings to be made. The machine could be made lighter and smaller. That did not mean less cost, but it saved a lot of useless material. In many cases the dimensions of the machine were controlled by the dimensions of the magnet, the latter determined the amount of aluminium, copper loss, and insulation, so one could cheapen the machine on that account as well as by reducing the magnet itself. It would not pay to substitute a cobalt-steel magnet for an ordinary tungsten-steel magnet; to make it a commercial proposition one had got to redesign the magneto. An advantage was that by using cobalt steel the magnet could be made straight. Regarding condenser breakdowns, the speaker had made tests of the transient voltage which sometimes reached a fairly high

figure, a plain practice was 600 volts a.c., with a fairly high frequency. Very rarely did they get breakdowns for purely electrical reasons; usually breakdown troubles were to a large extent due to mechanical reasons—vibration or faults or cracks starting in the mica. A number of British firms were now using baselite in preference to fibre bushes. Into the concentricity of cams half a dozen elements entered, and no matter how fine limits were worked to, it was quite impossible to work on each part to limits sufficiently fine to ensure concentricity. Magneto makers did not like to admit it, but it was a common practice to do some sort of correcting operation on the complete machine to ensure concentricity. The problem of getting the cam concentric had been about the most serious mechanical problem which the magneto industry had had to face. The speaker had heard a good many nasty things said about American magnetos, and some of them were undoubtedly true. They used very fine screws with very coarse threads without locking them, and, of course, the screws very soon fell out. They did all sorts of little foolish things like that which caused the magnetos to give trouble, and they got a bad name. It was not so much in the design itself—that was not bad—but simply because of the way the work was carried out.

DISCUSSION AT BIRMINGHAM.

Mr. E. A. WATSON'S paper was also discussed by members of the SOUTH-MIDLAND CENTRE of the INSTITUTION of ELECTRICAL ENGINEERS at Birmingham, on April 27th.

Mr. W. WILSON referred to the earlier practice of fitting magnetos with a plurality of narrow magnets and contrasted that with the present practice of fitting a single magnet. He had heard it explained that the reason for the use of several magnets was that, owing to the superficial nature of permanent magnetism, it was necessary to provide as large an area of free surfaces as possible, but he did not consider the explanation convincing, and asked whether a more satisfactory reason could be given.

Capt. CAVE-DROWN-CAVE spoke on the advantages of a gap in series between the h.p. winding of the magneto and the engine sparking plug, and referred to the practice, now common, of providing "jump-spark" distributors. He had heard of occasional trouble with these distributors owing to metal particles short-circuiting the h.p. leads, but his own experience with them was satisfactory. He also mentioned the possibilities of using influence machines for ignition purposes.

Mr. E. O. TURNER questioned the advisability of using the same leak resistance for utility tests at high and low speeds, and thought that at high speeds a higher leak resistance than that used at low speeds would be more consistent with engine working conditions. He commented unfavourably on Mr. Watson's curve showing the performance of a battery and coil ignition apparatus, and thought that the curve was not representative of the well-designed apparatus now obtainable. Further, he did not agree with Mr. Watson's advocacy of the jump spark distributor, but preferred the rubbing contact.

Dr. D. K. MORRIS referred to the important fact that, in determining from the demagnetisation curve the suitability of the permanent magnet for magneto work, the useful figure was not remanence, nor coercive force, nor their product, but the product of those values of B and H on the curve which gave the greatest value.

Prof. W. CRAMP said that the paper not only provided new and useful information for the benefit of makers and users of magnetos, but lifted the subject from the region of empirical guesswork to that of scientific design. After discussing certain points in the paper in detail, Prof. Cramp asked the author whether he had ever tried to measure mechanically the energy due to a given displacement of the armature. It seemed to him quite possible to accumulate energy in a moving mass, and so render the treatment of the subject independent of mental pictures.

Testing Electrical Appliances.—Among the many interesting subjects dealt with in the recently-published report of the Merchandise Sales Bureau of the American N.E.L.A., is the testing of electrical appliances by a special division. These tests are to be carried out for manufacturers principally in order that they may have something to refer customers to when guaranteeing the reliability of their products. Among the tested appliances, &c., will be flexible cords, incandescent lamps, electric irons, washers, toasters, &c. Tests upon electric irons are already in progress. The main point which is receiving attention is the efficiency, i.e., the ratio between the total wattage input and the useful work done. There will be tests for heating and cooking and observation of temperatures at different points as on the handle and at the point and centre of the sole plate. The effects of long-continued heating will be noted, and tests of mechanical or physical strength will also be carried out. The tests will be standardised so that they can be repeated on future occasions or elsewhere than the Association's laboratories.

THERMAL CHARACTERISTICS OF ELECTRIC OVENS AND HOT PLATES.

DISCUSSION AT NEWCASTLE-ON-TYNE.

At a meeting of the NORTH-EASTERN CENTRE of the INSTITUTION of ELECTRICAL ENGINEERS at Newcastle-on-Tyne, on April 26th, Mr. J. R. BEARD presiding, Dr. E. GRIFITHS and Mr. P. H. SCHOLFIELD submitted their paper upon "Some Thermal Characteristics of Electric Ovens and Hot Plates," which was abstracted in our issue of February 10th, and a short discussion followed.

Mr. DOWNS said the curve showing the influence of metallic contact between the hot plate and the disk was striking, and made the point quite clear. Regarding hot plates generally, he drew attention to the fact, that should not be overlooked, that their use required the provision of special pots and pans if economic use was to be obtained. He referred to the influence of surface oxidation of the copper disk and the point at which it reached maximum temperature, and asked whether a coating of black paint would improve the factor referred to. The condition they wanted for cooking and baking was different from what was wanted for boiling. For the former they required a very considerable heat, but for a comparatively short time, and from the point of view of economy the oven that reached its maximum heat quickly was much the best.

Prof. STROUD said it seemed to him there was too generally a tendency to copy older methods rather than to find new methods for themselves. He was glad to see the fact stressed about the sheeting of the oven and the condition of the vessel on the plate. The size of the utensil having regard to the size of the hot plate was of importance, and in some cases there must be considerable waste of heat from disregard of that fact. Why did they not get away from the gas-oven type of cooker? They needed to go into the question of design exhaustively; one in the form of a dome, with the heaters placed around it, had the advantage that there was no loss of heat due to the opening of the door, because the heat mounted upwards and could not escape. That type could be hung from the ceiling, and the articles to be cooked could be placed on a plate inside it. It was curious that people would look into the oven instead of ascertaining the heat otherwise.

Mr. FINKNEY thought the paper, excellent as it was, would be of service chiefly to those engaged in the manufacture of cookers. What was it they wanted the manufacturer to embody in the oven? Most of the modern ovens were pretty good, and he thought the chief weakness was the hot plate. What they required was a quick-heating hot plate—it must be efficient, reasonably quick heating, but above all they asked for reliability; that last point was an essential, and with respect to it they had much trouble and frequent demands for repairs. How far could the use of chrome steel, when it became more generally used, be utilised in the construction of utensils for electric cooking? The manufacture of suitable utensils should have their careful consideration, and manufacturers should do more towards supplying suitable articles. Another device deserving of attention was a heater for water boiling. There was much objection to the light type of oven owing to its lack of mechanical strength, and when that was remedied and they could get a cooker reasonably light, but possessing adequate strength for its intended purpose, they would have made considerable progress towards popularising the electric cooker.

Mr. WARD questioned somewhat the utility of the tests, and thought all-round tests would have been the best. He regretted that the authors had been more or less restricted in their inquiries. It seemed that the tests should have been of a more practical character. The facts that had been elicited were not of such a character that they could be used when speaking to prospective customers, or with those who already used electric cookers. The temperature curves for air in ovens and for the interior and exterior walls was excessive; the maximum of 15 minutes was too long, it seemed to him. Referring to Prof. Stroud's suggested dome oven, while with a door opening at the bottom there would be no loss of heat he thought it would be costly to maintain. They might devise a way of getting into it which would minimise any possible damage to the elements such as might follow from the frequent raising and lowering of the dome.

Mr. VIAL'S own experience was that the sheet metal lined ovens were more economical than those which followed the gas-stove design.

The CHAIRMAN raised the question of how far it would be possible to use vacuum blocks for insulation purposes between the linings of the oven.

Dr. GRIFITHS, in reply, said they must have good thermal contact on the hot plate. Regarding Prof. Stroud's suggestion, an enormous amount of heat was wasted in the opening of the oven door to see the progress of the cooking, and when they sent in their report they suggested that the ovens should have a thermometer, but it was stated that those instruments would not last and, even if they did, cooks would not pay any heed to them. He was afraid the chairman's suggestion was not practicable.

POWER TRANSMISSION AT 220,000 VOLTS.

A Californian Scheme.*

CONFIDENCE in the attainment of a 220,000-volt transmission pressure has long been inspired by the successful operation of the American 150,000-volt lines, but the actual construction of such an installation was delayed by the engrossing activities of the war period. That power transmission at this pressure will nevertheless become an accomplished fact in the near future is proved by the active steps which the Southern California Edison Co. is now taking in that direction. In what follows the auto-transformers referred to (for raising the line pressure from 150,000 to 220,000 volts) should not be confused with those described later, which are to be used for linking up a new generating station through a single transformation from 11,000 to 220,000 volts.

For some years past the Southern California Edison Co. has been studying the power resources of the San Joaquin

It is proposed to leave the inside of the stations exactly as they are now and to install in the outgoing lines banks of transformers for raising the voltage from 150,000 to 220,000. The transformers are to be star-connected on the h.p. side and delta on the x.m.v. The h.p. side will be arranged as an auto-transformer with 150,000-volt taps on the 220,000-volt winding, and the l.p. delta windings will be approximately 50 per cent. capacity and of the simplest possible design, no attempt will be made to phase them for any other functions.

There will be one bank of these transformers in each line, installed between the line and the station, and each bank will be equal to the capacity of the station. The transformers will become a part of the line, and will be treated as such, and the full capacity of any station can be supplied over either line through the transformers connected to that line. No switching equipment of any kind will be used on either side of these transformers; the only instruments will be ammeters and the earth connection.

While the capacity of the transformers is spoken of as being equal to the capacity of the station, it must be remembered that their principal function is to act as auto-transformers, and they will be actually only 35 or 40 per cent. of the size of ordinary transformers of the same rating. Moreover, they can be designed for maximum efficiency at one-half load and a slight falling off permitted when one bank is carrying the whole load of a station. This plan has the advantages of low first cost, high electrical and financial efficiency, elimination of high-voltage oil switches of high capacity, and does not disturb or render obsolete any existing plant or investment.

The fact that the circular-coil concentric winding type of transformer is to be used in building the highest voltage power transformers in the world gives special significance to this form of construction. The line pressure of 220,000 volts, which has been tacitly agreed upon as being the approximate economic potential for the extensions and interconnections under consideration, constitutes a very abrupt step in the curve of maximum transformer voltages, as indicated by fig. 1. Nevertheless, there is every indication that its use will be as successful as that which characterised the operation of the 150,000-volt apparatus. The circular-coil design tends towards safety, and the elimination of the air space in the main containing tank is a noteworthy improvement, as is also the new oil-filled bushing.

Last summer the S.C. Edison Co. placed an order with the General Electric Co., U.S.A., for four water-cooled, 50-cycle, 8,333-kVA transformers which will step up the 11,000-volt pressure generated at the Big Creek No. 8 hydro-electric station to 220,000 volts. This transmission line is of interest in that it will be available as a permanent link in the

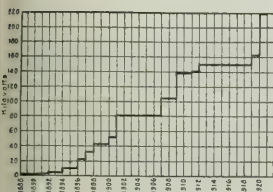


FIG. 1.—INCREASE OF MAXIMUM TRANSFORMER PRESSURE.

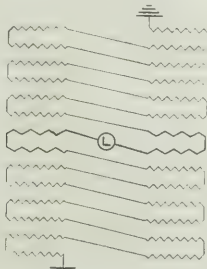


FIG. 2.—DIAGRAM OF CONNECTIONS.

river and preparing to develop them as the demand for power grows. The studies revealed the fact that there was between 700,000 and 800,000 kW available, the larger part of which must be transmitted to Los Angeles, a distance of 240 miles. Since the capacity of the two 150,000-volt circuits now operating over that distance is 55,000 kW each, it was apparent that the possibilities of higher voltages must be studied to reduce the number of circuits and to obtain a correspondingly reduced cost per kW transmitted.

The rapid growth of the load indicates that additional plant must be placed in operation by 1923, at which time additional capacity will be needed, and raising the voltage of the present Big Creek 150,000-volt lines to 220,000 volts promises to be the quickest and cheapest method of obtaining the increased capacity. On account of the fact that, in case anything develops to make this plan impracticable, additional circuits must be built in time to coincide with the completion of the power plant, the company is proceeding as actively as possible with the necessary development work on the transmission line at the present time. The problem is, therefore, not the general one of how to build a 220,000-volt transmission system, but the more specific one of how to convert the existing 150,000-volt system into one for 220,000 volts.

The studies have now progressed to the point where a concrete plan of tests is ready to be carried out.

Considering first the line, the experiments of Peek, Ryan, and others indicated the use of shield rings, the effect of which is to cause a more uniform distribution of potential across the individual units of an insulator string. With such an arrangement the stresses on the individual units are considerably less at 220,000 than at 150,000 volts without the shield rings, as far as fundamental voltages are concerned. The occasional flashing over of insulators on this line has not yet been accounted for, and while perhaps it is not due to any one cause, the normal line potential probably has little to do with it.

The first step, therefore, will be to equip one circuit with guard rings throughout, and continue to operate it for a time at 150,000 volts, which will possibly throw some light on the reason for the flashovers. The next step will be to isolate the lower 40 miles of this circuit and operate it at 220,000 volts energised from some transformers on hand, but not carrying a commercial load, while the remainder continues to operate at 150,000 volts. There are strong probabilities that this may be all that it is necessary to do, but in case additional length of insulator strings is needed and additional shielding, the tower tops will be modified to provide the increased clearances necessary and further tests will be carried out.

Passing to the various stations on the line, the present stations are all completely equipped for two entering line positions and for double 150,000-volt bus connections inside.

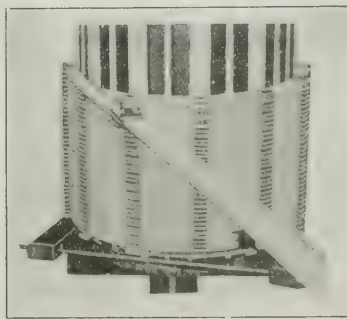


FIG. 3.—HELICAL L.P. COIL BEING WOUND ON INSULATING CYLINDER.

220,000-volt bus by which it is proposed to interconnect all the large natural powers throughout California.†

The transformers under discussion emphasise clearly the general advantages of the circular-coil design (viz., important simplification of the major insulation, superior mechanical strength against short-circuit forces, improved thermal characteristics, and the prevention of the concentration of electrostatic flux due to abnormal voltages), as well as the G.E. Co.'s novel arrangement of windings for Y-connected permanently-earthed units.

The schematic sketch, fig. 2, shows the connections on the h.p. side of a single-phase transformer, not the number of coils or their spacing; the slanting lines indicate series connections between the two core legs and the symmetrical sec-

* From the General Electric Review, May 19th, 1921.

† Paper by Sorensen, Cox and Armstrong, A.I.E.E., 1919.

tions in the body of the winding on either side of t , may be paralleled to provide tap voltages. The h.p. line enters the "buffer" zone at the centre of the stacks, or groups of h.p. windings, and progresses in either direction in two multiple circuits to earth, a method which avoids the necessity of insulating the winding from the core clamps except for the voltage of one coil, and eliminates the striking distances and creepage surfaces which would be necessary at these points for unearthed or delta-connected transformers. The insulation between turns and coils is graded so as to afford a very high safety factor at the line end where, in this design, abnormal stresses would reach a maximum. It is not necessary to repeat this extra insulation in the body of the windings as might be required with intermixed groups of high- and low-voltage coils.

The windings consist of a single helical coil for each core leg (fig. 3), and are wound on ventilated insulating cylinders as illustrated, and are so proportioned with respect to diameter and thickness as to give ample supporting surface and rigidity. They are installed next to the core iron and inside of the high-voltage disk coils. Support is provided at the top and bottom by insulating blocks resting on the core frames. Both the high- and l.p. coils are of the one turn per layer type, built of round cornered rectangular copper and ventilated and supported throughout by "U" spacers.

The transformers are of the same general construction as the 10,000-kVA, 120,000-volt unit shown in fig. 4, but, unlike the latter, have no porcelain supports at the ends of the

The containing tank is of the "oil conservator" type, having a separate chamber for oil expansion, and involving the elimination of the usual air space above the oil in the main tank and the isolation of the hot oil and transformer insulation from the surrounding air. The main tank is always completely filled with oil, and pressure is prevented by opening the auxiliary tank to the outside air through a "breathing" device. Any accumulation of moisture in the auxiliary tank due to condensation is caught in a sump and drawn off through a pet-cock at the bottom. This construction eliminates "breathing" in the main tank and keeps the oil absolutely dry; avoids explosions due to a possible mixture of air and gas formed from hot or decomposed oil; protects the oil from "sludging," and preserves the transformer insulation to a remarkable extent.

The total weight of the transformer is 50 tons, including oil. The height from rail to top of bushing is 24 ft., and the diameter is 10½ ft.

A current transformer is mounted on the cover and connected into the neutral circuit before the tank is earthed, and the current transformers of three units (one three-phase bank) have their secondaries connected in parallel so that any unbalanced current (earth current) can be measured.

It is an interesting fact that the manufacturers had actually designed the 220-kV transformers long before any definite plans had been made by power interests for operation at this voltage.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Dover Corporation Electricity Works and its Staff.

In the "Personal Column" of your current issue, it is stated that the Dover Town Council has decided to give notice to practically the whole of the technical staff at the electricity works, and to offer them the option of re-engaging at a much lower salary for each appointment.

This move must be resisted, not only with firmness, but with promptitude. It is to be hoped that as far as the E.P.E.A. is concerned, the official order will be that no official who is a member of the E.P.E.A. shall continue for a single week in the employ of the Dover Council at the reduced rate of pay.

There is no time for arguing and shilly-shallying about the matter. Either these notices are withdrawn or our members cease to serve the Dover Council.

Any other policy means that Councils up and down the country will be only too glad to follow suit, and to back Dover Council up, if they think there is any chance of forcing these terms on their staffs.

It is a matter of vital interest to every member; and if necessary we must be prepared to pay a high levy in order to support those of our members who may be temporarily out of a berth.

The only policy for the E.P.E.A. to take is to shut the place down. Any half measures, any vacillating or compromising, will mean a wholesale slump in salaries from Dover to Aberdeen.

The latter place has been humoured a good deal. The logical result is seen in the present "try on" at Dover. This must be stopped; and stopped with a jerk.

It is to be hoped that mains men and shift men (I happen to belong to the latter) will now drop their public quarrelling, and will back the E.P.E.A. through what promises to be a most serious crisis.

Our point is that we were so miserably underpaid in 1914, that any salary list based on double the 1914 rate would leave us far below the wretched economic level of that year.

The senior shift job at Dover is quoted as being paid at the princely salary of £100 a year in 1914. If the berth had been paid at a reasonable rate, the lowest salary would then have been £100, rising to £200 by £10 a year.

The salary acceptable to-day should, therefore, be at least £320. That post now carries £293, and it is proposed to reduce it to £236.

Let our National Executive handle this matter firmly and promptly, and it will have every member in the Association behind it.

June 27th, 1921.

P. W.

Electric Light Wiring Systems.

I have always viewed the intelligence of my fellow followers of the art with some considerable feelings of pride, but your correspondent's remarks on the relative merits of wiring systems have given rise to some misgivings.

Surely it is only a matter of common sense that a wiring system which, under certain conditions may be excellent, will be, under other conditions, out of the question.

Because one thinks personally that screwed tube makes the best wiring job, it does not necessarily rule out of court all other systems, when under consideration of installation

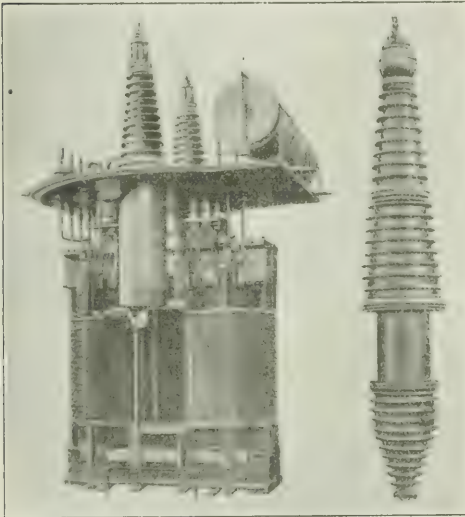


FIG. 4.—A 10,000-kVA
120,000-volt Transformer.



FIG. 5.—AN OIL-FILLED
250,000-volt Bushing.

stacks, the h.p. coils resting directly on steel plates anchored to the top and bottom core frames.

The line end of the h.p. winding, coming from the centre of the stacks as shown in fig. 2, is brought out through a new standard oil-filled 250,000-volt bushing, fig. 5, which is interchangeable between the transformers and h.p. oil circuit breakers. The external shell consists of two porcelain pieces above the transformer cover, one porcelain piece below the cover, and an intermediate metal cylinder which is flanged at the upper end to support the bushing. This metal portion always extends below the transformer oil level to avoid any possibility of corona in transformers having an air space between the oil level and cover. A metal tube extends from top to bottom through the centre of the bushing, and the intervening space between this tube and the porcelain shell is filled with "transil" oil and concentric cylindrical insulating barriers. The glass chamber at the top provides space for expansion of the oil and indicates its level. The joints between the shell sections are made with treated cork gaskets compressed locally by numerous bolts engaging metal clamping rings. The central tube serves as the conductor when used in a breaker and as a conduit for a cable conductor in a transformer.

The bushing has a die flashover voltage of 600,000. The lightning flashover is estimated at more than twice the normal frequency figure and is equal for wet or dry conditions. In the event of any high impressed voltages the bushing will not puncture, but will arc from the terminal to earth without damage and an essentially uniform surface distribution of potential is obtained thus preventing corona on the surfaces.

costs or the interference with decorations C.T.S. Henley's, or some such system would be the one to adopt.

I agree that Mr. Aldread's trouble with C.T.S. cable was probably due to careless handling and sharp bends.

I am amused by the remark of Mr. J. M. Ward that cementing the ends of the underground conduit gave more trouble from condensation. I should have thought that the remedy was to provide an outlet for the water, and not to seal the trouble up.

Lead sheathing is likely to give trouble under certain conditions, unless the sheathing is itself protected, e.g., by compounding.

The writer remembers a lead telephone cable fixed in a brick wall losing practically all of its sheathing in six months owing to salt being present in the sand used by the builders.

I should like to deprecate the practice of some conduit manufacturers in effectually enamelling the female threaded portion of conduit fittings; this is liable to occasion bad electrical continuity. The writer remembers instances of trouble in this direction.

In conclusion, whatever the system adopted, however well engineered the installation, the degree of skill of the wireman employed must be the deciding factor in a perfect installation.

H. Verrall.

June 27th, 1921.

With reference to Mr. J. M. Ward's letter in this week's REVIEW, I note from his remarks he has had considerable experience in electrical work, and I am astonished at his attitude towards screwed conduit.

He refers to a church building, where cables are run underground in screwed conduit covered with cement. Was it necessary to cover the conduit with cement? In buildings of this size, a trench is usually provided for this, whereby access can always be obtained. On the other hand, and in this particular instance, where the conduit was covered with cement, may I ask Mr. Ward if he is assured that condensation did occur? It is possible that the job may not have been watertight in the first instance. Much depends on what class of conduit was used. It must be borne in mind that various qualities are on the market, and in the electrical trade as well as other trades, inferior material is prevalent. Nothing gives more satisfaction than a well-laid-out installation of steel conduit, and I am confident that this particular difficulty could have been avoided in the first instance had a little more thought been given.

I am in constant touch with consulting engineers, architects, and electrical contractors, and with due respect to the other systems of lighting, they highly recommend the screwed conduit system, and when possible insist on this system being employed.

J. P. Gibb.

Dundee.

June 27th, 1921.

The Cost of Living in Spain.

If your correspondent "Rover" is going out alone to a Spanish village he will probably have no alternative but to put up at the local "fonda" or inn, when board and lodgings will cost him up to 12 pesetas (approximately 9s. at present exchange) a day. Accommodation is about on a par with that provided in remote English villages. The food is good and plentiful, but it generally takes an Englishman a week or two to get used to it, owing to the prevalence of olive oil and garlic. The sanitary arrangements are crude.

If two or three Englishmen are working together, the best way for them is to rent a small house and furnish it with a minimum of cheap furniture, but taking care to provide adequate kitchen utensils and cutlery. Domestic help can be hired for 40 or 50 pesetas a month, and a servant will do all the necessary buying of food, &c. She will doubtless receive a commission on her buyings from the shop-keepers, but will nevertheless buy cheaper than an Englishman can. Expenses by this method work out about the same as inn charges, but there is the advantage that fare more nearly approximating English food can be thus obtained. Also, expenses are more under control, and if one of the Englishmen is put in charge of the management of the house, the total cost of living need not be more than £8 or £9 per head per month, including wine.

"Rover" will find the Spaniards of all classes very sociable. They will be pleased to give him all kinds of assistance, and if he has a knowledge of the language (no matter how slight) he should find his stay in Spain a pleasant one.

E. Scott Rivett.

London.

June 25th, 1921.

The London Electricity Inquiry.

I should like to call your attention to the last paragraph in your Editorial of last week upon the above subject, which I think is not only misleading, but in part inaccurate.

The main reason that the railways can supply themselves with electrical energy at a cheaper rate than they could obtain it at from a Joint Electricity Authority is because the load factor of the railways is very much higher than that of the Joint Authority.

No doubt the sinking fund is a secondary and minor factor, and would depend, for its effect, upon the amount set aside by the railways for depreciation.

When you state, however, or rather infer, that generally private enterprise can compete favourably with municipal supply, you are making a statement which is entirely opposed to the evidence shown in all the published comparative statements of costs and prices charged, which is overwhelmingly in favour of the municipal undertakings.

June 25th, 1921.

Municipal.

Abnormal Meter Records.

May I bring to your notice the peculiar behaviour of 20 meters installed for lighting installations in this city? There was a sudden rise in consumption during the month of March out of all proportion to the size of the installations connected; in April all these meters showed their normal readings.

It may further be noted that the meters, which are of the Ferranti a.c., single-phase, 230-volt, 50-cycle type, are not all connected to the same distributor or transformer. Figures are enclosed showing the readings of eight of these for four months of this year and the corresponding months of last year.

UNITS CONSUMED, 1920.

Jan.	Feb.	Mar.	Apr.	Total.
15	15	14	31	75
11	6	11	8	36
53	42	54	41	190
36	29	37	18	120
17	14	11	40	82
17	22	7	20	66
23	20	18	18	79

UNITS CONSUMED, 1921.

Jan.	Feb.	Mar.	Apr.	Total.
35	18	123	21	197
5	8	98	27	138
71	35	115	44	265
12	13	105	27	157
8	10	202	20	240
30	28	228	13	299
8	2	93	8	111
15	14	139	27	195

I shall be obliged if you can give me any reason for the above.

R. Forrest Preston.

Engineer and Manager.

Electricity Works, Ahmedabad.

May 28th, 1921.

Armature Core Bands.

I would be pleased if you could give me your opinion, or any of your readers theirs, on the following, which I think would be of interest to a great number of subscribers to the REVIEW. During the course of my business (electrical) we have come across an armature which is rated at 1,750 r.p.m., this is wound with copper strip of size .5x.043; after winding it is banded on the core with No. 20 steel banding wire, $\frac{1}{8}$ in. wide, the outer bands with No. 18 steel banding wire; after running some time the core bands began to spread, and ultimately break away. Double layer bands were then used, and after running about four months, burst; the outer bands (on the winding) still remain and seem quite as good as when put on, and do not show any signs of breaking away. As I have never in my 15 years' experience, come across anything like this before, I trust that you will endeavour to give me the benefit of your readers' opinions, which will be greatly appreciated by

June 21st, 1921.

Armature.

Standard Brush-holders.

Some 12 months or so ago I was shown a small brush-holder which I was informed was likely to become the standard, or one of the standards, for use on d.c. machines. Although I have made several inquiries recently I cannot find out anything further with regard to the matter, and shall be glad if you can give me any information.

The whole question of brush gear and brushes sadly needs overhauling, and, personally, whenever I hear of a designer having brought out a new type of brush-holder—an item of news I occasionally come across—I must admit I feel rather inclined to slay him, as I am quite certain there are enough types of holder on the market already to satisfy any reasonable person's requirements.

Any information which you can give on this matter will, I am sure, be appreciated by a good many engineers.

June 21st, 1921.

Worried.

The Grading of Mains Engineers.

Like "Another Meter Engineer," the writer is very pleased to see that at last someone has dared to "break the ice," so to speak, regarding the status of the man in charge of the meters.

It is, indeed, a lamentable fact that amongst a great number of supply authorities the meter superintendent, meter tester, or whatever name they chose to give him, is looked upon as an individual who is expected to be able to satisfy any sceptical consumer as to the accuracy of his or her meter (not an easy job by any means), and to be at the beck and call of all and sundry on the undertaking, from the managing engineer to the office boy.

What is the use of the power station technical staff carefully compiling the cost of coal per unit sent out, unless of

steam per unit generated, &c., if the man in charge of the meters is not conscientiously carrying out his duties? Is it not akin to the old saying of straining out gnats and swallowing camels?

There can be no doubt whatever that on the meter man depends the revenue of the concern; his responsibility in this respect should, therefore, be recognised to the full, and every consideration and facility should be given him to carry out his work efficiently. He should have at least a respectable test room and reliable instruments, which should remain his as long as he is employed by the authority concerned, and not be used as a workshop for the wiremen, nor should his instruments be placed at the disposal of apprentices, &c. Yet how often does one find that the meter department consists of some out-of-the-way corner of the power house, badly lit, and filthy dirty, and what instruments he is fortunate (or unfortunate) enough to possess are badly in need of repair. A few pounds laid out on the meter department will more than repay themselves in a very short time if the right man is there to carry out the work, and if the right man is there, surely he should be placed on an equal footing in every way with the mains engineer, with whom more often than not he has to work in co-ordination.

The writer hopes to see more correspondence on this subject, and trusts that the day is not far distant when the long-forgotten meter engineer will receive his dues in more ways than one.

June 27th, 1921.

Rev. Counter.

In your issue of June 17th, one of your correspondents asks if any reader knows of any grading for the meter engineer. I know of a 4,000-kW station where the meter engineer had a pre-war weekly salary of 55s. This gentleman is now in receipt of £354 per annum, being graded on the salary of the mains superintendent, according to the E.P.E.A. Schedule. It is clear, therefore, that he must be in grade 7. In the same station the charge engineers were getting a pre-war salary of 50s. per week—they now get £295 per annum. That does not look, on the face of it, as though the meter engineer had a lot of grounds for grouching; whereas the charge engineer (one of whose spare-time duties used to be the calibrating and testing of meters) is in grade 8; one below that of the meter engineer. This is one of the many reasons why the charge engineer is fed up with the E.P.E.A.

It Won't Do.

Perhaps you will allow me to correct a misconception which "C. S. W." has placed upon certain statements in my recent letter wherein I urged the desirability of a levelling of shift men being elected to the E.P.E.A. committees. To argue from this that I advocated the packing of these committees with shift engineers merely because they are shift engineers, and without regard for their fitness or ability, is absurd, although the absurdity of the suggestion that brains are the exclusive prerogative of day men is no less obvious.

It is a little amusing to note "C. S. W.'s" estimate of the calibre of the genus shift engineer. He is an unskilful or hot-headed operator, to whose tender mercies the Association is not to be lightly handed over. This startling truth presages a serious state of affairs when the present supply of day men begins to give out and has to be replenished from the ranks of the lower grades. Will not the electricity supply industry then be in a parlous plight indeed?

Without disputing for a moment the excellence of the advice to select the best man for the job and vote for him, I still hold that psychology should be considered, and it is only common sense to believe that those who are bearing the heat and burden of the day on shift duties must necessarily have a more vivid sense of the problems peculiar to their grades than those who are fortunate enough—not invariably nor essentially clever enough—to have become emancipated. It is for this reason chiefly that I consider a proportion of shift men on the various committees highly desirable.

I fully concur in the opinion of "C. S. W." that the Association has been most skilfully steered so far through troublous times. All honour to the men who have succeeded so well in a difficult task. With regard to the Negotiating Committee, of course it is easy for those with a grievance to seize upon the first scapegoat that presents itself, and possibly the severe criticism to which this body has been subjected is undeserved. I have little doubt the member did their best in the interests of all, according to the faith that was in them. I would not dream of doubting their integrity, only I feel it is unfortunate that I, along with so large a number of members of the E.P.E.A., should have occasion to regret the necessity of signing myself

June 27th, 1921.

Grade 8.

Converting 50-cycle Alternating to 1,500-V Direct Current.

I am obliged to "M. A. R." for his criticism, and admit that for the moment, I had forgotten the mercury arc rectifier.

I am not an expert in electric traction, but in the case under discussion, I should be inclined to install mercury rectifiers in most of the sub-stations; but I would install, say, two motor converters somewhere on the system.

My reason would be that the mercury rectifier is irreversible and as regenerative control would probably be used, it is conceivable that the regenerated power of the system might occasionally exceed the load for a few minutes. Under those conditions, if the supply were wholly through rectifiers, the line volts might become excessive, and the only regenerative brake then available to the locomotives would be that provided by a resistance which, I imagine, would be required to maintain the arcs under such circumstances. Of course, I admit that the occurrence of the above condition would be more frequent in the case of the electrification of a comparatively short mountain section such as has been done in the United States, than in the case of a whole system like the S.E. & C.R.

The title not my choice of "M.A.R.'s" letter and my previous one is somewhat unfortunate, as the case was not one of the conversion of 1,500 V a.c., but of, I imagine, about 5,000 V a.c.

Up to about 12,000 V a.c. the motor converter, of course, needs no transformer.

K. W.

June 27th, 1921.

Marine Electrician.

Could you give me any information as to how I could get into the mercantile marine as an electrician, or where I could get such information?

E. R. M.

[The usual course, we believe, is to apply direct to shipping companies. Possibly our readers will help our correspondent. —EDS. ELEC. REV.]

Technical Books.

I should be very grateful to any of your readers who could express an opinion on a technical work which is in my possession, namely, the "Cyclopedia of Applied Electricity," published by the American Technical Society (1921).

I am only a young engineer, and would like to know from more experienced authorities if this work can be relied on for general information regarding electrical engineering in this country.

I should also be glad to hear of a similar complete and up-to-date publication dealing with practical electrical engineering as applied in England.

L. W. C.

June 26th, 1921.

["Modern Electrical Engineering" (1919), edited by Prof. M. Maclean, is the most encyclopaedic British work on this subject.—EDS. ELEC. REV.]

Diesel Engine Repaired by Welding.—Much has recently been written on the subject of electric welding, but the following brief description of the repair of a 600-h.p. Diesel engine carried out by this means may be of interest to engineers. The repair was effected without dismantling the engine, for the Charing Cross, West End & City Electricity Supply Co., Ltd., at the St. Martin's Lane station.

The base of the main A column of the engine was cracked as the result of an accident, the crack on one column extending right round the front half and about two-thirds round the back half of the column through metal varying from 2½ to 3½ in. thick, whilst the other column was cracked at the ends inside and outside. Work was commenced by chipping out the metal surrounding the crack from both sides of the casting, to form a "v" for the reception of the weld metal, 2½ in. wide and varying in depth with the thickness of the casting. The welding, which was carried out with "A. W. P." electrodes, was commenced as soon as one-half of the crack had been chipped out and other operations necessary on this class of work were completed.

It may here be mentioned that welding cast iron is at all times a difficult matter, and that the difficulties are increased where, as in this case, the casting cannot be preheated. The Union Electric Welding Co., Ltd., which was responsible for the work, is able, however, as has been pointed out in our columns by Major J. Caldwell, to weld this metal with good results owing to the fact that its operators can reduce to a minimum the injurious strains set up in the metal due to the contraction of the casting on cooling.

Welding was proceeded with in sections of about 9 in., great care being taken that the added metal was thoroughly united with the original metal. Approximately 700 lb. of "A. W. P." electrodes were used, representing 50 lb. of added metal and as the electricity for welding was supplied by the Charing Cross Co., the only equipment required consisted of a portable resistance, electrode holders, and cables. A portable air-compressing plant was used to serve the pneumatic tools used for the chipping operation.

Great credit is due to the engineer of the Charing Cross Co. for having this important repair carried out by means of electric welding, thereby saving the company a considerable amount of time and money. The engine was run on load within four weeks from the commencement of the repair.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Garage" Converter.

The problem of charging the smaller sizes of accumulator from an a.c. circuit may be easily solved by means of the "Garage" current converter (fig. 1) made by the OVERSEAS ENGINEERING CO., LTD., 163-165, Great Portland Street, W.1. This device consists of a small auto-transformer which reduces the pressure of an ordinary lighting circuit to the lower voltage necessary for charging accumulators. Combined with the

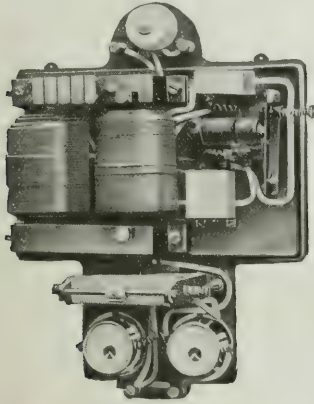


FIG. 1.—THE "GARAGE" CURRENT CONVERTER.

transformer is an ordinary vibrator which ensures that the current passes in one direction only. As the current taken by the converter is small, the appliance may be connected to any wall plug or lamp socket on a circuit of the correct voltage and frequency. The usual sizes range from 4 to 12 volts for 110- or 200/240-volt circuits; they are supplied for any frequency from 25 to 100 cycles.

A Flexible Insulating Coupling.

Among the exhibits at the recent Rubber Exhibition at the Agricultural Hall was a patent flexible coupling, shown by its makers, MESSRS. R. FAUSET GILLESPIE & CO., 42, Frederick Street, Edinburgh. This coupling (fig. 4) consists of two

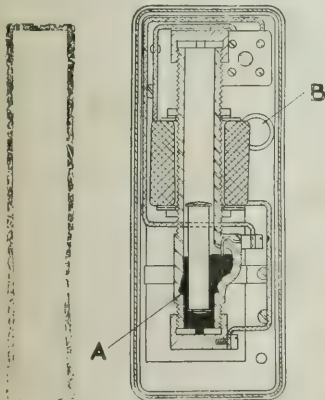


FIG. 2.—IMPROVED "UTILITY" CURRENT LIMITER.

castings only with a number of rubber buffers which are very durable. As the coupling is virtually a universal joint (the maximum degree of angularity being fixed by the clearance allowed between the two parts) all inaccuracies of alignment are neutralised. The coupling can be driven in either direction, and either of the two halves can be keyed to the driving shaft. The contact area between the iron and the rubber is automatically adjusted to suit the load.

The "Utility" Current Limiter.

The "Utility" current limiter was described in these columns some months ago. The makers, ELECTRICAL UTILITIES, LTD., 12, Shelgate Road, S.W. 11, have sent us particulars

of an improvement patent applied for, introduced into the instrument.

As in other types, the "Utility" current limiter provides for a flicker when excessive current is used, but a certain amount of heat can be obtained even with this flickering current. Hence a neat little improvement in the ebonite-mercury tube has been introduced. From the illustration (fig. 2) it will be seen that a groove A is provided in the lower part of the tube. This groove does not affect the working of the limiter in normal operation, or when there is a small overload, as the plunger does not rise high enough. If

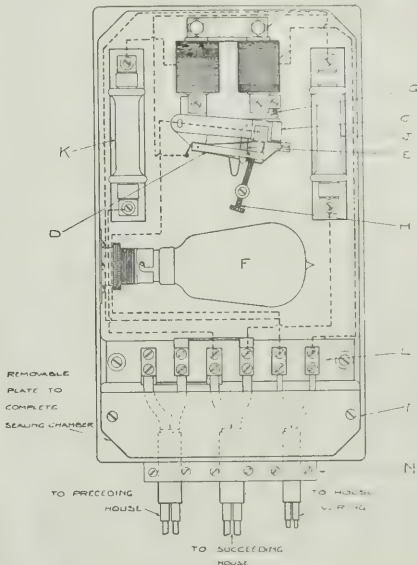


FIG. 3.—EDISON CURRENT LIMITER.

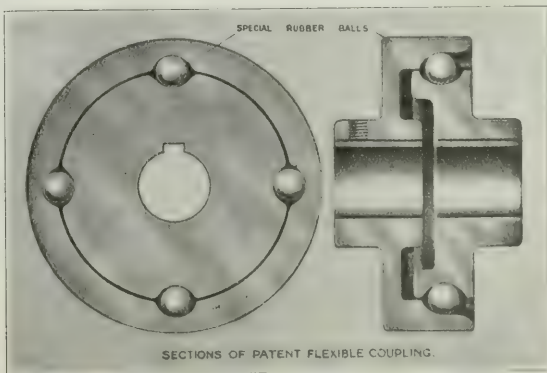


FIG. 4.—A FLEXIBLE INSULATING COUPLING.

however, a consumer who has, say, a lamp limiter in his house, endeavours to use a flat iron or other heating device, using, say, 1.5 amps, the plunger in its flickering operation will rise sufficiently for the bottom flange to slip into the groove and rest on the bottom face. There is no uncertainty in this action, as the plunger, although floating in mercury, is in unstable equilibrium, and tends to assume a tilting position in the tube, thus forcing one point of the bottom flange into the groove. With the plunger in this position the circuit is definitely broken, and will remain so until the limiter case is tapped. A comparatively slight tap will release the plunger, but if the excessive load continues the plunger again rises and immediately drops into the groove again. A further

A New Current Limiter.

As will be seen from the illustration (figs. 2, 3), the limiter proper consists of a U shaped laminated yoke (A), containing a main series coil (B), on each leg, and having a laminated armature (C) pivoted at one end below it. Below the armature is pivoted another arm of fibre (D) which is normally held to the main armature by a hooked member (E) extending into a pin in the fibre (D). The main armature (C) carries on its end a pin (F) and the fibre arm (D) the other, and the contacts (which are provided with carbon brushes) normally short-circuit the lamp resistance (F). When the predetermined current is exceeded, the main armature (C) is attracted to the yoke (A) and carries with it the fibre arm (D) since they are hooked together. When the main armature (D) since they are hooked together. When the main armature (C) has completed its travel, however, the end of the hooked member (E) impinges on a stop screw (G), and releases the fibre arm (D) which, consequently, drops away and thus removes the short on the lamp resistance (F). This puts the latter in series with the coil and dims all the lamps in circuit. Below the fibre arm (D) will be noted a further stop screw (H) and this, together with the screw (G), is the only adjustment necessary; the adjustment of the limiter in fact is exceedingly simple, and can be carried out by practically inexperienced people quite readily. In addition to the limiting device proper, the case (J) contains the lamp resistance (F), two single-pole fuses (I) and (K), a terminal board (L) for connection on the loop-in system), and a sealing chamber (M) (for use where lead-covered, paper-insulated cable is employed), as well as an earthing clamp (N). Therefore, the case contains absolutely all that is necessary in order to give service to a consumer. It is unnecessary for the supply authority to buy separately the limiter, the fuses, sealing chamber, &c., and to mount them all on a separate board and interconnect them; all supply authorities who do not use the loop-in system, but at least one Corporation which uses this system in combination with the Edisonwan limiting device states, are informed, that it can by this means give service at one half previous cost, a result which should commend the limiter to serious consideration.

NEW PATENTS APPLIED FOR, 1921.
(NOT YET PUBLISHED.)

16. 1991

- 16-194 "The β ray spectrum of ^{137}Ba V. W. Hughes, J. Phys. 14b,
 1949, 1, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914,

- [illegible]

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The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 1930.**
- 29,526 "Galvanic batteries." A. O. Lohr. November 26th, 1919. (United States Pat. No. 1,406,662)
2,487 "Dynamometer machines." I. J. Stephenson. October 10th, 1919. 143,801.
29,648 "Electric driven pump." A. Leister. November 26th, 1919. (United States Pat. No. 1,406,662).
9,000 "A method of administering compressed dynamometer machines." British Thomson-Houston Co., Ltd., F. H. Coughlin and H. W. Lyden. December 2nd, 1919. (164,060).
3rd, 1915. (136,170).
31,815 "Incandescent electric lamps with glow discharge." S. Scuderi. May 19th, 1919. (164,058).
Matters for the production of sound by electro-magnetic conversion of vibrations." M. A. Graham. December 2nd, 1919. (164,060).
32,790 "Method of manufacture of vacuum elements." E. Becker and A. Ludwig. December 2nd, 1919. (164,062).
- 1930.**
- 2,445 "Magneto-steroids." J. P. Adey. January 26th, 1920. (164,061).
12,965 "Apparatus for holding X-ray tubes." Simmons & Halske Aus. G.S. December 28th, 1917. (139,192).
3,065 "Acoustic and visual indicators for signalling purposes." E. L. Miles. February 19th, 1920. (164,083).
5,208 "Electrically controlled fastenings for doors and the like." H. Knipsel and F. Gerbsch. February 26th, 1920. (164,087).
5,433 "Electroacoustically-driven devices." Lamberts, Fray & Clark. June 11th, 1919. (144,010).
5,434 "Electrically-heated device." Lamberts, Fray & Clark. August 11th, 1919. (149,047).
5,438 "Electrically-heated utensil." Lamberts, Fray & Clark. August 11th, 1919. (149,053).
5,068 "Sound-sealing apparatus." British Thomson-Houston Co., Ltd. General Electric Co. February 25th, 1920. (164,091).
5,743 "Receivers of high-frequency sound waves." M. I. Pupin. February 25th, 1920. (164,091).
5,748 "Electric heaters." J. P. Lyon. February 25th, 1920. (164,093).
5,987 "Construction of aerial mass for wireless telegraphy and the like." S. Mosch. February 27th, 1920. (164,100).
6,000 "Electrically-driven blocks, hoists, and the like." J. Ogden. February 28th, 1920. (164,104).
6,079 "Wireless telephone." W. I. Ditcham. February 28th, 1920. (164,105).
6,117 "Electric trackless or railless tramway cars and electric trolleybus." G. R. Bishop and N. A. Chodwick. March 1st, 1920. (164,108).
6,221 "Dynamometer machine." A. B. Bell and Metropolitan Vickers Electrical Co., Ltd. March 1st, 1920. (164,114).
6,240 "Gas lanterns." Burgess Battery Co. March 13th, 1919. (164,060).
6,400 "Renewable of incandescent electric lamps." J. J. Russell. March 15th, 1920. (164,131).
6,591 "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. and J. S. Cain. March 4th, 1920. (164,135).
6,693 "Apparatus for electrical apparatus." M. S. Connor and S. Livingston. March 5th, 1920. (164,142).
6,855 "Automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., W. R. Carter and R. Moore. March 16th, 1920. (164,147).
6,860 "Means and apparatus for detecting and warning vital movements." Automatic Telephone Manufacturing Co., Ltd., and S. R. Smith. March 16th, 1920. (Addition to 1,38,260) (164,148).
6,887 "Automatic locating mechanism for use in machines for making mechanical link bases and the like." British Thomson-Houston Co., Ltd. March 16th, 1920. (164,149).
7,431 "Device for use in winding automatic coils." J. A. Deley and J. Fleming. March 16th, 1920. (164,162).
7,876 "Accurate insulating composition." E. D. Bow. March 17th, 1920. (164,190).
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8,250 "Switches." L. Norton and J. I. Neuman. March 26th, 1920. (164,187).
9,083 "Electrically-heated incubator." W. J. Anderson. March 26th, 1920. (164,193).
12,210 "Telephone system." S. Louis & Chamberlain and Healdham, Ltd. May 1st, 1920. (164,211).
12,345 "Inertness apparatus." J. Kell and W. Moore. April 2nd, 1920. (164,216).
Between G. L. Pearson, deceased. May 10th, 1920. (164,216).
12,350 "Electric contact makers for use with the screw-wheels of motor-drives." G. L. Pearson, deceased. May 12th, 1920. (164,217).
12,492 "Glowing batteries." Fullerton & Littleton Works, Ltd., and J. Littleton. May 13th, 1920. (164,221).
12,517 "Electric illuminating systems." J. A. Ross. May 17th, 1920. (164,225).
14,592 "Smoke plug." A. H. Goldstein and T. Barthe. May 17th, 1920. (164,226).
15,180 "Greenish lanterns." G. Odell and J. Odell. June 10th, 1920. (164,235).
15,857 "Telephone systems." Western Electric Co., Ltd. Western Electric Co., Inc. July 11th, 1920. (Addition to 151,140). (164,239).
16,110 "High-frequency electrical size limit systems." Western Electric Co., Inc. and Western Electric Co., Ltd. July 15th, 1920. (164,242).
16,245 "Smoking-plug for internal combustion engines." G. R. Schick. Aug. 16th, 1920. (164,243).
17,175 "Telephone." Amos & Smith, Ltd., and W. S. Hale. June 24th, 1920. (164,253).
17,997 "The process." J. C. Little. December 4th, 1919. (145,705).
21,130 "Smoking-plugs." J. S. Price. Feb. 16th, 1920. (164,251).
21,270 "Piezo-electric magnetic device." Soc. Anon. Des. Inst.-Industries. Feb. 16th, 1920. (164,252).
21,300 "Means for commencing and controlling the vehicles of electricity from trains." J. Bernadine. January 3rd, 1920. (147,981).

1921.

1921.
1918. (157,376).
5,717. "Induction coil for arc and polyphase-current circuit."
8,707. "Induction coil for arc and I. W. March 23rd, 1920. (160,774).
8,708. "Induction coil for arc and I. W. March 23rd, 1920. Divided application of 162,704. (164,293).
10,065. "Electric arc systems and apparatus." J. A. SPERRY. November 14th, 1914. Divided application on 135,871. (161,190).

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ENGINEERS IN CONFERENCE.

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LAST week was signalised by the resumption of the series of Engineering Conferences organised by the Institution of Civil Engineers, which was interrupted by the war; a very full programme was laid before the members, and there was a great deal that was interesting in the proceedings, which, despite one or two small hitches, proved very successful.

The presence of the American engineers delegated to confer upon Sir Robert Hadfield—and, through him, the British engineering profession in general—the highest honour at the command of the kindred fraternity in the United States, greatly enhanced the dignity and significance of the assembly over which Mr. John A. Brodie presided, and the large attendance of engineers from all parts of the country bore witness to their interest in the proceedings.

We were glad that the President, in opening the Conference, seized the opportunity to impress upon the audience the fact that the engineer owed it to the community to take an active part in the solution of the social and industrial problems with which the nation is confronted to-day. It is an old theme with us; we have always held that the training of an engineer, which involved not only the development of a logical and scientific habit of thought, but also an intimate association from the commencement of his apprenticeship with the manual workers in the industry, peculiarly fitted him to deal with labour questions, while the constant necessity of studying ways and means of attaining desired results with the minimum expenditure of time, effort, and money—in other words, the science of commercial efficiency—similarly equipped him with qualities essential to the successful conduct of public affairs. These are not all the requirements, it is true; the study of economics in the broadest sense, and of politics (but not the politics of the professional politician, from whom deliver us) is also necessary, but the competent engineer is a student to the end of his life, and may be trusted to acquire such information when he needs it. The same note was struck by Dr. Ira N. Hollis in responding to the President's welcome; he emphasised the necessity for the engineer to take his share in the social and political work of the world, and in evolving a new social system based on the doctrines of Christianity.

Turning to the work of the Conference, we may remark that there were over 50 short papers introducing discussions in seven Sections, sitting simultaneously, and that to attempt to survey this mass of matter would call for the qualities of a superman. Add to this the fact that the Institution of Mechanical Engineers was holding its London Summer Meeting at the same time, discussing 16 branches of the subject of "Thermal Efficiency of Heat Power Plants" during two of the three

days, and we have the conditions for a severe attack of mental indigestion. Unlike the proceedings of the Engineering Conference, the whole of the work of the Mechanical Engineers' Conference was of more or less immediate interest to the electrical and allied industries, and we are glad to know that it will be made available in printed form by the Institution concerned.

Whilst we do not question the obvious necessity of holding sectional meetings simultaneously on occasions of this nature, we doubt the wisdom of holding *two* engineering conferences at the same time, and we feel that it indicates a lack of co-ordination or co-operation between the two societies. We know that those words are becoming somewhat wearisome, but there never was a time in our industrial history when the observance of the principles which they denote was more imperatively necessary. We understand that the Summer Meeting was originally fixed for the preceding week; was the date altered merely in order to receive the American delegation, or was it true—as we have heard—that a spirit of rivalry (we would not say jealousy) was the cause? Whatever the reason, we think the decision was somewhat ill-advised and unfortunate. By all means let us have a large joint conference, but let it be one. We look forward to the day when the electrical societies in this country will join hands, under the ægis of E.D.A., in holding a convention comparable to the huge and enthusiastic gatherings of the N.E.L.A. in the United States—united and harmonious.

COMPETITION IN THE SOUTH AMERICAN MARKET.

DURING the course of the war the South American market was necessarily deprived of most of the customary imports of electrical machinery and plant from Europe, and both Japanese and American firms endeavoured to step into the breach. Swiss engineering works did a certain amount of business, or rather, made efforts to execute old orders when export and transport facilities were available to them. To the credit of at least two Swiss engineering firms can be set on record the fact that they definitely refused offers made to them by German firms to act as the intermediaries for the latter in the oversea export trade, in contradistinction to what happened or what was sought to be accomplished in certain other countries in Europe. As already mentioned, the Japanese succeeded in entering the South American market, while American firms tried greatly to extend the scope of their business in that part of the world. On the other hand, the German agents of all kinds in South America or their nominees made a practice of purchasing electrical and other engineering manufactures from American works for the purpose of keeping alive the German connections during the war. Black lists or no black lists, the intermediaries of the German agents managed to retain the connections for the latter in some form or other, for while it was possible to prevent German trading through intermediaries in European countries, it was impossible entirely to stop such trading by the operation of black lists enforced as far as possible by Allied diplomatic action in South America.

Now the turn of the tide appears to have begun. Japan, which in pre-war times had no labour question in the European sense of the term, has one at present, and it is said that the very cheap Japanese labour is a

matter of the past, owing to labour disputes and the higher wages which have to be paid to the men, who have awakened from their former ready resignation to circumstances. The Americans, too, have a labour problem to some extent, but not of the kind which will probably confront them, because they cannot expect to escape a reaction of the European labour movements at some future time. What these facts mean in connection with the South American market is that by way of comparison with the goods which the Germans are pouring into that continent, the Japanese and the American goods, at all events the latter, have become very dear and are unsaleable. Large shipments of German iron and steel, mechanical appliances of various descriptions, and electrical machinery, are understood to have reached South America at prices at which American manufacturers are unable to compete because they were produced at high prime costs, and are now lying unsold at the ports and warehouses in South America. No wonder the Americans are becoming alarmed at the change in the situation of affairs.

There is no doubt that German competition in the South American market has now set in with renewed vigour for many reasons. Apart from the facilities afforded by the depreciated German currency, wages in Germany are really insignificant, notwithstanding that they have been repeatedly increased during the past twelve months. The rates paid to mechanics, for instance, are, and were, 4s. 5d. for an eight-hour shift at the beginning of May of the present year on the basis of the then rate of exchange, which is the only true measure of the value of the wages as compared with those paid in other countries. The price of coal was, and still is, considerably cheaper in Germany than in England and perhaps also in America; shipping rates from German ports to South America are considerably lower because the wages paid to the crews are only one-third of those paid on British and American ships—it is even said that they are much less than one-third—the consequence is that the Germans either alone or in conjunction with their Dutch shipping friends are able to transport cargo at rates at which all other shipping companies in the world would be involved in a loss. The Germans have a growing number of their own ships; they constructed over 200,000 tons last year, and as soon as they are able further to increase the number of lines in service it is believed, at least in Scandinavian shipping circles, that they will secure a considerably greater amount of the carrying trade of the world, because under existing circumstances they can run their vessels on a much more economical basis than the shipping companies of any other country. It is of no use blinking the facts; the Germans are out to win if possible, by "peaceful trade penetration" what they failed to achieve by force of arms. Let us take, for instance, the German trade returns, the tardy publication of which has now been resumed by the Statistical Board of Berlin. Leaving out of consideration the question of values, which would be misleading under the present depreciated condition of the mark, the official German figures show that while the imports of machinery and of electrical manufactures in the eleven months ended with last November amounted only to 5,263 tons, the exports of machinery in the same period totalled 344,900 tons, and those of electrical manufactures reached 60,700 tons in the same term of months. And we see no reason for refusing to accept these statistics as representing the actual turnover of the foreign trade of the country. It will be impossible until a later date to ascertain what proportion of these tonnages was sent to South America or what tonnage has been also forwarded there in the present year. On the other hand, unofficial figures, given in values, purport to show that the Germans exported to Russia insulators for 4,700,000 marks, electric lamps for 20,300,000 marks, and wire and electrical

equipment for 2,500,000 marks between May and December last year.

It is impossible not to conclude that the Germans are making a big bid to recover and develop the export trade in general and the South American market in particular. The South American branches of the German banks have been at work for a long time past, and one—the German Transmarine Bank has just declared a dividend at the rate of 30 per cent. The German branches of the mechanical and electrical manufacturing works are actively pushing business, and every German merchant is an assiduous promoter of German trade, whether on the coast line or in the interior, while the electricity supply companies in which German concerns still have interests are active in the advancement of the sale of German plant and apparatus. In this connection we have yet to learn that the transfer to Spanish ownership of the various undertakings of the German Transmarine Electricity Co., and of its ramifications, will make any change in the furtherance of the use of German plant by these different works and departments or whether Spanish manufactures will now be put forward as substitutes. It must also be remembered that the German home works are lavish in their expenditure on the preparation of detailed schemes and estimates and drawings of proposed installations at mines and industrial works in accordance with the requests which they receive from their branches in South America.

The question now arises where British firms come in. It is a very big problem. Unless branch houses are established or extended in South America, or the services of British engineering firms already on the spot are secured, and they are treated in a very liberal manner, it seems hopeless to expect to do a large amount of business by correspondence. Engineering travellers occasionally visiting branch houses when the latter exist, and making a series of calls upon clients or prospective customers are all very well, but the people who will actually transact the business are those who can get and keep in touch with the industrial establishments which are being erected or modernised, the owners of which can only treat with local and qualified representatives, while the showroom business would be a further advantage for the development of trade. It is only the men on the spot who can make the necessary inspections and gain the essential details in the case of possible large contracts in order to prepare or obtain from home the specifications and estimates so as to secure the orders. All these matters mean money, and unless a liberal policy in this respect is adopted we must not be surprised if the Germans get a stronger hold on the South American market. In conclusion, attention may be directed to the resolution which was passed at the recent meeting of the Association of British Chambers of Commerce urging upon the Government the desirability of Government participation in the Brazilian Centenary Exhibition. During the course of the discussion, Messrs. R. Wichello and G. Marr, of the Brazil Chamber of Commerce, and Mr. G. H. Cooper, of Uruguay, put forward strong advocacy that British traders should take part in the exhibition on the ground that if they failed to do so, the effects on British trade in South America would be very detrimental.

Electric Castles in the Air.

Our reference last week to the credulity of the lay Press was promptly illustrated, after the journal had left our hands, by a leaderette in *The Times* under the above title, supporting the assertions of one of its correspondents, who betrayed a pathetic ignorance of the facts regarding the London Inquiry. Nothing can be more certain, from the evidence brought forward, than that the local authorities, and the Joint Electricity Authority, will *not* embark upon an enormous outlay for new capital stations within the next few years; yet "London Elector" declares that every one of the "grandiose" schemes before the Commissioners involves

'enormous sums of capital expenditure,' and that Parliament instead of passing the Electricity Bill would properly say: "Carry on as best you can under existing conditions until times improve." *That is exactly what the schemes propose to do.* But "London Elector" says: "How utterly unbalanced and untimely, therefore, are these extravagant notions of the Electricity Commissioners and the Ministry of Transport!" and *The Times* dutifully elaborates the theme, stating that "four new capital stations are to be erected in the first stage, thirty-four existing stations are to be progressively closed," and so on. It indicates a proposed expenditure of £13,050,000 in the next four years, and a further £30,750,000 by 1930, and states that "public authorities will not dare to borrow the necessary capital."

In point of fact, the main technical scheme involves an outlay of only £1,050,000 by the Joint Electricity Authority within the next five years, and the whole tendency of the proceedings is towards restricting capital expenditure to the minimum. Capital will have to be spent, in order to meet the increasing demand, in any event—Bill or no Bill, Authority or no Authority—and the problem that is being solved is how to economise in every possible direction, but especially by co-operative action.

In one respect, it must be admitted, *The Times* and its correspondent are in the right—where they criticise the heavy cost of the inquiries. Unfortunately the conduct of the proceedings is largely in the hands of counsel, able indeed, but myopic; with meticulous care they fasten upon points of insignificant detail—such as, for example, the fact that a public footpath runs across the Beckton site—and labour them *ad absurdum*, wasting time and money in the process. Such points are utterly unimportant—what is wanted is the broad view of the service of the public interests. The question whether the Gas Light & Coke Co. would feel comfortable with an electric super-station erected on its premises (seven years hence) was the subject of irrelevant conversation—the Gas Company and the electricity companies were quite happy about it. In such discussions time passes pleasantly but unprofitably. The Inquiry is now in its fourth week, and may go on for another fortnight according to present indications, and there is no doubt that the expense is out of all proportion to the work accomplished.

The National Commercial Association has dropped out of the National Board leaves the Joint Board.

Board now exclusively representative of the technical staffs through the E.P.E.A. Seeing that the inclusion of the clerical staffs was the chief cause of opposition to the National Board on the part of a very large number of undertakings, there is now an opportunity for the Board to get on a better footing, and to secure, at last, the establishment of District Boards throughout the country. At present only a few districts have such Boards to deal with technical staff matters. London itself has no Board. An effort should certainly be made to get the whole matter properly systematised, since it is only looking for trouble to wait till difficult questions arise before providing the organisation. It will be remembered that practically the whole of the last widespread dispute with the E.P.E.A. leading to a universal threat to strike was due to the absence of any local machinery such as District Boards which could have adjusted the numerous queries and misunderstandings. And a further warning that it is time to regularise the Board is the suggestion recently made by the General Purposes Committee of Hackney that the technical staff should be included under the District Councils; that is, the engineers and workmen would sit side by side in the same Whitley Council. This is disapproved in all quarters, including, we think, the E.P.E.A. Everything, therefore, points to the necessity of at once fully organising the National and District Boards on a permanent basis.

SOME ELEMENTS IN THE DESIGN OF LARGE FUSES.

By "A CENTRAL STATION ENGINEER."

In one should ask "What most makes for progress in technical, scientific, or other matters?" the answer might well be: "The proper and comprehensive understanding of elements." Most great advances in knowledge arise from an intimate understanding of facts which are elementary and fundamental, and most of our stupidities arise from a refusal to acknowledge truths which ought to be self-evident. The calculus was discovered by men who got to grips with the elements of curves, and Whitworth's great invention of the method of making plane surfaces by scraping, was also elementary. These two inventions made revolutions, the effects of which will be felt when the Russian Revolution is a

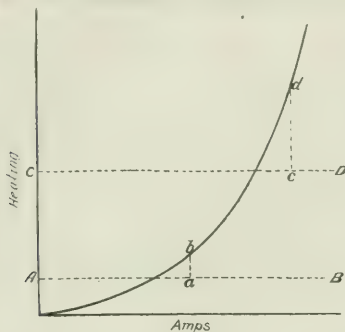


FIG. 1.

vague memory. Conversely our nation is now impeded by the belief, held by multitudes of people, that the less work a man does, the more wealth there is for everyone.

These ideas are not truisms, at any rate, to the writers of text-books. They mostly believe that the word elementary connotes something easy. "Very elementary," says the learned man, as he turns away to something worthy of his metal. If writers could get out of that attitude, they would put into their books a great deal more explanation of what the elements really mean, and more people would understand them. It should be the constant aim of thinkers to state their advanced conclusions in terms of the elements. This is not easy, as one may find on reading Einstein's work on relativity, which is profoundly elementary, but it makes for clearness of thought.

The elements of fuse design are easy, up to a point, but they have been neglected, for which reason many of the designs for large size fuses are so bad that most engineers have come to the conclusion that they must be replaced by oil breakers, even for 400 volts. This has increased costs, and it has hindered the development of electricity.

To get to business, let us consider a fuse for a normal current of 500 amps., say, at 400 volts a.c., with abundant power behind it. The ordinary design for this will consist of a porcelain handle, with a tube filled with fuse wires, so congested that there is very little ventilation. The heat generated, at normal loads, must escape the best way it can through the end pieces and through the tube, and as the facilities are small, the current density will be low. Let us suppose the drop of pressure is .1 volt. It may be less. The loss at 500 amps. will be only 50 watts. At 100 per cent. overload, the loss will be 200 watts, and at 2,000 amps., it will be only 800 watts (allowing nothing for the increased resistance of the hot fuse which would improve matters somewhat). It is evident that the melting would be far from instantaneous, even at the highest load mentioned.

Let us redesign the fuse, placing the strands well apart, in separate tubes, with ample ventilation. We may increase the drop to .2 volt, when the loss at

full load will be 100 watts, at 1,000 amps., 400 watts, and at 2,000 amps., 1,600 watts. The heat is further concentrated on half the volume of metal. Even with the greater cooling facilities, the temperature will rise more rapidly, and the fuse blow with more certainty. The smaller amount of metal, spread over a larger volume, will also blow with less explosive power, and there will be less tendency to arc over. The extra loss in running may be partly compensated by making the fuse shorter than in the first design.

We now come to the operation of the square law of heating. To give a full description of the rise of temperature, we must also know the law of cooling for any particular fuse. This seems to be a subject which might be explored by the young lions in our technical colleges. I will, however, put forward a suggestion, which may not be accurate, but it will serve to arouse attention. In fig. 1 the curve represents the heat generated with the various currents. The line A B represents the amount of heat which the fuse can get rid of continuously, without the temperature of the fuse wire rising above the safe limit. If we assume (for simplicity) that the fuse radiates this amount of heat even at the higher temperature of the fuse, it will be seen that the increase of temperature beyond A B will be relatively slow. If we increase cooling facilities so that we may increase the current to the position of the line C D, it will be seen that the rise of temperature of the wire will be now much more rapid when the current increases on overload. Even when allowance is made for the more rapid escape of heat at the higher temperature, one may reasonably suppose that the fuse which is run at a high density will melt more quickly and with more certainty than one run at a low density. Not only will this be so, but with its good ventilation, it will be cooler at normal loads.

A simple calculation will show how it comes about that a rush of current of extreme violence may get through a fuse before it blows. Let us suppose that

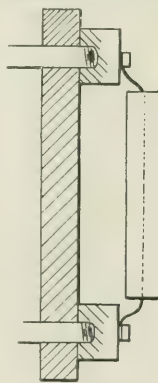


FIG. 2.

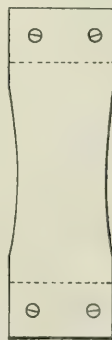


FIG. 3.



FIG. 4.

the fuse consists of six No. 16 S.W.G. copper wires, about 8 in. long, and that there is a sudden passage of 100,000 amps. (In one case, such a fuse was put right across a large battery, and there was reason to believe that some such current actually did flow, for an instant.) At this load the drop of pressure across the fuse would be about 28 V., so that the kW would be 2,800. In one second such three quarters of a kilowatt-hour would be consumed in heating the fuse. Just how soon this rate would serve to vaporise the metal I do not know, but the amount of the energy used in the fuse at this enormous current is much less than one would imagine at first sight. The method of calculation should be useful for working out the time lag in fuses under varying loads.

It might be thought that such a rush of current would be impossible. It would certainly be rare, but on present-day large power systems, with big transformers, the possibilities of large current rushes are enormous, particularly if the fault occurs close to the transformer and near to the generating station. Some of those who have been fortunate (?) enough to witness the effects of current rushes at close quarters, can give graphic accounts of what it all means. They do not usually wish to repeat the experience.

To make the subject controversial, let us consider some actual types of fuses in common use. The really bad fuses are those which consist of a bundle of wires, bunched together in a porcelain handle. The space is so filled with wires that there is little ventilation. The fuses become hot at low densities, which means that far more metal must be used than is desirable. On short circuits, they pass enormous currents, and when they do go, they blow with explosive effects. When they are of the clip replaceable type, with fixed ends, which are not self-aligning, they may be trusted to heat in the clips also, thus adding to the delight of the user. The type is all too common, and need not be illustrated.

A good fuse should run cool at normal loads, and should melt suddenly and break the circuit without arcing. This suggests that lead alloys should be suitable. They might be suitable if the resistance were not so high that too much bulk of metal is required, at any rate, in long break types. In enclosed fuses, lead alloy is used, but its length is kept short, and the arc is suppressed by dust, liquid, or other means. These seem to break the arc satisfactorily, but they have other defects, with some of which I have dealt in a preceding article.*

Magnetic blow-out fuses offer attractions. The fuse is very short, and the arc is blown out magnetically. I have had some in use for years, but have never had them blown. Whether they are certain to clear the arc or not, I do not know. If they are, they should be more used. The British Thomson-Houston Co. has a fuse which consists of a piece of thin sheet metal put across a breaker. When the fuse goes, the breaker flies open, and the arc blows out on carbon terminals. The design is ingenious, and as the fuse itself is very short, it is cooled by conduction, and may be run at a very high density, without much loss of voltage. It looks attractive, but is very expensive.

Aluminium fuses have been used. It was anticipated that the metal would oxidise on blowing, and cut out rapidly. They seem to have gone out of use, and report says that they were not a success.

A design of fuse is shown in figs. 2 and 3. This consists of thin sheet metal, cut with a slight waist. It is screwed right on to a block of metal, and taken through a tube, to allow of good ventilation. The waist ought to ensure that the blowing takes place in the tube, and yet the fuse should melt for a sufficient length to break the circuit. Fuses made with a sudden narrowing of section, as shown in fig. 4, are liable to arc over, after they have melted at the neck.

The above fuses should be suitable for about 300 amps. Larger currents can be taken care of by several in parallel. The ventilation should make for cool running, while the high density should bring about sudden melting on a rush of current, and the small amount of metal should prevent explosion. Criticism is invited.

Conclusion.—This article does not pretend to be exhaustive, but it will serve its purpose if it brings forward experiences of users, be they favourable or bad.

It is suggested that fuses are primarily used to interrupt the circuit when heavy rushes of current take place. Generally they are not intended to operate for plain overload.

They should be run at high densities, with ample cooling facilities. Heavy current fuses should be split into sections. Ample exits should be provided to allow

for the escape of the products of vaporisation, without danger to the attendants.

The designer of heavy-current fuses should always be invited to switch them on to a dead short circuit, with large power behind them. This will ensure that adequate care will be taken in the details.

Who invented the fuse? Does any one know? Or did it invent itself in the early days, when people did not know what an ampere was, and when they found out that a wire was too small by noting that it melted when the current was switched on? However the invention came into being, it was a great idea. We have neglected the necessary research work to make it thoroughly efficient on heavy currents, but that defect may be overcome by the expenditure of time, patience, and money. That would be readily forthcoming if it were required for horse racing or something equally useless, and why not for something sensible? If we will only take the trouble to study its little ways, the big fuse may become as good a servant as the little one, and probably far more reliable.

SOME ELECTRICAL STUNTS ON A FORD CAR.

By "VOLTMAN."

As one who has owned and driven a "flying bedstead," one of many synonyms given by skittish Americans to the Ford car, the writer never failed to find plenty of fun and instruction combined in its electrical side. When Henry Ford worked out the peculiar electric ignition system as the only really fool-proof and simple arrangement to put into the hands of thousands of Ford users he probably little thought that he had opened up something new and interesting to the electrical engineer, because funny and obscure happenings will occur with it never met before with electrical appliances.

The severely electrotechnical man would hardly expect the Ford contrivance to work as a practical proposition, yet it does so, and in thousands of cases. Crude, perhaps, and elemental in its simplicity, the Ford alternator is successful because it is elemental, a circle of magnets rotating in front of a ring of copper tape coils each with an iron core. There is no rubbing contact; one end of the tape goes to a terminal and the other to "frame."

Of course, one would expect that with the terrific banging and vibration the rotating ring of magnets would have very little magnetism after a week's use; yet they show little weakening even after three or four years' use, but what the magnets do is to gather "whiskers" of iron particles from the engine and gears as they wear. These "whiskers" are shot off by centrifugal force and get into the oil again and cause more wear.

Someone, however, discovered that it was quite easy to "clean shave" the magnets and wash out the troublesome "whiskers" with paraffin by sending a fairly heavy current through the bobbins, and reversing the magnetism of the magnets. Then, off drop the whiskers on spinning the engine round. For a long time no one seemed to think of the possibility of remagnetising the alternator by utilising the flux of the inductor bobbins, and consequently it proved a long and tiresome job putting a new lot of magnets in. Now, one simply plays about with a compass needle to get the right polarity, connects up a battery with a tapping key to the magneto terminal, and the operation is done without unscrewing a single nut in less time than it takes to write about it.

One of the obscure troubles the writer had experience of was a "short" or "ground" from one or more of the bobbins. It might have been caused by one of the aforesaid "whiskers" lodging behind a coil or else by a fragment of fine brass or copper wire thrown up out of the transmission case, such wire being used in the friction bands. Previously, to locate such a "short" was like looking for the proverbial needle in

* ELECTRICAL REVIEW, April 15th, 1921, p. 468.

a haystack. Now, one quickly finds out the existence of a "short" by a voltmeter, or even a lamp test, either being put in series with the nobbins when there will be very little current evident. The next operation is to put a few accumulator cells between the magneto terminal and frame, and in a few seconds burn out the "short," again without disturbing a screw or nut, or seeing anything of the machine, as it is, of course, all cased in.

A curious experience that puzzled the writer was concerned with the high-pressure coils which take current from the alternator and operate the sparking plugs. Frequently it was found that two and sometimes three plugs would spark simultaneously, though only one would fire. This effect was traced to magnetic leakage from one coil to the adjacent ones, and consequent induction of weak currents, fortunately too weak to do any harm to the sequence of firing.

THE ENGINEERING CONFERENCE, 1921.

On Tuesday, June 28th, Sir G. T. Beilby, F.R.S., delivered the twenty-seventh James Forrest Lecture at the Institution of Civil Engineers, taking as his subject the "Fuel Problems of the Future," thus inaugurating the Engineering Conference, 1921; the proceedings were continued on June 29th and 30th and July 1st.

Coal, Sir George concluded, was likely to remain for a long time the world's chief source of energy. Its more efficient use might be secured by more careful sorting and preparation at the mine; by the improvement of boiler firing; and by the sorting out of its combustible constituents into fuels of higher availability or convenience by preliminary carbonisation carried out either at high or at low temperatures. This had an important bearing on the development of home sources of fuel oil and motor spirit, and on the production of smokeless solid fuel for domestic purposes. Expressed in tons, the oil output of the world was 7 per cent. of its fuel; in therms, it was 10 per cent. Sir George examined the position of fuel alcohol, and said that until alcohol could be made from waste materials which could be collected and treated at small cost, it did not seem likely that Empire-produced alcohol could be imported into this country on any considerable scale. The production of alcohol on a really large scale as a motor fuel of high availability bristled with economic and technical difficulties, and it was still too soon to pronounce an opinion on the possibilities of the future.

On June 29th the president, Mr. J. A. Brodie, opened the Conference, and welcomed the delegates from the American Engineering Societies. Thereafter Dr. Ira N. Hollis, past President of the American Society of Mechanical Engineers, presented to him an illuminated address expressing sentiments of goodwill and fraternity towards British engineers, and looking forward to the close association of all the English-speaking nations for the welfare of the whole world.

Mr. Ambrose Swasey, chairman of the John Fritz Medal Board of Award, then presented to Sir Robert Hadfield the medal which the deputation had been commissioned to hand to him. In response, Sir Robert remarked that the distinction was intended not only for himself, but as an expression of the high regard and appreciation of the engineers of the United States for the work of British engineers during the war, for the preservation of civilisation, and he welcomed this cheering message as a happy portent for the future of the race.

In acknowledgment of the high distinction conferred upon him, he distributed an "Address of Thanks" in the form of a most interesting brochure of some 40 pages, dealing with a variety of subjects, such as the work of British and American engineers during the war, the history of the John Fritz Medal, the invention of manganese steel and low hysteresis steel (the latter is estimated to be saving at least £7,000,000 a year to the world in cost of coal alone) and the growth of science in general with many portraits of men of note in connection with science and engineering. Sir Robert's own portrait, however, was not included in the brochure, and we have pleasure in supplying the deficiency;

Sir Robert Hadfield is so well known in the electrical world, which has derived incalculable benefit from his work, a benefit, moreover, which increases as the years go by, that he needs no introduction; we shall content ourselves, therefore, with remarking that he has been awarded the John Scott medal and premium for the invention of manganese steel, and the Elliott-Cresson gold medal for metallurgical advances, by the Franklin Institute; three gold medals by the Société d'Encouragement pour l'Industrie Nationale of France; the Telford and George Stephenson gold medals and premiums, and the Howard Quinquennial prize and James Forrest premium by the Institution of Civil Engineers, and the Bessemer gold medal by the Iron and Steel Institute.



SIR ROBERT A. HADFIELD, BT., F.R.S., M. INST. C.E.,
Photo by] M. I. E. E., &c. [Swane

He is, of course, a Fellow of the Royal Society, and has been Master Cutler of Sheffield, his birthplace, besides president of numerous scientific bodies. His family, of Derbyshire origin, has for generations been connected with Sheffield, to which Sir Robert's own work has brought not only honour but also a large measure of prosperity.

The complete series of papers numbered 53, but we can here deal briefly with those of an electrical or allied nature only.

The proceedings were divided into seven sections, respectively: (1) Railways, roads, bridges, and tunnels; (2) harbours, docks, rivers, and canals; (3) machinery; (4) mining and metallurgical processes; (5) ship building; (6) waterworks, sewerage, and gasworks; (7) electricity works and power transmission. Unfortunately, an error was made in printing the programme which led to some confusion in connection with the reading and discussion of some of the papers, which occupied the mornings. During the afternoons visits were paid to a number of works, including the Stonebridge Park electricity station of the London and North-Western Railway Co.; Messrs. Siemens Bros.' works at Charlton; the Lots Road electricity station of the London Electric Railways, Ltd.; Messrs. Fraser and Chalmers's works at Erith; the Wimbledon electricity station and repair shops of the London and South-Western Railway Co.; and the automatic and trunk line telephone exchanges of the General Post Office.

Low Power Factor.

By R. O. KAPP, B.Sc. (abstract).

The principal disadvantages of a low power-factor from the supply engineer's point of view are:

1. The capital cost of the electrical part of an undertaking is inversely proportional to the power-factor. If the cost of this part is £15 per kVA of maximum demand (a moderate figure) this becomes £18.8 per kW of maximum demand at a power-factor of 0.80. So the bad power-factor necessitates an additional expenditure of £3.8s. per kW. The capital charges on this at 15 per cent. are 137 pence per year. If the load-factor is 25 per cent., a maximum demand of 1 kW represents about 2,200 kWh sold per year, and the bad power-factor costs 0.062 pence per unit. If the tariff was worked out on the assumption that the average power-factor would be 0.8, it would pay the undertaking to offer a rebate of anything up to, roughly, five shillings per 1,000 kWh to any consumer improving his power-factor to unity.

2. Wherever the station busbars are sub-divided by reactances and power has to be supplied from one busbar section to another (the normal working condition) with a bad power-factor the regulation is very bad and the alternators on the more heavily loaded sections supply an undue proportion of wattless current, so that the alternators on this section, if designed for the average power-factor of the system, are fully loaded while the steam turbines are not. The result is high steam consumption.

3. Wherever a district has a high-voltage supply through step-up and step-down transformers, the fluctuation of the consumer's voltage is greatly increased by a bad power-factor. So a consumer having a bad power-factor becomes a nuisance and an expense.

4. Unless special methods of power-factor improvement are installed the light load power-factor is considerably worse than that at full load on most installations. A low power-factor has also other minor drawbacks, such as increased distribution losses.

To be effective, power-factor improvement must be carried out on the consumer's premises. There is no technical difficulty about this. The difficulties of supervision and divided responsibility make it undesirable for the supply undertaking to pay for devices which are accessories to the consumer's plant, and so the problem for the supply engineer is to devise a tariff which will cause the consumer to install such devices.

To be effective, such a tariff must make sufficient difference between the electricity bill for a good and a bad power-factor to make it worth the consumer's while to effect the necessary improvement; it must be simple and free from ambiguity; the consumer must be convinced that it is fair. It should be based on integrating or recording instruments rather than on indicating instruments, as the latter type of instrument may be giving anything but a fair average figure at the time when it is read. It must be possible to determine the quantities for which a charge is made with accuracy, and the instruments for doing this must be inexpensive.

A method of charging frequently employed is a slight extension of the usual two-part tariff. The power-factor is under the consumer's control; generally the load factor is not. A tariff, which deals jointly with both is not likely to make it sufficiently obvious to the consumer how he can reduce his bill by installing power-factor improving devices. Other more direct methods would appear to meet the case better. One such is the well-known Arno tariff. This is a charge per unit consisting of two parts. The first part covers the works costs and as much of establishment charges and capital charges on the non-electrical part of the undertaking as is to be paid for by power consumers. The second part covers the capital charges on the electrical part of the undertaking. The cost of the electrical part was assumed above to be £15 per kVA. The capital charges on this are 540 pence a year. At 25 per cent. load-factor and unity power-factor, the sale of kWh is 2,200 per year. This is 0.25d. per kWh-hour. Let the first

part of the tariff be 1d. per kWh. The total charge would then be 1d. per kWh plus 0.25d. per kWh.

At unity power-factor the consumer would pay 1.25d. per kWh; at a power-factor of 0.8 he would pay 1.512d. per kWh. That is, to say, he would pay the 0.062d. more that his low power-factor costs the undertaking. A single meter is used in connection with the Arno tariff which integrates kWh hours, plus a fraction of kWh hours, so that the bill can be based on a single reading. A modification of this tariff was suggested by Mr. Barbagalea in a communication to the Italian Association of Electrical Engineers, and later independently by Mr. C. G. Carrothers in the *ELECTRICAL REVIEW*,* in which two standard watt-hour meters are used, and a simple computation from their readings gives a very close approximation to the Arno charge, which is the scientifically accurate one.

All these methods suffer from one drawback. The consumer is paying for something of which he does not get the benefit; that is, he is paying in one way or another for the idle component of the power. No doubt if supply undertakings start an educational campaign consumers will eventually understand that such charges are not only fair, but to the interest of everyone concerned. They will find it much easier to understand this, however, if the adjustment takes the form of a bonus for a good power-factor rather than a penalty for a bad one. It is suggested that tariffs should be based on the assumption that the average power-factor will be 0.8. It is reasonable to expect consumers to have a power-factor of this value without any special appliances, so very heavy penalties may be exacted for values below 0.8. If the consumer improves his power-factor above 0.8 the supply undertaking should allow a bonus of so many pence per 1,000 kWh for every 1 per cent. by which the average power-factor as shown by the readings of two standard integrating watt-hour-meters is improved.

DISCUSSION.

The CHAIRMAN, Mr. L. B. Atkinson, opened the discussion by explaining that the problem was a very real one, and briefly referring to several methods of improving low power-factor. All of them, however, except the use of the over-excited synchronous motor, involved the provision of extra appliances. This country had not devoted sufficient attention to the production of an a.c. commutator motor, which he thought would solve all their difficulties. That type of machine had been developed considerably in the U.S.A., and it was probable that if the author's suggestions were adopted they would stimulate the revival of interest in unity power-factor motors.

Dr. S. P. SMITH pointed out that the subject was pretty well understood technically, but "machine men" wanted the help of station engineers. The subject had been rendered more acute by the prevalent high costs. France had given the matter more serious consideration of late, and it should be understood that the consumer in some way or other paid for low power factor in the end; therefore, to make him rectify it was the most fair method. The rectifying apparatus might need more skilled attention than was given to the consumers' ordinary motors, and that point must be considered before tariffs were adjusted. He thought the use of reactance was only transitory, and they might attain a point where it need no longer be employed. The speaker was very pleased to hear the chairman draw attention to the a.c. commutator motor, because with that type of machine they could do practically anything they wished, but not with the induction motor. He thought the bad feeling against the a.c. commutator machine was dying away, and they must remember that speed control was only to be obtained by paying for it in some way or other. The synchronous induction motor had a future before it; where constant speed or unity power factor was required its use was the simplest way of solving the difficulty.

Mr. W. R. COOPER explained that if he were a consumer he would not care to be bothered with the installation of extra plant, but if the supply authority cared to install plant which would not bother him it was at liberty to do so. For that reason he favoured the use of condensers.

Mr. S. E. FIDDEN, after recalling some of his experiences in the early days at Sheffield, mentioned that an electric furnace was a wonderful power factor rectifier up to a certain point. Variation in power factor seemed to depend on the type of plant that was installed, but the greatest sinner was a rolling mill, and its owner should be made to pay or rectify his bad power factor. Another difficulty was in connection with switchgear; some old Ferranti switches used to break the circuit all right with a high power factor, but would flash over with a low one. He had eliminated that trouble by connecting oil switches in series with the old ones. The consumer paid in any case, which was unfair; the man who caused the trouble should be made to pay. He therefore hoped some suitable tariff would be found, and agreed that a power factor of 0.8 should be satisfactory.

Mr. W. M. SELWY was of the opinion that there were many ways of improving power factor, all having disadvantages, but no single one with a decided advantage. There were four aspects of the case: (a) Technically, the apparatus was available, and there was no problem which could not be solved at a cost; (b) commercially no measure of agreement on the matter had been come to at all; (c) from the legal

point of view it was very encouraging that the British Electrical Development Association was memorialising the Electricity Commissioners with regard to the legalising of some form of standard tariff; the psychological aspect arose from the legal one, i.e., an implied contract which was found to be broken on the part of the parties and was broken. They must get away from the fact to the measured rate of charging for electricity, but the difficulty was to get consumers to understand the latter and the reason for the change.

Mr. C. P. SPARKS gave some particulars of two undertakings of quite a different character, one being an oil-field supply with a power factor of 0.5, where some form of correction was necessary at group points. A.c. winding and haulage in mining work was another case wherein it was advantageous to correct, but in both those instances the supply, distribution, and consumption were all in the hands of one concern. In the ordinary way only a certain percentage of the consumers was to blame. It would not pay to provide apparatus to correct for a very high power factor. It was very difficult to make consumers to spend money on correcting devices which would give them the benefit of a small bonus. He was of the opinion that it was up to the supply authorities to make the correction.

Mr. A. H. DYKES gave some particulars of methods of charging he had adopted on the kVA basis, and thought the proper place to rectify was on the consumer's premises. He had obtained good results with the use of condensers on the h.p. side with transformers on the consumer's premises.

Mr. J. R. BEAUFRE discussed tariffs and how they should be applied, expressing the opinion that they must classify consumers. The Croody motor, made by Messrs. Parkinson, was a marvellous machine, and its success, he thought, was largely due to the improvement in carbon brushes and the attainment of sparkless commutation. How far did the generating station contribute itself to the low power factor? That point was particularly noticeable in stations working on light load.

Mr. R. O. KAPP, in reply, pointed out that they could maintain a power factor of 0.8 by using any reasonably good motors, but to attain a higher figure they must install special appliances. It would pay to install plant to correct up to 0.8, but it cost a great deal to reach figures of from 0.85 to 0.9. He was of the opinion that in future supply undertakings would have to provide publicity departments, not for advertising purposes, but to help and advise consumers.

Ship and Harbour Design and Equipment as affecting the Rapid Loading and Discharging of Cargo Vessels.

By A. R. T. WOODS. (Abstract.)

DURING 1920 the ports of the United Kingdom had to provide transport and handling facilities for over 100 million tons of traffic. Under present conditions the failure of the machinery provided on shore for the handling and distribution of goods on the quays on which, has led to fewer voyages being made and thus reduced the potential carrying capacity of the ships engaged in the foreign trade by something like 20 per cent. We are thus compelled to explore the avenue of possible improvements in the cargo-handling equipment of ships and docks.

However efficient a ship's gear may be, it is essential that it should be supplemented by good organisation on shore and also by the provision of mechanical appliances in accordance with the best practice.

It is an obvious but unpleasant truth that the majority of British dock systems suffer from want of foresight.

What we are more concerned with, however, at present is the provision of additional mechanical equipment to enable shipping to increase its earning power by a reduction on the time spent in loading and discharging. The winch and the cargo crane have been good servants in the past, but there is a tendency on the part of dock authorities to rely too much upon devices of this type. The conveyor system has demonstrated its applicability to grain cargoes and generally to what may be termed "light" and "bulk" cargo. The extension of facilities of this type would prove of undoubted value in increasing the rate of discharge. Double-storey sheds equipped with roof cranes which have done good work at Liverpool should be more generally adopted. Simultaneously with discharge into the sheds cargo can be swung from ship to roadway and then loaded into rail trucks or road vehicles. If the probability of increased production of contrivances for dealing with cargo that the free flow of traffic through the ports is to be enabled ships to work at full capacity can be secured. The solution must be delayed, for upon it depends in great measure the well-being, and, indeed, the maintenance, of our overseas trade.

Development of Crane Facilities for Discharging Vessels of Large Size.

By H. L. DEANE, JR., M.I.E.E. (Abstract.)

There has been a rapid evolution in the design of the crane facilities which have been applied by the electrical engineering industry to cranes. After comparing the speeds and dimensions of the early hydraulic with a typical modern electric quay crane, the author points out that crane facilities necessarily have to be designed

to suit the shipping which is likely to frequent the port, and, in preparing specifications, a large number of considerations must therefore be taken into account. In dealing with these it is of importance to keep in view the very debatable question whether crane equipment provided by the port authority should be reckoned as a dividend earning facility or whether it should be looked upon as a necessary expenditure which is only partly met by the revenues directly derived therefrom.

DISCUSSION.

In the discussion following the reading of the papers contributed to Section II (chairman, Sir Maurice Fitzmaurice, C.M.G.), on the opening day of the Conference, Mr. F. E. WENTWORTH-SHIELDS, referring to Mr. Woods's paper, said that he had seen the ships' winches and the quay cranes pulling cargo out of the same hatch, a fact rendered possible by the use of electrically-driven trucks to carry the cargo away as fast as it was got out.

Dealing with Mr. Deane's paper, Mr. M. F. G. WILSON remarked that there was no doubt that the electric crane was displacing the hydraulic crane everywhere, and a new installation of hydraulic cranes was now very seldom seen. Regarding first cost, there was not much difference in the prices of hydraulic and electric cranes, but the cost of laying the hydraulic pipes, installing accumulators, &c., added greatly to the cost of the hydraulic system, while, of course, the electric crane was much more flexible.

Continuing the discussion, and dealing with Mr. Deane's paper, Mr. C. R. S. KIRKBRICK said it was well known that the advantage of the electric crane over the hydraulic crane was that with the former the power consumption was directly proportional to the load, whereas the latter used the same amount of water, irrespective of whether it was working with a light or full load. Touching upon the demand of ship-owners for an increased crane radius and the loss of time its adoption would entail, the speaker said that he was trying to solve the problem by a new type of crane in which, instead of travelling the load on a 60-ft. radius, he would employ a horizontal beam travelling with a small monkey crane on the top. The load would thus move in a radius of about 30 ft. only, the backward and forward motion being along a straight line. He hoped with this arrangement to speed up the slewing time by about 25 per cent.

Sir ARCHIBALD DENNY, BART., speaking with regard to cranes on ship and shore, said only one or two ports had a large crane equipment, and urged that ports should extend their crane facilities with the most modern appliances.

The following speaker, Mr. A. T. WALMSLEY, also favoured the placing of cranes on the quays instead of on the ships, as quay cranes gave a greater command of trucks and rails.

(To be continued.)

THE THERMAL EFFICIENCY OF HEAT POWER PLANT.

At the London summer meeting of the INSTITUTION OF MECHANICAL ENGINEERS, which was held on Thursday and Friday last week, an informal conference took place on "Means of Improving the Thermal Efficiency of Heat Power Plants." During the two days, separate meetings were held in four rooms simultaneously, at which 16 short papers were read and discussed.

Dealing with "Engine House Management," Mr. H. DUNELL, O.B.E., referred mainly to the smaller power stations, and attributed the losses in the engine house to (1) waste of steam before it reached the engine; (2) inefficient condition of the engine. Under the first head he drew attention to leaky joints, ineffective steam traps, inadequate lagging, &c.; pointing out that, especially with superheated steam which was not visible, a leak in a steam pipe might mean a very serious loss; a one-inch open pipe could discharge all the steam that a 30-ft. Lancashire boiler could generate. To keep the joints tight, the pipes should be kept warm on light load, and there was no better lagging than magnesia. Steam traps were a source of loss, and he preferred plug cocks for intermittent drainage, where possible, with periodical attention. The discharge from traps should be visible, and they should receive constant attention. He preferred the flotation type.

Turning to the engine, while reaction turbines retained their efficiency for long periods, Mr. Dunell remarked that impulse blading needed inspection to detect erosion. Indicator diagrams of reciprocating engines should be taken periodically, to reveal hidden defects. Mixed-pressure plant needed most attention; oil should not be allowed to coat the blading of exhaust steam turbines, and if it was found it could be cleaned off with paraffin followed by a steam jet. Surface condensers should not be neglected for long; the scale could easily be cleaned off in the early stages, but when it attained a certain thickness it developed rapidly. Warm caustic soda solution was useful for removing it. River steamers in the Far East, using sandy water, had clean condensers, and he asked whether sandy water could be used with advantage here. Periodical running tests of the plant should be made and used.

Mr. GILLESPIE said that between magnesia and clay there was a very large range of efficient coverings; magnesia was the best, but others were good.

Mr. MARTEW emphasised the importance of a proper lay-out of the steam piping; some arrangements invited leakage owing to the inadequate provision for expansion. In some cases a cold blast of air from a window would be found blowing across hot pipes. Water was liable to cause blade stripping in turbines; oil should also be kept out of them. He had found an electrical method of removing oil both effective and inexpensive. He was dubious as to the use of hydrochloric acid for cleaning condensers. The metering of steam, water, electricity, &c., was very desirable, but unfortunately steam flow meters were very costly.

Mr. EDWARDS, referring to the author's advocacy of indicator diagrams, said there were all sorts of losses outside the engine which could only be found by keeping records. As a case in point, he mentioned a heavy loss which was traced to steam traps discharging underground; by converting them to discharge above ground, in sight, a saving of £1,000 a year was made. By laying steam pipes in trenches, covered with loose fossil meal, as good results were obtained as with magnesia. Perfect separation of oil from exhaust steam had been effected with an oil separator followed by three old Lancashire boilers in series, used for thermal storage; there was not a trace of oil on the turbine blades after two years' use.

After other speakers had taken part in the discussion, the chairman, Mr. F. H. LIVENS, remarked that the ability of the reciprocating engine to run on from year to year without revealing defects would seal its doom; the internal-combustion engine called for immediate attention when anything went wrong. Routine records might be troublesome and of little service, but frequent tests of individual items of plant led to great savings, and the indicator was a very valuable aid. Impurities in the working fluids—water, steam, and oil—were the source of many losses.

In reply, Mr. DUNELL said that with magnesia two inches thick, only 7 per cent. of the heat passing through a pipe was lost. Steam pipes were continually spewing scraps of scale, &c., which got under the valves of steam traps and caused waste. He doubted the advisability of placing pipes out of sight in trenches.

A paper on "High Steam-pressure and other means of Increasing the Economy of Steam Engines," by Mr. F. SAMUELSON, was read in the author's absence by Mr. HALLWELL. Pointing out that the present methods of generating power with steam were very inefficient, the author said that improved efficiency was most readily obtained by increasing the range of working temperature; the addition of a mercury boiler and turbine* to an ordinary steam plant considerably raised the range of temperature and resulted in a saving of 40 to 60 per cent. In laying down new plant, the easiest method of increasing the temperature range was by superheating the steam, raising its pressure, or both. Data were given showing the comparative efficiency ratios corresponding with various initial pressures and temperatures of steam. The practical limit of working temperature was 800 degrees; hence they must resort to higher pressures. The advantages of feed-water heating, and of extracting steam from an intermediate stage of expansion for industrial heating purposes, were pointed out, but the author thought there was little overall benefit to be derived from reheating between stages. Finally, it was stated that the British Thomson-Houston Co.'s experimental plant at Rugby, working at 350 lb./sq. in. pressure and 700 deg. F., had proved quite successful, and gave an economy of over 18 per cent. The output was 5,000 kW, and the maximum temperature 750 deg. Trouble was experienced at first due to the use of brass spacers in the turbine blading, but this was overcome by the use of steel. Complete tests had not yet been carried out.

Mr. S. E. FEDDEN, commenting on the mercury vapour turbine, referred to experiments in Berlin some 15 or 16 years ago, and asked whether it had not been found that leakages of the mercury vapour were very dangerous. The diagram of the mercury vapour plant at its present stage of development looked rather like that of a toy. Dealing with the curves provided with the paper, Mr. Fedden pointed out that the gain in efficiency at the high pressures and temperatures was small, and suggested that the increased capital and running costs might easily swallow up the saving. He would not go above 700 deg. Steel economisers and a pure water supply would be necessary, and there were many details to consider before advancing to the higher figures. What was the effect of "bleeding" the turbine on the efficiency of the whole plant? One might lose as much as one gained, and he called for proof regarding the total efficiency between the coal fired and the switchboard. He had used air heaters for 20 years, and found the cost of maintenance was high; in one case the increased furnace temperature burnt the fire bars, and much of the hot air to be by-passed.

Mr. W. M. SELVEY said Mr. Emmet's work was now pretty well known, and the use of two working fluids had often been tried; in the long run the saving made in one way was lost in another. But they must not always turn down new proposals; experience must be gained with them before progress could be made. Steam pressures had been raised to 300 or 350 lb. years ago, but when boilers generating 100,000 lb. of steam per hour were in question, mechanical considerations became important. There was no inherent difficulty in work-

ing at 350 lb., and the North Tees station was using 475 lb. pressure with promising results, but there was a limit to the permissible temperature, and manufacturing firms were not prepared at present to go far above 700 deg. F. The use of high-grade heat for feed-water, and heating the air supply, upset the delicate balance of temperature on the grate bars, and they must be very cautious lest attempts to obtain increased efficiency led to increased cost of maintenance.

Mr. OXLEY thought they were all moving in a groove in search of improvements of 1 or 1 per cent. efficiency, could they not strike a very new customary methods? In this case the attempt to use mercury vapour at high temperatures was worthy of serious consideration. Endeavours to improve steam or gas engines depended upon the materials available, and only led to gains of one or two per cent. The material of construction of a turbine for mercury vapour was a matter of great importance. It was generally held abroad that to go beyond 350 lb. and 750 deg. was very questionable, and even those limits were somewhat risky, owing to the qualities of the materials. At 750 deg. the live steam parts of the turbine began to glow in the dark.

Mr. ROLPH said that cast-iron of greatly improved qualities was likely to be available shortly, and researches on turbine blading, &c., were in progress.

Mr. L. M. JOCKEL had hoped for more data about the mercury vapour system. He referred to the very interesting installations at work at Dalmarnock, and in progress at Neuchâtel and Barton, and drew attention to the important opportunities for improving efficiency at the low-temperature end of the steam cycle, where the difference of 5 deg. between the exhaust steam and the condensate meant a heavy loss of energy. Great waste occurred in condensing plant; he had tested various condensers, and got the best results with the Kinetic Contraflo type, which with a radial flow reaction turbine made a good combination.

The chairman, Mr. R. W. ALLEN, C.B.E., referred to the use of 300 lb. pressure in the Navy; no difficulty was met with in obtaining boilers for this pressure with low superheat—the difficulties came in with high superheat. The war had taught them what could be done by research; at Sheffield they produced the special steels required for aeroplane engines in a few months, and if these high pressures were necessary, they should get Sheffield to solve the problem.

Replying on the discussion, Mr. HALLWELL said the paper, limited to 1,000 words, was only a guide-post for the discussion on economy. The 1,000-kW mercury-vapour turbine could hardly be regarded as a toy. It was a useful size to experiment with, and was driving part of the General Electric Works. The joints in the mercury pipes were mainly welded, and leakage was taken care of. With regard to the use of steel tubes and pure water, it was the gases in the water that created the worst troubles in these high-pressure and high-temperature plants, and they must keep air from the feed water. As Mr. Selvey said, the troubles were mostly mechanical, and it was up to mechanical engineers to overcome them. In turbine work 500 deg. F. was the limiting temperature for cast iron; for higher temperatures steel was necessary except for the blading, which was of phosphor-bronze. Mild steel was satisfactory up to 800 deg. The troubles so far met which were not due to the materials, but to the novel mechanical conditions.

(To be continued.)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Dover Corporation Electricity Works and its Staff.

The timely letter of "R. W." with regard to the above in your last issue should serve to call the attention of all electrical engineers to the reprehensible course of action which the Dover Corporation proposes to adopt.

In December of last year this Association received a definite promise in writing from the Corporation, to the effect that it intended to put into operation the schedule of salaries as issued by the National Joint Board. The recent decision of the Corporation to throw over the schedule and to effect such drastic reductions in the salaries of the technical staff as a direct violation of that promise, and is calculated to give a staggering blow to one's faith in the integrity of public authorities.

One frequently hears criticisms of the lack of faith shown on the part of employers, and of their failure to honourably carry out agreements to which they were parties, but surely it would be hard to find a parallel to the decision of the Dover Corporation.

If the Dover Corporation feels that the present payment of the schedule is bearing hardly upon it, there exists in its district area the constitutional machinery in the form of a District Board at which its grievances could be ventilated, and, if substantiated, could be corrected. To ignore that machinery is to undo all the good work that has recently been done in the conciliatory machinery and uniform methods of negotia-

* The Emmet mercury vapour plant was described in the ELECTRICAL REVIEW of October 22nd, 1920.

tion, and to bring about a reversion to the old bad methods of individual bargaining.

I have stated in reply to your note, president that the Association has proposed to take prompt and definite action in the matter, as it recognises that this is a lost cause, and that if the action of Dover is allowed to pass unchallenged, there will be no end of the same thing throughout the country. The first stone must be arrested, otherwise there will be an avalanche.

Steps are being taken by the Association to warn all its members against even applying for, still less accepting, the positions at present occupied by our members when they become vacant, and it ventures to hope that other engineers who are outside the ranks of the Association will refrain from applying for the positions, and so impress the Dover Corporation with the sense of the folly of its contemplated action. If all electrical engineers will take a proper view of the matter and refuse to accept positions, the Corporation will be forced to reconsider its decision.

W. Arthur Jones,
General Secretary, E.P.E.A.

London,
July 4th, 1921.

Correspondence re the E.P.E.A.

Almost every week one is presented in your "Correspondence" columns with a whole sheaf of letters written by aggrieved members of the E.P.E.A.

I think it is high time these "grousers" desisted from fighting one another and anybody and everybody in general through the medium of your columns, and loyally supported their Association. If they are not satisfied with their executive, then why do they not go to the Association meetings and stand and deliver themselves of all their woes? Perhaps they have not the pluck to face it out, but must resort to a *nom-de-plume* in your "Correspondence" columns.

I am not a member of the E.P.E.A., as I am not in the supply industry, and therefore have no axe to grind; it is merely that this correspondence makes me tired, and I should welcome something of more general interest.

May I suggest that correspondence re the E.P.E.A. should only be published if the writers give their names, as it seems to me a very back-handed action to slate the Association under a *nom-de-plume*.

E. W. Dorey.

London,
July 2nd, 1921.

Sawdust as Fuel.

Could any of your readers inform me of any process, briquetting, &c., by which saw-dust can be used as fuel, either for domestic or steam-raising purposes?

Tom C. Schneidau.

Wolverton,
July 2nd, 1921.

[An installation of 200 h.p. driven with gas from wood-refuse at a timber mill at Maldon, Essex, put down by Mr. H. P. Girling, was described in our issue of December 27th, 1912. A Swedish installation of similar type was described in our issue of April 16th, 1915, and a saw-mill plant where the refuse was burnt under boilers, to the designs of Mr. W. Worby Beaumont, in our issue of April 5th, 1916. For briquetting methods we must appeal to our readers.—Eds. Elec. Rev.]

Charges for Service Mains.

I would like to ask your readers, through your valuable journal, why the South London Electric Supply Corporation makes such excessive charges for outside mains leading to new consumers' premises. Could not this be covered in the price charged per unit? If the late war has brought about these charges, then let the pre-war consumers, who were lucky enough to miss these mains charges, bear some of the costs of their less fortunate brethren. It is obvious that these charges for outside works must be holding up wiring contracts, to the benefit of gas companies.

I should like to learn of the experiences and opinions of wiring contractors on this very important subject.

Disgusted.

July 25th, 1921.

Technical Books.

I have inquired in to-day's issue of your ELECTRICAL REVIEW are answered capably in part, but no single book can completely represent the practice in any branch of engineering, which is constantly advancing. The student, to fit himself to handle any practical problem, must not be satisfied with the opinion of any individual, but must learn to cull from many sources their ideas and methods, and then select therefrom what best suits his particular needs in any specific case.

A compendium of reports leads one to more specialised writings on each particular subject, e.g., I have no hesitation in commending to "L. W. C." books dealing practically with the fundamentals of electrical engineering in England such as J. M. Dutton's "C.C. Arrangements"; H. E. Poole's "H.P. Switchgear and Protection"; A. E. Clayton's

"Power Factor Correction"; and A. P. Trotter's "Elements of Illuminating Engineering," but these are not encyclopaedic. They are modest in price and size, and excellent in contents.

Theodore Stevens.

London,
July 1st, 1921.

A Contact Arc Splitter.

With reference to your article on page 834 of the ELECTRICAL REVIEW of June 21st, 1921, regarding a contact arc splitter which, we note, you state has recently been developed by the Westinghouse Electric International Co., of East Pittsburgh, Penn., U.S.A., we should like to point out that this has been a device which we have fitted on circuit breakers in cases, and, as a matter of fact, on all the Admiralty circuit breakers which we have supplied for the British Admiralty during the last nine years, so we feel that the device shown is not new in any way. We enclose herewith lithos which we have torn from a pamphlet which we prepared some years ago for use in the Navy, which shows the arc splitters as mounted on our circuit breakers, and which you will see, on referring to your diagram in the ELECTRICAL REVIEW, fig. 1, page 834, is exactly the same. We feel that we are entitled to any credit there may be regarding this device, and this is our reason for writing this letter.

For Whipp & Bourne, Ltd.
FRANK R. WHIPP.

Castleton,
June 30th, 1921.

[The arc splitter devised by Messrs. Whipp & Bourne, Ltd., over nine years ago is, as they state, a direct anticipation of the American arc splitter which we illustrated, and we are glad to know that their design was so early in the field.—Eds. Elec. Rev.]

Coal Shortage and Oil Fuel.

In reply to the letter from "One Junior Charge Engineer," first it is stated that about three times as much oil is used under a boiler as under a Diesel cylinder cover. (I take it this means per kWh.) If so, should it not be six times as much?

I am at a loss to understand several of the paragraphs, which are so inconsistent as to become almost unreadable, and I can only surmise that the experience gained it, as quoted, in a junior stage; this is certainly not the discussion looked for at this age, when we are hoping to make the best of our enormous fuel problem for the future.

I am afraid "Junior Charge Engineer" is very wide of the mark in such paragraphs as—

Twenty minutes to get a boiler on the range.
Twenty seconds to get a Diesel on load; of course, if you miss synchronising, you may have to operate the governor gear.
I fail to see what engine-room crews lying in ports have to do with our internal power supply, and it is the first time I have heard that reliable Diesels were not built in this country.

In conclusion, I am afraid "Junior Charge Engineer" must have ill-treated the very few Diesel engines he may have seen.

S. H. Fowles.

Jarrow-on-Tyne,
June 27th, 1921.

Locality of Situations Advertised.

I think it would be a great advantage and save considerable disappointment if employers when advertising vacancies in your columns and using a box number would state whether the job is in London, the Midlands, or the North, or give some indication of the district.

E. A.

July 2nd, 1921.

The Engineering Industry in Johannesburg.

I should like to draw the attention of readers of your paper who may be considering emigration to this country to the fact that at the present moment there is a considerable amount of unemployment in the skilled engineering trades here; just now the municipalities and employers generally, including the Government, are having considerable difficulty in coping with this unemployment problem, and it is possible that the coal strike at home may prolong this present temporary slump.

It falls to my lot to interview a considerable number of men arriving from the Old Country, some seeking for employment, and others requiring licences to enable them to undertake electrical wiring work in this town.

I wish to impress upon intending emigrants that it is essential to bring out with them all available testimonials and references covering their careers from apprenticeship upwards, as it is difficult for a man to obtain employment unless he can produce a proper set of credentials to show what his experience and training have been. It is surprising how many men come out apparently with the idea that credentials and references are of no value. Licences to undertake wiring in this town can only be obtained on production of credentials proving at least five years' suitable experience, and wiring

contractors, both in this town, and to an increasing extent in other towns, give preference to men possessing the wireman's licence granted by the Johannesburg municipality.

B. Sankey,

General Manager, Gas and Electric Supply Department; Chairman, Board for the Licensing of Electricians, Johannesburg.

June 6th, 1921.

[In a subsequent letter Mr. Sankey encloses a cutting from the *Rand Daily Mail*, showing that the situation is still worse than he had supposed, and that mechanics and others should not go out to the Cape "on spec." at present. The extract reads:—

The Cape Peninsula is faced with a serious problem in connection with unemployment. The ranks of the unemployed, both Europeans and coloured, are becoming larger week by week. This is due partly to the present depression in trade, but mainly to the fact that men, skilled mechanics as well as unskilled labourers, are drifting into the city from all parts. There seems to be an impression abroad that work can be obtained. This is a mistake. They not only cannot find work, but they cannot readily obtain accommodation, for the housing problem has not yet been solved. . . . Another factor which is operating towards increasing the ranks of the unemployed is that steamers are bringing to South Africa numbers of men from Europe, who have been persuaded that work can be obtained here easily. The labour bureaux are being besieged by men, many of them good mechanics, seeking employment, and they cannot be placed.

Mr. Sankey's warning is very useful and timely. Similar comments on industrial conditions elsewhere overseas are invited, on behalf of our readers—but we hope they will be more cheering!—EDS. *ELEC. REV.*]

Marine Electrician.

Referring to the query of "E. R. M." in the current issue of the *ELECTRICAL REVIEW*, with regard to taking up a situation as a marine electrician, I trust the following information will prove useful to the intending applicant.

In the first place, it is usual for anyone desirous of going to sea to serve an apprenticeship of possibly six months with the shipping companies' shore staff of engineers, and then as his abilities are proved, he is drafted aboard one of their vessels, as a vacancy arises.

There are several of the first-class passenger companies, the addresses of which can be obtained from any shipping office, who carry an electrician to look after all the maintenance and repairs of the electrical appliances aboard ship, and if "E. R. M." writes to the superintendent engineer, stating all his experience, and with copies of testimonials, he will no doubt receive a reply, requesting him to appear before the head engineer, for an interview.

A. Peckston.

Middlesbrough.
July 2nd, 1921.

Armature Core Bands.

With reference to "Armature's" letter in this week's *REVIEW*, I experienced a similar case to that quoted, some twelve months ago.

The motor was direct coupled to a centrifugal pump running at 2,000 r.p.m. On three occasions the bands burst, which eventually necessitated the armature being rewound.

During the process of stripping, I found the coils were a loose fit in the slots, and concluded that owing to their rising, due to centrifugal force when the machine was running, a continual pressure was being exerted on the undersides of the core bands, with the result that after the machine had been running for a time the bands burst.

I increased the slot insulation, making the coils a reasonably tight fit, and encased the steel bands in a copper casing, sweating the whole up solid.

This machine has now been running continually for nine months, and the bands show no signs of slackening.

On the other hand, "Armature" may have struck a bad consignment of banding wire. Recently I had occasion to test a reel of No. 18 steel banding wire, taking three samples from different parts of the reel, and found a considerable variation in the breaking strain in each case.

I should be pleased to hear when "Armature" has overcome his trouble and what he found to be the cause of it.

Motor.

July 4th, 1921.

Electric Light Wiring Systems.

With reference to the paper on the above subject read before the National Association of Supervising Electricians, I much regret the tone of the letter of "Two Phase" that appears in your issue of the 24th inst. and quite expected to find at the end of it: "This correspondence must now cease."

"Two Phase" has brought an enlightening technical discussion down to the level of acrimonious personalities.

If your correspondent cares to accept my invitation to the next technical debate of the N.A.S.E., he will find that by design they are frankly, though fairly, critical, and for that reason educational.

That supervising electricians depend in any degree upon manufacturers for their daily bread is, on the face of it, simply frothy verbosity. The Association has a long record of lectures by inventors and manufacturers, who have all been grateful for the practical criticism our members have been able to offer.

I do not agree that C.T.S. has received greater condemnation than other systems. It has been brought into greater prominence in this discussion by the frantic efforts of its disciples to justify its use under all conditions, which is a ubiquity the makers do not claim. In any case, the letter of "Two Phase" contains nothing that is illuminating on the subject. In a certain gas works in London, C.T.S. was installed in the retort houses, and ordinary V.I.E. taped and braided drawn into screwed welded tube in other parts of the works.

I have examined the job superficially in the light of these discussions, and find that there is a tendency for the sheathing to crack on the outside of sharp bends, and, of course, there is a certain amount of sag in the horizontal runs, which as far as I know can only be avoided by using some adhesive paste when erecting.

I have also examined the conduit job, and find that air and water, and possibly free gases, have attacked the tubing, and rust has practically entirely displaced the enamel. The interior of the tube appears in fair condition, but I should venture to say that C.T.S. will prove the more durable job. On the other hand, I know a small motor garage where the hand lamp lead spends most of its time in the oil and grease of the floor and pit, and after 18 months required replacing. Now, the point I arrive at is that, by this review of facts, I am not condemning C.T.S. because it cracked at a sharp bend; I shall simply see that when it is used again there is no sharp bend. Because rust heavily attacked conduit in a gas works, I shall not rule out conduit always. In a gas works I should use a sherardised tube system in conjunction with C.T.S.

In a motor garage that allows oil to be about the floor, obviously the lead must be protected by a flexible metallic tube, although even this has faults. In other words, we have gained experience.

If "Two Phase" cares to send me his address, I shall be pleased to advise him of the date of our next lecture, and, indeed, any other electrical gentleman interested.

J. H. Windibank,
Vice-chairman,

National Association of Supervising Electricians.
South Norwood.
June 28th, 1921.

National Electric Light Association of America: Chicago Convention.

With reference to the Leader in your issue of July 1st, the Council of the E.D.A. has already had under consideration the possibility of arranging for joint conventions of the various electrical interests in this country, and although the existing subdivision of Electricity Supply and other Electrical Associations has hitherto made anything of the kind difficult, yet there appears every reason to hope that with a little perseverance and goodwill we may ultimately look forward to some arrangement for bringing together the members of all sections of the industry once a year. The value of such an effort would repay almost any trouble involved in it.

As at present, working meetings and conventions of the different sections are of great benefit to the members, and to the branches of the industry represented by the several sections, but they carry little propaganda value towards the public.

Associated together in the form of a general meeting dealing with every interest comprised in the electrical industry, they would, in addition to the proper work carried out by each section, make a very notable cumulative impression on the public mind, secure the interest of the Press and probably produce a business-getting influence out of all proportion to the cost involved.

J. W. Beauchamp,
Director and Secretary,

British Electrical Development Association, Inc.

London.
July 5th, 1921.

Birmingham Electrical Golfing Society.—The Summe

Meeting of this Society was held at Sandwell Park, under ideal conditions. The Parlia Cup was up for competition, this being won by Mr. J. D. Mesters, with a score of 94-15=79. The other prizewinners were Messrs. W. A. Jackson, J. H. Harpin, W. A. Dexter, and G. Hardier, the last-named gentleman securing the prize for the sealed nine holes. There was a representative gathering, and the event was very enjoyable.

REVIEWS.

Elementary Principles of Continuous Current Armature Windings. By F. M. DENTON, A.C.G.I., A.Amer.I.E.E. Pp. 102+x; figs. 44. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

Small Single-phase Transformers. By E. T. PAINTON, B.Sc., A.M.I.E.E. Pp. 37+x; figs. 40. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

High Tension Traction Gear. By H. E. POOLE, B.Sc., A.C.G.I., A.M.I.E.E. Pp. 118+ix; figs. 26. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

These three books form a part of Messrs. Pitman's series of technical primers which is designed to provide information in the various branches of engineering technology in a cheap and concise form. The series, which is edited by Mr. R. E. Neale, B.Sc., A.C.G.I., A.M.I.E.E., comprises a set of volumes whose size is foolscap 8vo, and which are, therefore, convenient for the pocket; they are distinguished by clear printing and the diagrams are well reproduced.

Mr. Denton's book forms a comprehensive study of direct current armature windings, and is intended for use by professional electrical engineers. Many years ago Prof. Cramp suggested a method whereby drum lap windings might be looked on as being derived from ring windings; the present writer carries this idea further and shows that drum wave windings may also be looked upon as derived from ring windings of the multiplex type. Readers who have had difficulties in following the more usual explanations of the action of wave windings may find this new method of approach of great utility. In addition to the consideration of simplex windings of the lap and wave types, multiplex drum windings receive a fair share of attention and, in particular, the series-parallel type of winding is carefully considered.

A full exposition of the uses and correct application of equalising connectors to the types of winding to which they are applicable is also given, and the book concludes with a schedule of examples of windings actually employed by a number of well-known firms, with explanatory notes when necessary. We can cordially recommend the book to students, and also to electrical engineers who have occasion to go into the subject under consideration. It is clearly written by a man thoroughly conversant with his subject, which is presented in a compact and efficient form likely to appeal to all technical readers.

The second of these primers is written largely with a view to assisting amateurs who wish to construct small transformers to their own calculations. The first half of the book is concerned with explanations of transformer action in language suitable for men without any considerable technical knowledge. Vector diagrams are not used, and anything but the simplest mathematics is avoided, but it gives a good and accurate idea of transformer working for the type of men for whom the book is written. Subjects included in this part of the work are voltage regulation, efficiency and losses, and an account of the magnetic and electrical circuits of transformers.

The second part of the work is concerned with the design of small transformers (particularly up to 1 kW), the main point kept in view being to produce a transformer having given operating characteristics at a minimum cost. The calculations, though involving only simple mathematics, are perhaps likely to be somewhat laborious to the amateur, and we feel that this section of the work is likely to appeal more to men having greater technical knowledge. The method outlined is of great interest, the few assumptions made being of quite a minor character. An alternative method of calculation is also given in which reasonable assumptions as to the main dimensions are first made, followed by checks to see if the desired characteristics have been attained. The book may be well recommended to men who desire to construct a transformer for their own use, and many parts will be of considerable interest to men engaged in transformer design and construction as a profession.

In the third book we feel that the author has endeavoured to treat a very large subject in too small a space, with the result, despite the concise style adopted, that the clearness of the explanations suffers, and in some cases they are not readily followed. After an introductory chapter we find approximately one half of the book is devoted to an account of the general arrangements and mechanism of oil break switches. In these sections it is clear that the author is thoroughly at home, and he conveys a large amount of information in the minimum of space. At times he seems to fall into the error of imagining that his readers are as conversant with the general outline of the subject as he is himself, and those who are not will, as a result, have to follow the subject matter very closely, and possibly supply certain gaps from other sources. As an instance of this we may quote the consideration of fuse shunted overload trip coils where it is pointed out that the absence of fuse shunting may adversely affect the accuracy of the readings of the switch board instruments. Readers who are familiar with the usual arrangements will have no difficulty in appreciating this point, but others, of less experience, may, in the absence of further information, wonder why this effect is brought about. The latter portion of the book is devoted

to the consideration of isolating switches, arrester gear, high pressure fuses, and methods of switch testing, and concludes with a short bibliography of the subject.

The book will be useful to those who have a general knowledge of the usual arrangements in high pressure switches and who wish to obtain additional information in the most concise form.

Armature Winding. A Practical Handbook for Students, Armature Winders, and Engineers in Charge. By C. SYLVESTER. Pp. xiii+171, figs. 129. London: Rentell and Co., Ltd. Price 7s. 6d. net.

There must be many winders wishing to advance their technical knowledge who find difficulty with standard text books owing to the limitation of their knowledge of first principles. There is thus a real need for books to bridge the gap between the usual text book and the ambitious winder's technical capacity. The intention of the author was to produce a book of this kind, for in the preface he promises that the winder who "will allow himself to be assisted by the advice contained in the following pages" will become "expert in every sense of the word."

One might deduce from the wording of the preface that the author has not had a conventional scientific training, but that he has mastered the technology of his subject by self-study, and is, therefore, qualified to teach others. A very careful and sympathetic study of the little book, however, serves only to reveal that the author does not really understand the essentials of the subject with which he deals, and his uninitiated readers are much more likely to be misled than helped. Incorrect statements and partial truths are rife throughout the book. A fair idea of the gross inaccuracies can be given by quoting an extract from Chapter 3, in which the author explains how a small generator is designed.

"A good formula for finding the electromotive force of a two-pole machine is:—

$$E = Z n / 10^8$$

that is where E = the electromotive force.

θ = the total number of lines of force cut by the armature conductors.

n = number of revolutions of the armature per minute.

10^8 = number of lines of force which is necessary for one conductor to cut to produce one volt.

Z = number of conductors on the face of the armature.

From the above formula it will be seen that the electromotive force depends upon, and is proportional to, the three values, 10^8 , Z , and n . If any one, or all three, are altered, the electromotive force will also be altered accordingly."

This senseless statement is followed by:—

$$\frac{E \times 10^8}{Z \times n} = \theta \quad \frac{110 \times 10,000,000}{1,152 \times 35} = 272,000.$$

On this page alone (p. 37) there are no fewer than seven blatant errors, and some of them cannot fail to have a decidedly harmful influence in misleading uninformed readers anxious to learn. On page 157 is the following amazing arithmetic for showing the student how to calculate the total resistance of two 30 ohm resistances in parallel:—

$$\frac{1}{30} + \frac{1}{30} = \frac{2}{30} = \frac{1}{15} = 15 \text{ ohms.}$$

Errors in simple arithmetic are very numerous, and in some cases must confuse the raw mind. For example, the author sets out to show how to design a dynamo for an output of 500 watts, and the first step he takes is to prove, by his elastic arithmetic, that the output of a 500-watt generator is really 506 watts.

We turn in despair from these technical matters in the hope of finding some merit in the way the author deals with the practical side of his subject, but only again to be disappointed. The reader is solemnly told that all core plates are bent in the act of punching, and that a pair of rolls for straightening the plates is an essential piece of machinery. When describing a baking oven for a repair shop, the author says: "The oven should be preferably steam heated, with pipes sufficient to produce a temperature of about 150 deg. F. A small fan fitted in the side of the oven will draw air through these pipes and this temperature will be maintained." Drawing air through steam heating pipes can hardly add to the heating effect, and, no doubt, what the author has seen is a fan for ventilating the oven, and he has not understood its purpose. On page 73, the would-be designer is informed that cotton-covered wire for coils for machines having a voltage above 200 sometimes has six layers of cotton. A definition is given for wave and lap windings that no winder could understand, and to make the confusion complete, a clear illustration of a wave winding is called a lap winding, and what is really a lap winding is called a wave winding. On page 53 is given a description and illustration of a former for turbo-alternator field coils, both of which entirely fail to give any idea of how such a jig should be designed.

Altogether the errors are so numerous and so gross that it is not possible to come to any other conclusion than that the book is one that should never have been published.

Tidal Power. By A. M. A. STRUBEN, O.B.E., A.M.I.C.E. Pp. xii+112; figs. 13. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

Mr. Struben's little book comes at a moment when there is a revival of interest in the subject, and it is unfortunate that it was written just before the particulars of the great Severn scheme were published. Still, in spite of the absence of any comments by the author on that project, the book is very useful as a *résumé* of our present knowledge of the economic use of power from the tides.

The author does not minimise the difficulties that confront tidal power development, of which the chief is the great difference in "range" between spring and neap tides, but is of opinion that our increasing experience of hydro-electric plants will prove of great service in the solution of the technical side of the problem. He discusses various tidal basin systems, and gives a series of diagrammatic sketches of such systems capable of developing (at 100 per cent. efficiency) from 113 to 1,032 kW per basin area of 100 acres. He does not give consideration to the proposal popularised by Mr. J. O. Boving to generate at two or more points where the tide-times do not coincide and supply power to a common network.

The chapter on "Financial Considerations" is necessarily rather indefinite, seeing the lack of precedent in the establishment of tidal power schemes and the great physical differences to be encountered in the bays and estuaries of the British Isles. Mr. Struben gives it as his opinion that "tidal power can compete on a footing of equality with steam power as regards cost per unit produced by existing undertakings, when the capital invested in the latter amounts to £50 per kW installed, even when the cost of tidal power stations reaches as high a figure as £137 per kW installed." It does not appear that the costs and losses of long-distance transmission have been considered when arriving at this figure, and working costs (exclusive of management) have been taken as 20d. per unit generated—an estimate which will probably need revision upward.

The two chapters on "Preparation of Projects" and "Research" are stimulating, and will appeal to all British engineers. The whole book serves as a timely reminder that the United Kingdom is a thickly populated and industrial country, with all parts comparatively close to the seashore, and with a greatly indented coast line—natural advantages for tidal power development which none of our great national rivals possess.—E. S. R.

LEGAL.

AN ELECTRICAL UNEMPLOYMENT INSURANCE CASE.

At Loughborough, last week, the Ministry of Labour prosecuted a switchboard operator employed by the Corporation for not providing an Unemployment Insurance book. According to the *Nottingham Express*, Mr. R. B. Leach, the manager of the electricity works, said that the defendant refused to have the book, and that they had stamped it up for him on the temporary cards specially provided. It was manual work. On the average his earnings amounted to more than £5 per week.

An inspector of the Ministry of Labour said defendant when seen by him emphatically refused to have a card, saying he did not want to have anything to do with it.

Mr. HEANE submitted that the defendant was not a manual labourer within the meaning of the Act. He quoted a High Court decision, which ruled that dairy foremen and tailors' cutters were not manual labourers. He submitted that he had no case to answer, as the prosecution had not made out their

case. Defendant was a responsible worker, in charge of thousands of pounds' worth of machinery.

The Bench unanimously agreed that the defendant was not a manual labourer, and they allowed costs.

PERSON & COX, LTD., v. BERRY.

In the Mayor's and City of London Court, last week, before Judge Jackson, an action was brought by Person & Cox, Ltd. (in liquidation), by M. Morgan, its liquidator, 17, Eldon Street, E.C.4, against Mr. W. J. Berry, dry cell manufacturer, of Southwark Street, to recover £25 lls. 4d. for electric accessories supplied. Defendant's counsel asked for an adjournment, and said that the plaintiffs had signed a deed of arrangement.

Mr. REGINALD G. DAVIS, plaintiffs' solicitor, opposed the adjournment, and said plaintiffs had never signed the deed of arrangement. They always refused. The debt was admitted. He had every sympathy with the defendant, who had sold his business to a gentleman who undertook to pay off his liabilities. He did not propose to enforce the judgment for a time, so that the defendant could recover the money from the purchasers of the business.

Judge JACKSON thought that very fair, and judgment was given for the plaintiffs, execution being stayed for two months.

WHITE v. CHAMBERS & FLEMING.

BEFORE Mr. Justice Gordon, in the High Court of Ireland, Dublin, a convention was made a rule of Court in an action by Mr. James White, of North Frederick Street, in that city, against Messrs. F. W. Chambers and G. P. Fleming, La Scala Theatre, Dublin, for £150, balance due in respect of electrical work. The settlement provided for the payment of £44 odd lodged with the defence, and a further £35, the parties to abide their own costs.

HURST ELECTRIC PLANT, LTD., v. CAVAN LIGHT & POWER CO. In this case, which was reported here last week, his Lordship has given judgment against defendants for £130 and costs for breach of contract, remarking that plaintiffs could realise on the switchboard, which was in their possession.

HOUSING SCHEMES AND ELECTRIC LIGHT ACCOUNTS.

At the Liverpool Police Court, recently, thirty or more tenants of Corporation hutments at Knotty Ash were summoned for non-payment of their electric light accounts. Many of them said they had refused to pay because they were under the impression that the rent of from 16s. to 20s. per week included the cost of lighting. "It was understood when they charged such high rents," said one, "that light would be included." It was pointed out, however, there was no ground for this assumption, and the Bench made orders for the payment of the accounts.—*Liverpool Post*.

RIO TINTO CO., LTD., v. A. G. BROWN, BOVERI & CIE.

IN the Commercial Court of the King's Bench Division on July 5th, this case came on for hearing. It is an action for damages for alleged breach of contract relating to the construction of an electric railway in Spain by the defendants for the plaintiffs.

SIR JOHN SIMON opened the case for the plaintiffs.

On July 6th, it was intimated that the parties had arrived at a settlement, but as the defendants were a Swiss company, it was agreed that the case should stand over until Friday so that they might get confirmation from Baden. We shall report the matter next week.

BUSINESS NOTES.

Bankruptcy Proceedings.—K. H. KERR & Co., makers of electrical accessories, Barrhill Works, Dalbeattie, Scotland.—A meeting of creditors was called for July 5th (the firm having been obliged to suspend payment), to consider the state of affairs and such proposal for settlement as might be made by the debtors. With the approval of creditors largely interested, Messrs. W. and W. B. Galbraith, of Glasgow, had been instructed to investigate the debtors' affairs, and prepare a statement.

WILLIAM WHEATCROFT, 162, Freeman Street, Great Grimsby, labourer, previously electrician. The following are creditors:—

Colbrook, W.,	£400	Arrotta Elec. Mfr. Co. (Louth),	£24
Fickland,	41	Tyson, H.,	21
Dring, H. Saltedby	50	Swamy, Thos.,	20
Allen, F. W.,	88	Cross, G.,	19
Beadle, T., & Co., Ltd.,	30	Chapman, Dr.,	10
Gibbons	25	Cleeveleys Advertising Co.,	10

C. A. CARPENTER, electrical engineer, 4-5, Mason's Avenue, Basinghall Street, E.C.—Receiving order made June 27th on creditor's petition. First meeting, July 11th; public examination, September 13th; both at Carey Street, W.C.

J. H. TOMS, electrical engineer, 13, Gray's Inn Road, W.C.—Receiving order made June 27th on debtor's own petition. First meeting, July 11th; public examination, September 27th; both at Carey Street, W.C.

G. H. GEE, electrician, 10, Front Street, Annfield, Durham.—Receiving order made June 24th on creditors' petition. First

meeting, July 12th; public examination, July 28th; both at Newcastle-on-Tyne.

E. CLONEY, tramway divisional traffic superintendent.—Fourth and final dividend of 5s. 6d. in the £, payable July 8th, at Carey Street, W.C.

J. W. LAYTON, electrician, 5, Nobles Bank, Hendon.—First and final dividend of 1s. 4½d. in the £, payable July 7th, at the Official Receiver's Office, Sunderland.

R. C. JONES (Elect-Ma Engineering Co.), 10, Caledonia Street, King's Cross, W.C. Adjournd public examination, July 29th, at Carey Street, W.C.

A. ROWLANDS, electrical engineer, 45, Thrumpton Lane, East Retford, Notts.—Last day for proofs for dividend, July 20th. Trustee, Mr. F. C. Brogden, Official Receiver, 10, Bank Street, Lincoln.

W. HEDGECOX, electrical engineer, 121, Salop Street, Wolverhampton.—Last day for proofs for dividend, July 22nd. Trustee, Mr. S. W. Page, Official Receiver's Office, 30, Lechfield Street, Wolverhampton.

Company Liquidations.—ANGLO-NORWEGIAN ELECTRO-CHEMICAL AND FINANCE CO., LTD.—Winding up voluntarily.

UNITED ELECTRIC CAR CO., LTD.—Winding up voluntarily. Liquidator, Mr. G. B. Freeman, 66, Coleman Street, E.C. A meeting of creditors was called for July 7th. Particulars of claims must be sent to the liquidator by August 31st.

ENGINEERING AND ARC LAMPS, LTD. A meeting of members is called for August 4th, at 29, Gracechurch Street, E.C., to hear an account of the winding-up from the liquidator, Mr. W. A. Henderson.

PORTABELL ELECTRIC MOTORS (1919), LTD.—First meeting of creditors and contributors, July 12th, at Carey Street, W.C.

E.B.C. ELECTRICAL CO., LTD.—A petition for the winding-up has been presented to the High Court by Mr. L. C. Harvey, consulting engineer, of 26, Victoria Street, S.W., and will be heard in London on July 19th.

Dissolutions of Partnership.—**ADAM & GAYLER**, electricians, Dyott Works, Suffolk Place, Birmingham. Mr. F. J. Adam and Mr. W. E. Gayler have dissolved partnership. Mr. F. J. Adam will attend to debts and continue the business.

ELECTRICAL EQUIPMENT AND INSTALLATION CO., electrical engineers, 64, Finsbury Pavement, E.C.—Mr. J. P. Castle and Mr. C. J. Arnold have dissolved partnership. Messrs. Castle & Co., solicitors, 31, Gracechurch Street, E.C., will attend to debts.

Trade Announcements.—The firm of **A. V. WILLMOTT**, 124-127, Minories, London, E.1, has been re-constituted, and will be known as A. V. Willmott, Son, & Phillips. Messrs. R. O. Willmott and Mr. F. S. C. Phillips having joined the firm, which will specialise at the same address in insulating materials, traction and transmission material, &c.

MESSRS. LESLIE DIXON & CO., 91, Queen Victoria Street, London, E.C. 4, are now the representatives in the South of England for Messrs. John Fletcher, Ltd., electrical slate manufacturers, whose works are at Carnarvon.

MR. DAVID G. BROOKS, representing the Walsall Hardware Manufacturing Co., Ltd., has moved from 79, Lincoln's Inn, Corporation Street, to Daimler House, Paradise Street, Birmingham.

Messrs. Bruce Peebles & Co., Ltd., have recently appointed **MESSRS. CHARLESWORTH, PEEBLES & CO.**, of 134, St. Vincent Street, Glasgow, as their agents for the whole of Scotland, with the exception of the area in the East of Scotland which, as for many years past, will still be covered by **MESSRS. MITCHELL, GRAHAM & SON, LTD.**, 56, Buccleuch Street, Edinburgh. Mr. J. A. Hood still remains the Bruce Peebles Scottish representative.

Catalogues and Lists.—**MR. C. GORDON SMITH**, Royal London Buildings, Lichfield Street, Wolverhampton.—An illustrated and priced leaflet dealing with a patent "Economy" flood lamp for stage lighting, &c.

MESSRS. E. G. APPELEY & CO., LTD., 70, Victoria Street, Westminster, S.W.1.—A series of leaflets in volume form illustrating and describing "Phoenix" electro-magnets for various purposes, such as scrap handling, steel rail conveying, lifting castings, &c. The leaflets include a description of a 5-ton crane adapted for use with a magnet.

MESSRS. HIGGS BROS., Sand Pits, Birmingham.—"Monthly Magazine," July, 1921, containing stock and price-lists of motors and dynamos, notes on starting gear, and anecdotes.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, E.C.2.—List U L 1, "Industrial Lighting Boxes," giving full details, illustrations, and prices of small joint boxes for use in the lighting of collieries, shipyards, factories, warehouses, &c.

MESSRS. SCHOLEY & CO., LTD., 56, Victoria Street, Westminster, S.W.1.—A folder advertising the "Croydon Premier" auction cleaner, giving several views of the works of the Electric Suction Cleaner Co.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—"Installation News," New Series, No. 7, July, 1921, containing notes on "Earthing of Factory and Works Installations," and descriptions of the "Simplex" hand-lamp and colliery-lighting system and "Stellite" lanterns for industrial and street lighting.

MESSRS. GEORGE ELLISON, Perry Bar, Birmingham.—List No. 17, illustrating and describing "Mill"-type free-handle air-break circuit breakers; and List No. 19, dealing with trailing cable sockets and plugs for air-break gate-end boxes, giving illustrations and dimensions. Both lists are fully priced.

KEIGHLEY GAS AND OIL ENGINE CO., Imperial Works, Keighley.—An illustrated blotter advertising "Imperial (Keighley)" gas, oil, and spirit engines.

MESSRS. HASLAM & STRETTON, LTD., 11, Windsor Place, Cardiff.—A descriptive circular of the approved "Thor" miners' safety lamp. Illustrated.

THE EXCELSIOR SHADE MANUFACTURING CO., Betterway House, Stamford Street, Nottingham.—A well-illustrated catalogue of "Betterway" lamp shades and fittings in various metal finishes. Also two of a series of office mottoes.

MESSRS. C. A. PARSONS & CO., LTD., Heaton Works, Newcastle-on-Tyne.—Pamphlet No. 3, illustrating and describing the application of steam turbines to paper mills. This shows the advantages of the turbine or turbo-electric drive for mill machinery, as well as the auxiliary advantage of the turbines in the provision of the steam necessary in certain processes.

MESSRS. E. P. ALLAM & CO., 107-109, Gray's Inn Road, W.C. 1.—Monthly stock list, No. 10, July, 1921, giving particulars of d.c. motors, new and second-hand.

THE ANGLO-SWEDISH ELECTRIC WELDING CO., LTD., Wood Wharf, Greenwich, S.E. 10.—A profusely-illustrated publication (35 pp.), describing the Kjellberg arc welding process and its applications.

MESSRS. F. J. SHENTON & CO., LTD., 68 and 69, Shoe Lane, E.C. 4.—A leaflet illustrating "Supreme" standard accumulators and burglar alarms. Fully priced.

MESSRS. BRUNTONS, Musselburgh, Scotland.—A well-illustrated catalogue of cold rolled-steel strip of many sizes; the list gives full instructions for ordering, and tables of decimal and metric equivalents, &c.

MESSRS. WATSON & SONS (ELECTRO-MEDICAL), LTD., Sunic House, Parker Street, Kingsway, W.C. 2.—Bulletins Nos. 355 and 356 dealing respectively with "Sunic" automatic X-ray combination, couches and screening stands, and a portable transformer unit (both illustrated and priced); Folder No. 388, giving sizes and prices of back and front intensifier screens; and "Sunic Record," No. 14, giving the preliminary report of the X-Ray and Radium Protection Committee.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C. 2.—Pamphlet E.2,351, giving an illustrated description, with prices, of studio arc lamps.

MESSRS. SAMUEL JACKSON & CO., 53, Briggate, Shipley, Yorks.—An illustrated and priced leaflet advertising the "Empira" electric washing machine.

Catalogues Wanted.—**MR. R. A. JONES**, who has recently taken over control of Messrs. Bass & Co., 402, Essex Road, wishes to receive catalogues.

Inquiries.—Makers of the "Manchester" oil engine, and of the "Lombard" 5-A intermediate corridor switch, are asked for.

Book Notices.—**"Thermionic Tubes in Radio Telegraphy and Telephony."** By J. Scott-Taggart. Pp. xxiv + 424; 344 figs. London: The Wireless Press, Ltd. Price 25s. net.

"Kelly's Directory of Merchants, Manufacturers, and Shippers of the World for 1921." In two vols. Price 64s. net. London: Kelly's Directories, Ltd.

"The Journal of the South African Institution of Engineers." Vol. XIX, No. 11, June, 1921. The subject of the paper included in this issue is "Factors Affecting Mining Efficiency." The Institution's comments on the Electricity Power Supply Bill and the Apprenticeship Bill are also given. Accompanying this number of the Journal is a complete list of members.

"Theory of Wave Transmission." By G. Constantinesco. Vol. I, Pp. iv + 211; figs. 51. London: Proprietors of Patents Controlling Wave Transmission.—This is a treatise on the transmission of power by vibrations, by the inventor of the system; an alternative title is "Theory of Sonics," from which it will be gathered that the transmission of energy "by means of impressed periodic variations of pressure or tension producing longitudinal vibrations in solid, liquid, or gaseous columns," has attained the dignity of a new branch of engineering science—that which deals with all applications of elastic properties of liquids for the transmission of power as distinct from "Hydraulics," which deals with liquids treated as being incompressible. The author first explains the production of impulses, their propagation along a column of matter, and their application to the performance of work at a remote point, after which he develops the theory of the subject, which naturally bears a close resemblance to that of alternating electric currents; terms such as "sonomotive pressure," "sonic current," "capacities and condensers," &c., as well as power factor, and workless components, not only heighten the similarity, but represent analogous quantities. Further on, when we come to the description of the actual apparatus employed, we meet with rotors and stators, synchronous and asynchronous three-phase motors, collectors, and so on, while later sections deal with "high-frequency currents," "charged lines," "transformers," &c. In the appendix numerous tables of constants and mathematical functions employed in the calculations are given. While it is not within our sphere to discuss in detail a work on "Sonics," we are interested in observing that a new science has thus been created and developed to so advanced a degree by the efforts of a single man, and we congratulate Mr. Constantinesco on the result of his labours.

"The M. and C. Apprentices' Magazine." Vol. V, No. 18, Summer, 1921. (54 pp.)—This number contains a talk on wages, &c., by Mr. Sam Mavor, and many other interesting articles and notes.

"Memorandum on Electric Arc Welding." Form 329 of the Factory Department, Home Office. (10 pp.) London: H.M. Stationery Office. Price 3d. net.

Punch Summer Number (1s) celebrates Mr. Punch's eightieth birthday. In addition to other features, which are up to the usual standard, the number contains a section in colour depicting in contrast many interesting changes that have been witnessed during the period.

E.P.D.—The Federation of British Industries, last week, addressed a communication to the Chancellor of the Exchequer urging upon his sympathetic consideration two clauses dealing with the question of forward contracts and bad debts, which will be moved upon the report stage of the present Finance Bill. The object of both clauses is similar—viz., to secure that all firms should be placed as nearly as possible upon an equal footing as regards the burdens to be borne and the relief to be obtained under the provisions for the termination of E.P.D.

Lantern Slides.—**MESSRS. BRUCE PEEBLES & CO.**, LTD., of Edinburgh, have prepared a very complete set of nearly 80 lantern slides showing their works and manufactures, and these are available for illustrating lectures on electrical machinery. In addition to views of their works, there are others dealing with generators and motors, motor generators, rotary converters, frequency changers, and the Peebles-la-Cour motor converter.

Copper and Lead Prices.—**MESSRS. F. SMITH & CO.** report, July 5th:—"Copper (electrolytic) bars, £77 10s., 30s. increase; do. sheets, no change; do. wire rods, £93 10s., 30s. increase; do. h.c. wire, 11½d., 3d. increase; silicon bronze wire, 1s. 3½d., 3d. decrease."

MESSRS. JAMES & SHAKESPEARE report, July 6th:—"Copper bars (best selected), sheet and rod, and English pig lead, no change in last week's quotations."

Fire.—MESSRS. ALBERT LEE & CO., LTD., ask us to state that the fire which occurred at their works at Andrews Road, Hackney, was not of a serious nature, and it in no way interfered with the business. They are still able to execute orders for glassware of all types from stock.

Electrical Measuring Instruments.—The publication of a special article in the *Westminster Gazette* of May 18th, dealing with some of the possible effects of the then proposed Safeguarding of Industries Bill on certain electrical products, in particular measuring instruments of precision, has been followed by a letter from Mr. D. N. Dunlop, on behalf of the B.E.A.M.A., dated June 23rd, and appearing in the *Gazette* for July 1st. Mr. Dunlop writes as follows:—"The article laid it down as practically indisputable that an American instrument, the 'Weston,' is so essentially different from, and superior to, any English instrument of the same kind, that it must be regarded by manufacturers in this country as a 'basic tool.' I am to say that while the Weston instrument is admittedly excellent of its kind, it is not in any sense unique, and that there are a number of English makers of electrical instruments (whose names are available) capable of producing, and now producing in ample sufficient numbers, instruments performing precisely the same functions, and with quite as high a degree of accuracy. With regard to the statement that Mr. Enthoven, of the late Import Restrictions Department, gave special permits for the importation of 'some tons' of Weston instruments, thus indicating their indispensability, the writer of the article appears to be misinformed. Licences to import were issued during the war not because equivalent instruments were not made in this country, but because English makers were then engaged on other products considered by the authorities to be of greater immediate importance for war purposes, and ammeters and voltmeters of the Weston class were, therefore, not available in sufficient numbers."

U.S. Electrical Exports.—The Department of Commerce reports that exports of electrical goods from the United States in April were valued at \$9,085,598, or about \$2,000,000 more than the total in April, 1920. So far this year the exports are averaging nearly \$12,000,000 a month, which, if continued, would make a record year. The total for 1920 was \$102,618,508. *Reuter's Trade Service* (Washington, June 14th).

Engineering Wages.—As briefly mentioned in our last issue, a provisional agreement between the parties to the engineering wages dispute was reached on June 30th, in time to avert a cessation of work. The terms of the agreement, which is being voted upon by the employees, are as follows:—The wage reductions are to be effected in three stages. The first reduction will take effect upon July 15th, and will consist of 3s. off weekly wages, and 7½ per cent. off time rates. A similar reduction will be made as from August 15th. The third stage, which concerns the "Churchill" munitions bonus of 12½ per cent. on time rates, and 7½ per cent. on piece rates, is to be the subject of negotiation in September. The proposals were adopted by the Trade Union delegates with but few dissentients, and the prospect of acceptance by the workers concerned is regarded with optimism, as the leaders recommend this course.

In announcing the arrival at the above agreement in the House of Commons on June 30th, Dr. Macnamara (Minister of Labour) paid a tribute to both sides, and said:—"The successful issue of the negotiations is a signal illustration of what can be done when employers and workpeople's leaders sit down together to face a problem with a real intention of grappling with it until a solution has been found."

Private Meeting.—ALBERT HARRY OSBORN, electrical engineer, 67, Southgate Street, and 101, Welford Road, Leicester.—The creditors interested herein were called together recently at the offices of Messrs. Appell & Barnes, Leicester, when a statement of affairs was presented which showed liabilities of £587, all of which were due to trade creditors. The assets were estimated to realise £290, from which had to be deducted £5 for preferential claims, leaving net assets of £285, or a deficiency of £302. It was reported that the values placed on the assets were those of the debtor. A full set of books had not been kept, and the only explanation of the deficiency was bad debts to the extent of £125, and loss made on contracts. The drawings had only averaged £3 a week. The debtor had been in business for some six or seven years. Recently creditors had been pressing, and in order to protect the estate, a deed of assignment had been executed, the trustee being Mr. R. Dunn, chartered accountant, of Messrs. Appell & Barnes, 3, Welford Road, Leicester. An offer was made of a cash composition of 5s. in the £, but after discussing the position, it was decided that the estate should be dealt with under the deed already executed.

New Manufacturing Plants in India.—The directors of the Tata Co. are negotiating for the establishment of plants for the manufacture of railway wagons and locomotives, agricultural implements, wire products, tin plates, enamelled wire cables, and special steels for reinforcements. It is expected that these and other plants will ultimately be established at Jamshedpur. *Reuter's Trade Service*, Bombay, June 10th.

China.—TRAMWAYS FOR PEKING.—The Peking municipal authorities concluded a loan with the Banque Industrielle de Chine on May 9th for the construction of tramways in the capital. The capital of the tramway company will be \$4,000,000, half of which will be raised by public subscription. Work will start when the money is raised.

Belgian Rail Contract.—The *Times* Brussels correspondent states that a Belgian firm of Marchienne has secured the contract for 95,000 tons of rails offered by the Argentine Government. The Belgian tender worked out at 46s. 1r. (about £10 10s.) as against the lowest French tender of 528 fr. (£11 10s.), a German tender of 2,550 M. (£9 11s.), an American tender of 861.95 (about £16 10s.), and a British tender of £14 10s.

Foreign Firms in China.—Foreign firms in China are increasing rapidly. The latest report shows the following:—

U.S.A....	113 firms	6,660 personnel.
Belgium	20 ..	391 ..
Denmark	27 ..	546 ..
Austria	5 ..	27 ..
Great Britain	541 ..	13,234 ..
Netherlands	25 ..	367 ..
France	171 ..	4,409 ..
Germany	2 ..	1,235 ..
Italy	19 ..	367 ..
Japan ...	4,878 ..	171,485 ..
Norway	12 ..	249 ..
Portugal	93 ..	2,390 ..
Russia	1,780 ..	148,170 ..
Spain... ..	8 ..	272 ..
Switzerland	4 ..	632 ..
Others, unclassified	33 ..	537 ..

—*Journal of the Office of the High Industrial Commissioner.*

Annual Outings.—On Saturday, June 25th, the staff of Messrs. Aish & Co., electrical contractors, Bournemouth, went by motor-coach to Brighton. On the outward journey, Bognor, Littlehampton, and Worthing were visited; the return journey was made through Arundel and Chichester.

On Saturday last the employees of the Hackney Borough Council Electricity Department held their annual outing, proceeding to Southend by charabanc. A large party sat down to lunch at the Palace Hotel, Mr. L. L. Robinson, borough electrical engineer, being in the chair, supported by the Mayor of Southend, the Mayor of Hackney, Councillor B. A. Little, vice-chairman of the Electricity Committee; Mr. R. Birkett, electrical engineer at Southend; Mr. J. R. J. Bowden, deputy electrical engineer of Hackney; Mr. T. Dalby, power-house superintendent; Mr. J. F. Heathman, chief clerk, Electricity Department, who was responsible for the arrangements, and others. The chairman proposed the toast of "The Mayor and Corporation of Southend and the Southend Electricity Department," and expressed the pleasure of the company at the presence of Mr. Birkett. Responding to the toast, the Mayor of Southend recalled the fact that he was born in the Borough of Hackney, and had spent many happy years within its boundaries. He was very pleased to have them in the town, and trusted that they would have a very enjoyable time, and that this would not be the last time that the Hackney Electricity Department would make Southend the place of their annual outing. Mr. Birkett also responded, inviting those who so desired to inspect the electricity works and the boulevard tramway system. The Mayor of Hackney, in proposing the toast of "The Hackney Electricity Undertaking," paid a tribute to the ability of Mr. Robinson, and expressed his pleasure at his return to duty after a successful operation. The Mayor pleaded for cordial relations between the technical and operative staffs. Mr. Ingrey, the chairman of the Shop Stewards, responded on behalf of the employees. Mr. Heathman, chief clerk, Electricity Department, proposed the toast of "The Guests," which was responded to by Councillor W. Parker, J.P.

The staff and workmen of the Tunbridge Wells Corporation electricity department held their annual outing on the 25th ult., going by motor charabanc to Eastbourne, Pevensey, and Hastings. This was the first outing since 1914, and a party of 33 (including the borough electrical engineer) had a delightful drive through some of the most picturesque country in Sussex. Lunch was partaken of during a three hours' stay at Eastbourne. At Pevensey an inspection was made of the famous old Mint House and Castle ruins, followed by an excellent tea. The party then made for Hastings, where a halt of two hours was made prior to the run home.

The staff of the Electrical Supplies Co. held their outing on Saturday, June 25th. They went by charabanc to Marlow, where a very varied programme was provided, including numerous round games, ending up with a dance in the evening. Owing to the temperature, the more strenuous items were omitted, and the whole party spent a good time on the river. At the dinner the chairman gave a few very encouraging remarks to the staff, pointing out that the present slump could not continue for long, and they were quite prepared for the revival when it came.

For Sale.—By direction of the Disposal Board, Messrs. Douglas Young & Co. will sell by auction, at the National Filling Factory, on July 14th, the remaining plant and machinery, including motors, pumps, &c.

Newport Corporation has for disposal one 500-kw set consisting of a cross-compound reciprocating type engine (Markham & Co.), coupled to a 468/500-V d.c. generator.

Burnley Corporation electricity department invites offers for one 250-kw Belliss-Dick-Kerr generating set 440-550 V, complete with condensing plant, and one 30 ft. x 8 ft. Lancashire boiler, with Bennis stocker.

Messrs. Churchill & Sim will offer by auction at Hendon on July 12th and 13th, the stock of timber of the Aircraft Manufacturing Co., Ltd. (in voluntary liquidation). For particulars see our advertisement pages.

Russian Electrical Notes.—According to a Russian paper, a plan has been prepared for the electrification of the peat working machines, &c., of the Komaroff marshes, near the shore of the Gulf of Finland, in the Peterhoff district. It is proposed to raise the steam required with boilers that are going to be removed from certain ships. The electrotechnical section of the Government has prepared plans for the electrification of 13 villages in the Pelgorsk district of the Novgorod Government. Preparatory work has been begun for the construction of the temporary electrical station at Volodga, and the extension of the Novgorod station, whilst considerable progress has been made with the distribution schemes for various electrical stations in the country, and the central electricity works of St. Petersburg is being completed.

A message from Homel says that in Penitzes an electrical station has been constructed, and the chief streets of the town and the public institutions are now lighted by current from it. It is stated that work is about completed for starting the electrical plant at the Treugolnik factory; but fuel is assured for a month only, and the furnaces have been adapted to burn liquid fuel in the future.

It is reported, says an article in the *Investia*, that there has been a feverish activity in the installation of small electrical plants in the country.

Readers concerned with Russian affairs may be interested to learn that the Russian papers may be seen at a Reading Room at 116, Oxford Street, W. 1.

Electricians' Wages.—Notices have been posted in all affected works, reminding the electricians that, in accordance with the agreement made at York between the E.T.U. and N.F.E.A., the second wage reduction comes into effect on the first pay-day following July 9th. This makes a total reduction of 10 per cent. from the wages being paid prior to the agreement.

Profit-Sharing in Coal Mining.—The Executive of the Labour Co-partnership Association has issued the following:—"The Executive of this Association has had before it the official settlement of the coal crisis. There is one part of the settlement that specially interests this Association, and that is the adoption of the principle of co-partnership and profit-sharing for which it has worked for many years. The standard wage which has been set implies that profits shall be paid out of a fund secured by the united goodwill of the miners and mine owners, and that a large share of the surplus shall go to the workers themselves. Now that the first step has been taken, this Association looks forward hopefully to the development, as circumstances permit, of the complete co-partnership idea."

Unemployment.—The latest available returns of the Ministry of Labour show that the total number of unemployed registered at labour exchanges for the week ended June 24th was 2,178,000, an increase of 10,000 upon the preceding week's total. This was in addition to workers on short time, who numbered 953,290.

E.D.A. Activities.—"Selective Publicity for Installation Contractors and Electricity Supply Undertakings" (E.D.A. 166), recently issued by the British Electrical Development Association, may be described as a complete letter writer for the use of those named in the title. It comprises a set of twelve circular letters pointing out to the recipients the labour-saving properties, cleanliness, &c., of electrical methods in the home. Each is suitably illustrated, and the arrangement is such that a reasonable appeal is made month by month throughout the year. Hints as to the best way to prepare and dispatch these letters are given, and the cost per 1,000 is shown in detail.

The A. & G.E. at Derby.—At the R.A.S.E. Show at Derby, the King visited Stand 47 of AGRICULTURAL AND GENERAL ENGINEERS, LTD., and was received by Mr. J. G. Burford and Mr. G. M. Blackstone, directors, and Lieut.-Col. C. F. Hitchins, D.S.O., general manager of the company. The general manager informed His Majesty that the company was an association of 14 of the oldest and best known engineering firms in the country, employing in normal times some 18,000 workpeople, producing all types of engines both steam and internal combustion, also every description of agricultural implements, &c. His Majesty expressed his pleasure at the initiative displayed by British manufacturers.

Electrical Goods in South Africa.—*South African Mining and Engineering* for June 4th, says that owing to the insufficiency of current and the inactivity in the building trade at present, business is rather slow in Johannesburg and along the Reef, and not so many orders are now coming in from other parts of the Union. There is no change to report in prices, but the tendency is for them to come down, as the latest quotations from Britain are coming in easier, tubing especially so. Material is arriving regularly from Britain, but none at all from the Continent, owing to the 26 per cent. Customs levy recently imposed, whose vagaries are not yet rightly understood on either side of the water. The recent reduction in freights will help to cheapen electrical goods later on. At present all lines are well stocked here.

German Competition in South Africa.—At the annual meeting of the Port Elizabeth Chamber of Commerce, the President said:—"Many of us have not handled German goods, but we must now seriously consider whether it is not futile to attempt to ignore the commercial activities of seventy millions of people. The Germans are at work again, and supply certain goods below American and British cost. The up-country man considers price, and if we decline to handle German goods it is useless to import British or American goods to sell at a loss."—*Reuter*.

LIGHTING AND POWER NOTES.

Belfast.—**PRICE INCREASE.**—At the monthly meeting of the Corporation on the 1st inst., a recommendation was put forward by the Electricity Committee, fixing the tariff for electric light and power at 30 per cent. above the existing rate, as from July 1st.

Bexley.—**INCREASED PRICE FOR BULK SUPPLY.**—The Urban District Council has asked the Fooks Cray Electricity Supply Co. to agree to accept for bulk supply of electricity, the amended terms of 2'305d. per kWh against 94d. now paid. The Council is advised that the company could obtain a bulk supply from the Woolwich Borough Council if the agreement with Bexley were revoked.

Birkenhead.—**BULK SUPPLY.**—An arrangement has been come to between the Electricity Committees of Birkenhead and Wallasey, subject to the approval of both Town Councils, for the supply of electricity in bulk by Wallasey to Birkenhead, with a minimum annual payment of £3,500. The Birkenhead Town Council, at its monthly meeting on July 6th, was asked to accept a tender for the laying of cables from the Marshall Street sub-station, Birkenhead, to the Wallasey generating station at a cost of £9,241.

Birmingham.—**EXTENSIONS.**—The Finance Committee has approved the application of the Electric Supply Committee for the sum of £395,000 to cover a part of the extension scheme spread over a period until 1925.

RESTRICTIONS RELAXED.—The Emergency Committee of the City Council had under consideration last week the question of the emergency restrictions in the light of the altered conditions (the return of miners to pits in the Midlands). The Committee came to the conclusion that a relaxation of the restrictions could be made so far as they affected the lighting and small power users, and recommended that these be immediately removed. When, at a later date, supplies of coal of good quality were forthcoming, the restrictions on tramway services and large power consumers would also be relaxed. This immediate relief for the electricity users is greatly appreciated, and the effect has been that many factories have resumed almost normal working.

Blackburn.—**YEAR'S WORKING.**—The total revenue of the Corporation electricity department for the year ended March 31st last was £110,165, as compared with £91,321 in the preceding year. Working expenses amounted to £91,919, as against £70,744, leaving a gross balance of £18,216 (£20,577). This balance was absorbed by capital charges, and the net result was a deficit of £2,321, comparing unfavourably with a net loss of £345 on the previous year's working.

Blackpool.—**SUSPENSION OF METER RENTS.**—The Corporation Electricity Committee has decided to suspend the operation of meter rentals for the June quarter, in consequence of the restrictions on supply.

Chatham.—**PRICE INCREASE.**—The Kent Electric Power Co. has increased the price of electricity for lighting by 1d. per unit, and for power and heating by 3d. per unit.

Chesterfield.—**LOANS.**—The Town Council has applied for loans of £1,000 for service cables, £1,000 for distributors, £2,000 for e.h.p. cables, and £750 for the covering-in of the river at the electricity works.

Continental.—**FRANCE.**—It was reported, last week, that the electricity works at Dieppe had been destroyed by fire, depriving the town of light and power. The damage is estimated at 2,000,000 fr.

DENMARK.—The Technical Commission appointed by the Home Ministry is exploring the possibility of utilizing sea currents for the production of electrical power. A systematic investigation has been instituted of the currents in the Little Belt, which are known to be strong at times but which have not yet been accurately measured, in order to determine whether they would yield sufficient constant power to render exploitation profitable.—*Reuter's Trade Service* (Copenhagen).

GERMANY.—The nationalisation of the electrical industry in Germany began, according to an article in the *Elektrotechnische Zeitschrift*, in December, 1919. The law of that year permitted the State by way of compensation, to appropriate every undertaking generating electricity exceeding 50,000 V or 5,000 kW. By this means the State became the owner of all the high pressure lines which were capable of being interlinked and worked by the State and the local companies. Among the new schemes complementary thereto, mention may be made of the canalisation of the River Neckar from Mannheim to Plochingen. Up to the present, funds have been lacking for this, although Dr. Bosch, of Stuttgart, offered to contribute 13,000,000 marks. In a distance of 200 km., the Neckar falls 16 metres between Plochingen and the Rhine; 34 sluices would suffice, with falls ranging from 2.6 to 8.5 metres, permitting the passage of ships of 1,200 tons burden. It is reckoned that 400,000,000 kWh could be generated yearly allowing for all losses. The details of the scheme for the linking of the Rhine with the Danube by a canal are complicated, and construction at certain points would be difficult. The canal would use the winding part of the Main River, and would pass through Würzburg, Nürnberg, Aschaffenburg, &c. This scheme would have a yearly output of between 700,000,000 and 1,000,000,000 kWh. There is also a scheme for the building of a canal on the Rhine

between Basle and Strasbourg. It is reckoned that 1,800,000 kWh could be obtained yearly from the falls below Basle, and 1,900,000,000 kWh from the falls above that city. In the North of Germany there is a question of linking the Weser with the Fulda, and it is proposed to replace the existing sluices by larger ones. It is believed that 70,000,000 kWh yearly could be obtained, which would be enough to cover the outlay. There is likewise the Oder River project (100,000,000 kWh), that of the Weser, and lastly, the Masurian Canal, which would furnish electricity to East Prussia (20,000,000 kWh).—*L'Electricien*.

Cookham.—**PROVISIONAL ORDER.**—Application has been made to the Electricity Commissioners by Lord Weston, Sir Geo. Young, Bart., and others, for authority to generate and distribute electricity for public and private purposes in the villages of Cookham and Cookham Dean.

Coventry.—**YEAR'S WORKING.**—The results of the working of the city electricity department for the year ended March 31st were as follows:—Total revenue, £226,145, as compared with £192,488 in the previous year; working expenses, £168,501, as against £134,748; gross profit, £57,614, as against £57,740; capital charges, £52,434 (£47,685); net profit, £5,209 (£10,055). The greater part of this profit is to be utilised for works expenditure and for new plant; only a balance of £31 is to be carried forward.

Electricity District.—**N.E. MIDLANDS.**—The *Yorkshire Post* says that the Sheffield Corporation has lodged with the Electricity Commissioners a comprehensive scheme for the constitution of an electricity authority for the North-East Midlands area. The new authority will be composed of 18 members—12 appointed by the Sheffield and Rotherham Councils, and one each for the Chesterfield and Doncaster Councils, the West Riding, Derbyshire, Notts, and Lindsey County Councils. It is proposed to link up the big Sheffield power stations at Neepsend and Blackburn Meadows with the Rotherham generating station, and later, as required, further links will be made between Mexborough, Doncaster, Chesterfield, Chapeltown, and the intermediate districts. The district includes the big collieries of South Yorkshire.

The additional plant required under the scheme is proposed to be provided as follows:—Blackburn Meadows, 30,000 kW; Rotherham, 30,000 kW; the new stations at Doncaster and Mexborough, 90,000 kW, increasing later to 120,000 kW. As the plant at the following stations becomes obsolete, it will be discarded, provided an alternative and cheaper supply is available; the East Street and Kelham Island stations of the Sheffield Corporation, and the existing stations at Chesterfield, Doncaster, Worksop, and Mexborough, and the Rotherham No. 1 station.

Ellesmere Port.—**TRANSFER OF ORDER.**—Having written to the Electricity Commissioners asking them the terms upon which they suggest that the Ellesmere Port Electric Lighting Order should be transferred to the Mersey Power Co., the Council has now received from the Commissioners a draft deed of transfer, which provides for the re-purchase of the undertaking by the Joint Electricity Authority on agreed terms in 1932-3, the date when the Runcorn and Widnes undertakings of the Mersey Power Co. are re-purchasable. The Commissioners added that in their opinion the best interests of the district would be served by the transfer of the order to the company. Some of the Commissioners had personally visited the Ellesmere Port district on the termination of the recent Liverpool Inquiry, and the district was one in which there were already established important industries, extensive in character, though few in number. The Council's consulting engineer agreed that the amount of electricity to be distributed in Ellesmere Port for public lighting or for domestic purposes would be small and insignificant compared with the amount required for industrial purposes, and the Commissioners pointed out that for the Council to establish a small and necessarily limited system of distribution for private and public lighting separate from the system which had been laid, and would have to be laid, for the supply to existing and future industrial works, would entail a duplication which would add unnecessarily to the capital expenditure, and would, therefore, increase the cost of electricity to the district. The clerk to the Council stated that the Commissioners had omitted the most important point from their reply—that was the matter of a bulk supply to the Council.

Folkestone.—**EXTENSION OF AREA OF SUPPLY.**—The Folkestone Electricity Supply Co., Ltd., is applying to the Electricity Commissioners for a special order authorising the extension of the area of supply to include the Urban District of Cheriton and the parishes of Saltwood, Newington, and Hawkinge.

Gloucester.—**PRICE ADJUSTMENT.**—The Town Council has decided to increase the price of electricity by one fortieth of a penny per unit for each shilling above 25s. per ton, which the Corporation has to pay for coal.

Heston and Isleworth.—**PROPOSED NEW STATION.**—The *Evening Standard* states that the District Council, in conjunction with the borough of Ealing, has decided to submit to the Electricity Commissioners a scheme for establishing a new power station for the combined districts near the Duke of Northumberland's residence on the banks of the Thames. The total area of the district is about 9,000 acres. The assessments are nearly £1,000,000. The present generating stations are very inconveniently placed, and sanction for the extension of these stations could not be obtained from the Commissioners.

Houghton-le-Spring.—**HOUSE LIGHTING.**—The Rural District Council has approached the Houghton-le-Spring District Electric Lighting Co. with regard to a supply to the new houses on various local sites. The company has expressed its willingness to supply electricity provided that the Council guarantees a fair return upon the capital expenditure which will be incurred.

Japan.—**NEW POWER COMPANIES.**—A scheme is under way to establish the Abukumagawa Hydro-Electric Co., and the Tokio Electric Transmission Co. The first will have a capital of 10,000,000, and develop 55,000 kW by harnessing the Abukuma River, Fukushimaken, while the other company will have a capital of 30,000,000 yen, and supply this power to Tokio.—*Reuters Trade Service* (Tokio).

Kington-on-Thames.—**YEAR'S WORKING.**—The accounts of the Corporation's electricity undertaking for the year ended March 31st last, show a total income of £43,254, as against £36,705 in the previous year. Working expenses totalled £31,199, as against £24,093, leaving a gross balance of £12,055 (£12,702). After the payment of capital charges, the net result was a profit of £697, a considerable decrease upon last year's profit of £2,256. The total number of kWh sold increased from 1,848,038 to 1,928,476.

Manchester.—**YEAR'S WORKING.**—The annual report upon the City electricity undertaking for the year ended March 31st, 1921, has recently been published. The total revenue from all sources amounted to £1,547,226, as against £1,197,199 in the preceding year. Working expenses totalled £1,115,239, as compared with £765,357. The gross surplus was, therefore, practically the same as in the year 1919-20, amounting to £431,987, as against £431,842. Capital charges were, however, heavier, reducing the net profit of the undertaking from £87,634 to £69,123. Of this balance, £37,230 was appropriated in aid of the city rates, while the remainder was transferred to reserve. The number of kWh sold rose from 182,419,070 to 199,618,813. The total expenditure on capital account during the year was £426,273, and additional borrowing powers to the extent of £1,750,277 were obtained. Of this last amount, £1,392,000 was in respect of the new Barton station and high-pressure mains. In the course of the year many contracts were placed for the supply of equipment for the Barton station, including e.h.p. and l.p. switchgear, transformers, steelwork circulating-water pumps, and water-screwing plant. One 2,000-kW motor-generator was placed in the Dickinson Street sub-station, and one 1,500-kW motor-converter. Orders were placed with Messrs. Bruce Peebles & Co., Ltd., for eight motor-converters for installation in distributing stations. Mains were extended by a length of over 13 miles, and contracts were allotted for the supply of 33,000-V cables in connection with the first section of the Barton station.

Preston.—**PROPOSED PURCHASE.**—The Corporation is applying to the Electricity Commissioners for authority to generate and supply electricity for public and private purposes, and to purchase the undertaking of the National Electric Supply Co., Ltd.

Sunderland.—**YEAR'S WORKING.**—The annual report of the Corporation electricity department for the past financial year shows a total revenue from all sources of £170,668, as compared with £137,240 in the previous year. The working expenditure was £121,913, as against £94,718, leaving a gross balance of £48,755 (£46,522). This balance was applied as follows:—Interest on capital, £13,504; income-tax, £1,778; repayment of loans £21,258; cost of boilers, &c., £1,940; battery vehicles, £4,295; and depreciation of stock, £465, the balance of £5,485 being carried forward to the present account. The total number of units sold was 21,150,197, an increase of 9 per cent. upon the previous year's sales. The cost per unit rose from 154d. to 179d.

The department has been able to maintain a good supply of electricity during the whole period of the coal trade dispute. Restrictions had to be imposed on consumers for a time, but for the last month of the strike a full supply was maintained. The main source of coal supply has been an old copperas bank near the river side a few miles away, and from this heap some thousands of tons of small coal have been obtained. The heap has lasted only just long enough for the purpose. The two largest of the 12 boilers have been kept going by means of oil-burning plant which was temporarily installed.

Taunton.—**EXTENSION OF SUPPLY APPROVED.**—The Rural District Council has given conditional consent to the application of the Town Council to supply electricity to the Parishes of Bishop's Lydeard, Norton Fitzwarren, and Staplegrave.

Walsall.—**YEAR'S WORKING.**—The report upon the Corporation electricity undertaking for the year ended March 31st, 1921, records a total income of £96,061, as against £78,351, in the previous year. Working expenses totalled £74,378, as compared with £71,860, leaving a gross balance of £21,683 (£40,391). Loan interest, debt redemption and other capital charges absorbed £20,069, making the net result a profit of £1,614, a considerable decrease on the figure for the previous year—£10,524. The total number of kWh sold rose from 7,419,255 to 8,397,868. While the cost per kWh sold, including capital charges, increased from 2'193. to 2'70d., the price obtained only rose from 2'53 to 2'74d.

Weybridge.—**PRICE INCREASE REFUSED.**—It is stated that the Electricity Commissioners have declined to sanction an increase in the maximum price of electricity from 10d. to 1s. per kWh at Walton-on-Thames and Weybridge.

Wolverhampton.—ELECTRICITY SCHEME RECOMMENDED.—The Electric Supply Committee has recommended the Council to accept the Electricity Commissioners' scheme for the re-organisation of the various Midland electrical undertakings. For some time the attitude of the Wolverhampton authority had been a little doubtful, and a decision to stand apart might have decisively influenced the fate of the scheme. The proposed reorganisation will embrace Wolverhampton, West Bromwich, Stoke-on-Trent, Ironbridge, Rugeley, and Cannock. This development is of considerable importance to industry in South Staffordshire and the Black Country.

TRAMWAY AND RAILWAY NOTES.

Birkenhead.—REVISED FARES.—The Tramways Committee has prepared a scheme for the revision of fares and stages to come into operation on August 1st. In some instances it is proposed to curtail the stages, whilst in others the fare for the whole route is to be increased.

Birmingham.—RAILLESS CARS.—The Tramways Committee recommends the institution of a railless car service on the Nechells route as an alternative to track reconstruction. Although 12 new cars, costing £3,000 each, will be required, the Committee considers that a considerable saving will be effected by the adoption of this system.

Blackburn.—YEAR'S WORKING.—The report upon the Corporation tramways for the year ended March 31st, 1921, records a total income of £137,758, as compared with £119,958. Working expenses amounted to £119,840, as against £91,911, leaving a gross trading balance of £17,918 (£28,047). After payment of capital charges, the net result was a profit of £751, compared with £213 of the preceding year. Receipts per car-mile increased from 22'5d. to 26'12d., and the number of passengers carried from 17,902,546 to 18,260,154.

Brighton.—SHORT-TERM LOAN.—In order to cover a deficit in the tramway accounts for the year ended March 31st last, stated to be due to exceptionally heavy track renewals charged against revenue, the Tramways Committee is seeking to raise money by means of a short-term loan. The Finance Committee does not look with favour upon this course as the deficit is properly chargeable against local rates.

Colne.—LOAN.—The Town Council is making application to the Ministry of Transport for sanction to borrow £6,600 for the purchase of new tramcars.

Continental.—AUSTRIA.—The *Economic Review*, quoting the *Nene Freie Presse*, says that the loss of almost all her coal mines at the end of the war turned Austria's eyes to the question of the development of her water-power. Failing foreign credit, Austrian capital has supplied the means to begin the electrification of the railways, and in some measure to make good the deficiencies of the coal supply. The yearly coal requirement of the State railways is about 3,000,000 tons, to produce an output of 116,000 h.p. Of the total 3,400 km. of railway, 650 km. on the Arlberg and Tanern lines will first be electrified, with a demand of about 25,000 h.p. or, if the Salzkammergut line be included, 40,000 h.p. that is, about a third of the output of the yearly coal consumption. The power stations on the Spuller Lake and the River Ruetz are nearing completion, and the unemployed are building the Malnitz and Stub River stations. At Arlberg, on the Innsbruck-Bregenz line, the installation of the lines is now in progress, electric locomotives, heavy and light, for passenger and goods traffic are in preparation, and special accumulator-trucks are to serve side-lines. All the important apparatus is the product of Austrian factories.

PORTUGAL.—The tramway strike, which has been in operation for more than a month, came to an end to-day.—*Reuter* (Lisbon, July 3rd).

Japan.—HIGH-SPEED ELECTRIC RAILWAY.—Application has been made to the Government for a charter to construct a high-speed electric railway between Tokio and Nikko, a distance of 80 miles. Under this scheme it is proposed to cover the distance in two hours.—*Reuter's Trade Service* (Tokio).

London.—UNDERGROUND FARES.—On June 30th Mr. A. Neal, Parliamentary Secretary to the Ministry of Transport, replying to Mr. Leonard Lyle, who asked whether, in view of the decrease in the cost of labour owing to the fall in the Board of Trade index number, the public might anticipate in the near future some reduction in the heavy fares on the underground railways of London, and called attention to the increase in the value of the shares of the company operating these railways, said:—"My right hon. friend has not overlooked the powers of review conferred upon him by Sub-Sec. 3 of Sec. 6 of the London Electric Railway Companies (Fares, &c.) Act, 1920, and at the termination of the present half-year the companies will be called upon to submit statements of the financial results of working for examination. It is upon these figures, and not upon fluctuations in the market price of shares, that any adjustment of charges must be based."—*The Times*.

THE LEYTON TRAMWAYS.—The municipal tramway undertaking of Leyton was to be transferred to the L.C.C. as from July 1st.

Manchester.—YEAR'S WORKING.—The working of the Corporation tramways during the year ended March 31st, 1921, brought in a total revenue of £1,813,401, as compared with £1,586,863 in the preceding year. The working expenses amounted to £1,507,566, as against £1,207,231 in 1919-20, leaving a gross surplus of £305,835 (£379,632). Adding interest on investments, &c., the total was £316,147 (£398,495). Capital charges absorbed £191,718 (£170,658), leaving a balance of £124,429 (£227,837). From this, £18,263 was deducted for income-tax, and the balance (£106,165) transferred to the renewals fund. The number of passengers carried decreased from 285,046,914 in 1919-20 to 277,738,710 in the year under review. The car-mileage also decreased from 18,906,654 to 18,711,007, in spite of an increase of over four miles of track. The total mileage (single track) owned or leased or over which the Corporation exercises running powers is now over 203 miles.

EXTENSION OF SERVICE.—Following upon the municipalisation of the Denton and Audenshaw tramways, the Manchester Corporation has secured running powers over 2½ miles of the route. The Corporation intends to run a service straight through to Hyde, a distance of seven miles, when the track has been relaid.

TELEGRAPH AND TELEPHONE NOTES.

Cable Delays.—Considerable improvement has recently been effected in the transmission times of telegrams between this country and South Africa, but, unfortunately, increased general delay has again to be apprehended owing to the interruption of the Eastern Telegraph Co.'s cable between Aden and Zanzibar at a position where, at this time of the year, the S.W. Monsoon blows with great strength. It is feared that, owing to the weather, the restoration cannot be expected for some considerable time.—*Reuter's Trade Service*.

Mr. Pike Pease, replying to questions in Parliament, said that as soon as cable repair work in the Red Sea was completed (probably within the next week) it was hoped that the present exceptional delays in cable service to the Far East would cease.

The Telephone Service.—COMMITTEE'S INQUIRY.—The Select Committee on Telephones, of which Mr. Evelyn Cecil is chairman, hopes to conclude the taking of evidence before the end of the session. It intends afterwards to send its expert assessor, Mr. W. W. Cook, to report on the telephone systems of the United States, Canada, Sweden, Norway, and Denmark. The Committee is of opinion that the inquiry cannot be complete without an independent report of this character from an expert not connected with the Post Office, says *The Times*. A formal interim report may be made at the end of the session, but it will be necessary for the Committee to be re-appointed next year. The drafting of the final report will be proceeded with in the autumn, and it will be presented, it is probable, not long after the re-assembly of Parliament.

LOWER RECEIPTS.—The Post Office has issued the following explanation of the decrease of 1 million sterling in the telephone receipts for the quarter ended June 30th, shown in the Revenue Returns published on July 1st:—"The falling off in the telephone receipts paid over to the Exchequer in the quarter just ended, is due merely to the fact that under the new tariff subscribers pay their rental and call fees quarterly, and to some extent in arrear, whereas under the old tariff the rental was paid annually in advance, and call fees periodically in advance. The total shortage of cash revenue in the year of transition due to this change-over is estimated at £2,600,000. The change of system was introduced for the convenience of the public, and has all along been part of the scheme of the new tariff."—*The Times*.

Post Office Board.—The Postmaster-General has appointed a Post Office Board, consisting of the heads of the most important branches of Post Office work. The members are:—Right Hon. F. G. Kellaway, M.P., Postmaster-General. Right Hon. H. Pike Pease, M.P., Assistant Postmaster-General. Sir Evelyn Murray, K.C.B., Secretary to the Post Office. Mr. E. Raven, O.B., Second Secretary to the Post Office. Sir Henry N. Bunbury, K.C.B., Comptroller and Accountant-General.

ASSISTANT SECRETARIES TO THE POST OFFICE.

Mr. W. G. Gates, C.B., Home Mails Branch.
Mr. F. J. Brown, C.B.E., Telegraph Branch.
Brig.-General F. H. Williamson, C.B.E., Foreign and Colonial Branch.
Mr. J. Y. Bell, Establishment Branch.
Mr. A. R. Kidner, Telephone Branch.
Mr. W. T. Leech, Staff Branch.
Mr. W. E. Parsons, Buildings and Supplies Branch.
Sir William Noble, Engineer-in-Chief.
Lieut.-Col. T. M. Banks, D.S.O., M.C., Secretary.

Wireless Telegraphy.—At the conference in London of the Prime Ministers of the Empire on July 5th, a committee was appointed, says the *Daily Mail*, to consider the practical means available at the present time for developing Imperial communications by land, sea, air, cable, and wireless telegraphy and telephony.

Post Office Advisory Council.—The Postmaster-General has appointed Lord Colwyn and Sir John Dewrance, K.B.E., to be vice-chairmen of the Post Office Advisory Council, says *The Times*.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the **ELECTRICAL REVIEW** in which the "Official Notice" appeared.)

OPEN.

Australia.—**MELBOURNE.**—August 24th. Victorian Railways. Motor-generator set, accessories and switchgear (for automatic telephone exchange, Contract No. 34,132).^{*}

August 31st. Victorian Railways. Accumulator cells and accessories, Contract No. 34,171; electric light equipment (axle generator system, Contract No. 34,172).^{*}

October 19th. Victorian Railways. Fresh tenders are invited for the supply of an electric furnace for the Newport workshops. —*Reuter's Trade Service* (Melbourne).

SHIRE OF HAMPSHIRE (VICTORIA).—August 17th. Boiler-house plant, steam-driven electricity generators, transformers, meters, switchgear, cables, poles. Specifications from Mr. H. C. Ingleton, Shire Hall, Camperdown, Victoria. —*Tenders.*

BRISBANE.—July 18th. Queensland Water Supply Department. 54,000 yd. h.d. copper cables, various diameters, for overhead transmission; 2,980 ft. lead-covered, armoured copper cables, various gauges, with accessories.^{*}

TASMANIA.—August 15th. P.M.G.'s Department. Switchboard material. (See this issue.)

Belgium.—August 9th. Provincial Government authorities at Mons. Either a gas engine or electric motor, together with a pump, to raise from 150 to 200 cubic metres of water per hour from the Strepye waterworks to the Houdeng reservoirs.

Brandon and Byshottles.—Electric light installation, houses for the Urban District Council. J. A. Robson, architect, Langley Moor.

Cardiff.—July 18th. Electric light wiring and fittings in concrete houses at Ely. City Electrical Engineer, Cardiff.

Edinburgh.—July 18th. Electricity Supply Department. Storage battery (Specification No. 35). (July 1st.)

France.—July 15th. The French Ministry of Posts and Telegraphs. Miscellaneous telegraph material, including 15,000 zincs for Calland batteries, 60,000 zinc rods for Leclanché batteries, 20,000 zincs for manganese batteries, 20,000 compound positives for Leclanché batteries and 15,000 compound positives for manganese cells. In the case of the first three lots, the successful tendering firm will be required to manufacture the new supplies from existing old material. Particulars from the Service de la Vérification du Matériel, 75, Boulevard Brune; tenders are to be sent to the Direction de l'Exploitation Télégraphique, 103, Rue de Grenelle, Paris.

Glasgow.—The District Committee of the Tower Ward of the County of Lanark. Electric lighting for 50 houses to be erected at Gartcosh. Mr. Jas. A. McCallum, District Clerk, 15, West George Street, Glasgow.

Holmfirth.—July 15th. Urban District Council Electricity Department. One 60-kW, 480-V d.c. generator, shunt-wound, with regulator and slide rails. (See this issue.)

Ilford.—July 11th. Electric light installation, Christchurch Road School, for the Electricity Committee. Mr. A. H. Shaw, electrical engineer, Ley Street.

Jugo-Slavia.—July 18th. Minister of Posts and Telegraphs. Telephone material.^{*}

London.—L.C.C. July 11th. Supplying and laying h.p. electric cables, &c. (June 24th.)

Metropolitan Asylums Board. July 20th. Alterations and repairs to the electric lighting, fire alarms and domestic bell installations at St. George's Home, Chelsea. (See this issue.)

Manchester.—July 12th. Tramways Committee. Steel tramway poles and silicon bronze trolley wire. Mr. J. M. McElroy, General Manager.

July 29th. Electricity Committee. Five 2,500-kW rotary converters, static transformers, switchgear, two 1-p. starting transformers, &c., or motor-converters, switchgear, &c., and one 1,500-kW rotary converter, static transformer, switchgear, 1-p. starting transformer, &c., or motor-converter, switchgear, &c. (See this issue.)

Mexborough.—July 23rd. Urban District Council. Electricity Department. E.h.p. switchgear; 1-p., d.c. switchboard. (July 1st.)

Newport.—July 25th. Electricity Department. 750-kW rotary converter, transformer and switchgear. (See this issue.)

Rhyl.—July 9th. Urban District Council. Electricity Department. 1,000 yd. 3' x 3' x 15 l.p. cable, one 5-way feeder pillar, switchboard panel and gear. (June 24th.)

South Africa.—**BARBERTON.**—July 29th. Municipal Council. Plant in connection with the proposed scheme for the supply of electricity:—Two steam boilers, two 75-kW steam-driven

alternators, switchboard, and instruments, steel chimney, piping, feed pumps, cables, &c., steel poles, conductors, &c., transformers, house service meters, &c. Specifications, &c. 2s., from Prof. W. Buchanan, 75, Louis Botha Avenue, Johannesburg.

Southampton.—July 9th. Electricity Department. Twelve months' supply of meters. (July 1st.)

Spain.—August 1st. Municipality of San Sebastian (Guipuzcoa). Supply and installation of the electrical material required for the new lighting system of the town. —*Reuter's Trade Service* (Madrid).

Uruguay.—**MONTE VIDEO.**—September 3rd. State Electricity Works. The Commercial Secretary to His Majesty's Legation at Monte Video reports by cable to the Department of Overseas Trade, that the local authorities are advertising for tenders for the supply of 59,250 metallic-filament lamps of assorted sizes, from 10 to 300 c.p., 225 volts, which are required by the State Power House.

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 85, Old Queen Street, S.W.1.

CLOSED.

Australia.—Sydney City Council has accepted a Victorian tender of £125,000 for turbo-alternators in connection with the installation of new plant, costing £500,000. —*Reuter's Trade Service* (Sydney).

MELBOURNE.—The Victorian Electricity Commissioners have accepted the tender of Messrs. Milliken Bros., London, of £72,868, for the construction of 643 galvanised steel towers for the transmission of power from Morwell to Melbourne. Messrs. Milliken's tender was £23,250 under the lowest tender for manufacture in Australia. —*Reuter's Trade Service* (Melbourne).

Belgium.—Six concerns submitted tenders, last week, to the Belgian Post and Telegraph authorities in Brussels for the supply of a quantity of cable heads, the lowest (15,430 francs) being that of P. Wilhelm, of Brussels. The offers varied considerably, one firm quoting up to 66,185 francs.

France.—The French Ministry of the Colonies in Paris has just placed a contract with the Société d'Electro-Metallurgie de Dives for the supply of 8 tons of high-conductivity copper wire at 5,530 francs per metric ton and 500 kilog. of bronze wire at 703 francs per 100 kilog.

London.—**ST. MARYLEBONE.**—Electricity Department. Recommended:—

House service meters for one year.—Chamberlain & Hookham, Ltd., and Ferranti, Ltd.
Steerwork required for the boiler-house and pump-room extension, £4,500.—Sanders & Forster, Ltd.

Mexborough.—Urban District Council. Accepted:—

One 750-kW rotary converter, with transformer, £4,405.—General Electric Co., Ltd.

Salford.—Tramways Committee. Accepted:—

Four tramcar controllers, £390.—English Electric Co., Ltd.

Electricity Committee. Accepted:—

L.p. cable, various sizes, in connection with the housing scheme at Lower Kersal and Weaste, £918 (approx.).—Fielded Edison Cable Works, Ltd.
Additional plant for the two new water-tube boilers, comprising steel chimneys and flues, induced-draught plant, coal bunkers and supplementary oil burners, £7,597.—Babcock & Wilcox, Ltd.

"Usco" ash-handling plant in connection with the two new water-tube boilers, £8,114.—Underfed Soker Co., Ltd.
Three cast-iron feed-water tanks, £26.—J. Wolstenholme & Son, Ltd.
Duplicate feed-water heater, £170.—J. & G. Weir, Ltd.

Warrington.—The Electricity and Tramways Committee has cancelled its contract with the Anglo-Belgian Improvements Corporation for tramway rails.

FORTHCOMING EVENTS.

Tramways and Light Railways Association. Friday, July 16th. At Caxton Hall, Caxton Street, Westminster, S.W. At 2 p.m. Annual Congress.

A New Turbo-electric Locomotive.—The new turbo-electric locomotive intended for use on railways, which has been patented by Mr. Ramsay, of Newcastle-on-Tyne, is creating keen interest in railway and engineering circles. The locomotive has been built at Messrs. Armstrong's works, and will shortly undergo its trials; the London and North-Western Railway Co. will carry out the experiments. Either oil or coal can be burnt in the ordinary boiler, which supplies steam to a turbine, the latter in turn driving an electrical generator. The turbine exhausts into an air-cooled condenser, and important economies are expected to be realised by the use of this new type of locomotive. Existing engine frames can be fitted with the new equipment with very little alteration. The first steam-electric locomotive was the Heilmann type, which was tried some 30 years ago.

UNEMPLOYMENT INSURANCE.

By JOS. J. H. STANSFIELD, F.C.I.S.

IN the issue of July 1st, it was stated that the weekly rates payable by employed persons and employers were to be increased as from July 4th, and the rates were given for comparison with those previously payable.

It was also stated that a Bill had been presented by Dr. Macnamara which would, if passed, increase these rates before the Act which was passed last March came into force, and that details would, in due course, be published.

These are now to hand, and from the comparison which is given below it will be noted how materially the rates have been increased.

From the Employed Person.
August, 1920. July, 1921. July, 1921 amended.

Men...	4d.	5d.	7d.
Women...	3d.	4d.	6d.
Boys under 18...	2d.	2½d.	3½d.
Girls " "...	1½d.	2d.	3d.

From the Employer.

Men...	4d.	6d.	8d.
Women...	3½d.	5d.	7d.
Boys under 18...	2d.	2½d.	4d.
Girls " "...	2d.	2d.	3½d.

Unfortunately the increased rates do not mean increased benefits, for unemployment benefit is to be reduced as follows:—

	£	s.	d.	£	s.	d.
Men...	From	1	0	to	15	0
Women...	From	0	16	to	12	0
Boys...	From	0	10	to	7	6
Girls...	From	0	8	to	6	0

NOTES.

Educational.—The Education Committee of the London County Council has prepared a schedule of revised fees for day and evening courses at the technical institutes, &c., maintained or aided by the Council. Generally, the minima proposed are not greatly in excess of the existing fees, and in some instances no alteration is suggested, but in one or two cases the recommended increase represents a considerable advance. Upon the whole, the fees for technical and apprenticeship courses are not augmented to a large extent. The effects of the adoption of the schedule are briefly summarised by the Finance Committee as follows:—Under existing conditions the percentage of fees to total expenditure in maintained technical institutes for the year 1921-22 would be 35; and for polytechnics, &c., 14.5. Under the schedule these percentages will be raised to 6.2 and 19.4 respectively.

The Education Committee also recommends a grant of £5,000 towards the cost of completing the south-west wing of the Engineering Department of University College. In connection with this, it is stated that £70,000 is required for building and initial equipment and £30,000 for maintaining and improving equipment. £33,000 has been subscribed in response to an appeal for funds, and Lord Cowdray has promised £10,000 as soon as the initial £70,000 has been raised.

STUDENTS FROM THE DOMINIONS.—On Monday the Government entertained the delegates to the Congress of the Universities of the Empire at luncheon at the Savoy Hotel. Mr. A. J. Balfour presided, and, referring to the increased appreciation of University training which had been manifested since the war, emphasised the value of exchange of students and teachers with the United States. Sir Robert Falconer (president of the University of Toronto) said that in the Dominions the same demand for higher education was experienced, and it was of the utmost importance that the British universities should become a centre to which the Dominion graduates would turn after they had completed their work overseas. For years to come they would be reluctant to go to German universities, and the old universities would benefit by the influx of the vigorous youth from the Dominions.

The Cost of Printing and Publishing.—In reply to a letter in *The Times*, signed by a number of officers of learned societies and librarians, and protesting against the high price of scientific and other serious books, Mr. Geoffrey S. Williams, president of the Publishers' Association, points out that publishers are dependent on the printing, binding, and paper-making trades, and cannot possibly issue books at lower prices until the charges made by these trades are materially reduced. The cost of printing, he states is now about 71 times what it was in 1914; paper (of an inferior quality) costs more than double; binding (also inferior) costs over three times as much, and the total cost of a large edition of a small book works out at 180 per cent above the 1914 figure. The maximum increase in the selling price, however, is 150 per cent. above the 1914 price, and it is generally much less. In the case of scientific books the cost of production has been trebled since 1914. The cost of materials has begun to fall, but wages, which are the dominant factor, remain at the highest point yet reached.

Appointments Vacant.—Teacher in electrical engineering, for the E at Ham Technical College; evening classes demonstrator in electrical engineering, for the City and Guilds Engineering College; telephone inspector (£250 + £115), for the Government of British Guiana. For particulars, see our advertisement pages to-day.

Fatality.—"Death from misadventure" was the verdict at an inquest held on June 30th, at New Tredegar, on a boy of 10 who, while attempting to reach a bird's nest, came into contact with a wire carrying current at 3,000 V, at the engine house of the Old Pit. A companion said the lad was in flames on the wire when he looked round. The colliery engineer, Mr. W. J. Jones, undertook to carry out certain precautionary measures with a view to preventing such accidents in the future.

Electric Cooking Tests.—A considerable advance in the efficiency of electric cooking is indicated by a report of tests carried out with "Lightning" ovens for various classes of cooking. The information has been supplied by Electrical Utilities, Ltd., from details gathered from various sources. Joints of meat ranging in weight from 2½ to 25.75 lb. were cooked; the energy consumption in the case of the former was 987 kWh, and the loss in cooking, 6.33 per cent. The wastage in the case of the largest joint was only 3.22 per cent., and the energy consumption 2.25 kWh. The results are naturally better for the larger joints, as an appreciable portion of the energy is absorbed in raising the temperature of the oven. It is possible to bake 18 lb. of bread at one time in the oven, and the energy consumption for this is about 1.5 kWh. For cooking cakes it is necessary first to heat the oven for 15 minutes, which takes about 5 kWh; the actual cooking only consumes .33 kWh.

A Russian Electrical Congress.—An important electrical congress has just been held in Moscow. At one of the sessions the chairman, Bashkoff, said that the position of the electrical industry in the country was a very difficult one, mostly because of the scarcity of skilled hands. He warned his hearers that the electrical industry had to confront a great problem, and that all their energies must be directed to its solution, taking account of all possibilities. There was relatively very little electrical material available, but still they must not be pessimistic. In the country there was yet a fair quantity of electrical equipment. What was wanted was its proper distribution amongst those who could use it. In this direction a great deal had already been done, but the organisation might be much better. It must be more systematic. Greater scope must be left to the local councils in the matter of electricity, and assistance should be given by the formation of local committees, the whole, however, being controlled by the Chief Department of Electrical Industry. In the discussion following the chairman's address, a number of delegates held that fixed prices must be made for goods, particularly for the smaller industries; the importance of local manufacture of electrical material was insisted on, and also that the central body should organise industries in various localities where hands should be instructed or encouraged to make themselves acquainted with the industry, so that they might be fit to be employed in the larger factories later.

Tall Stories from the Tropics.—Under this heading the *Evening Standard*, of July 2nd, printed the following startling item:—"Weird tales of the tropics were told by Captain R. H. Torrible, of the steamer *Denis*, which plies between New York and Manaus, a port about a thousand miles up the Amazon River. What is more, says the Central News New York correspondent, the captain declared that, strange as were the things he described, they were quite true.

"He told how on a river that empties into the Amazon, near Manaus, he saw myriads of electric eels so strongly charged with electricity that the bosom of the stream was flooded with light, and the crew were able to read their pocket Bibles by the glow, which was estimated at 40 watts per eel.

"When some of the eels were brought on deck, the captain added, the ship's dynamoes were short-circuited. When the vessel was tied up at the pier a boy fell into the river. The eels surged round him and when he was taken out of the water he was dead. A doctor who examined the body said the lad had been killed by an overcharge of electricity."

We knew there was a strong current in the Amazon, but evidently the eels make light of it.

Industry and Cheap Fuel.—An important statement has been submitted to the Prime Minister by the National Federation of Iron and Steel Manufacturers and the Iron and Steel Trades Confederation (representing the workers), with regard to the condition of the iron and steel industry, which occupies 1½ million workers. As the result of the coal strike, the industry is at a standstill, and destitution prevails in iron and steel producing districts throughout the country. European competition is severe owing to the low level of real wages in Germany, due partly to the fact that the German working classes are working up from the very low standard of living imposed by our blockade during the war, and are, therefore, for the present, relatively content with advances in wages which leave their real earnings still far below the pre-war level; and partly to the system of family and other bonuses, which enable the working man to meet his expenses at a minimum cost to the total wages bill. These considerations apply, though to a less extent, in France and Belgium.

It is the considered opinion of employers in the trade that, in view of foreign conditions, the industry will not be able to re-start unless fuel, as well as other items of cost, is reduced to a level not higher than from 75 to 100 per cent. above pre-war values.

A Municipal Vehicle Demonstration.—With regard to the note under the above heading on p. 821 of our issue of June 24th, it was stated in error that Messrs. Electricars had on view a 16-cwt. vehicle, whereas it actually had a 50-cwt. carrying capacity. The chassis was an improved type of the model originally produced by Messrs. Edison Accumulators, Ltd. It is known as the Model "E. A.," and has proved to be very satisfactory. The chassis frame is of the built-up type, the side members being constructed of two high-tensile steel flitch plates reinforced by well-seasoned American ash filler pieces. Solid-drawn steel tube cross members are used, and the rear wheels are each driven independently through totally-enclosed continuously-lubricated gearing from a series-wound motor, which is mounted outside the chassis frame, thus providing accessibility should the brush gear need adjustment. The controller box is also mounted outside the frame on the near side immediately behind the front mudguard; the battery compartments are situated under the driver's seat, and under the bonnet in front of the dash respectively.

The body, which is entirely constructed of sheet-steel, is tipped by an automatic electric tipping gear, which is put into action by a simple reversing switch. As soon as the switch is closed, a small electric motor raises the front end of the body by means of a square-threaded screw (through a suitable reduction gear), and a nut to which is anchored a series of toggle-jointed levers which have a scissor-like action. The process of tipping is effected within 30 seconds. All channel section bracing pieces are kept on the outside of the body, thus allowing the load a clean sweep when tipping.

At present this type of vehicle is manufactured in two sizes, which have carrying capacities of 50 and 70 cwt. respectively.

Railway Electrification.—In the Swedish daily paper, *Nya Dagens Allehanda*, for April 7th, Mr. C. Rossander, one of the leading consulting engineers of Stockholm, gave an interesting account of a five weeks' tour he had just carried out in Germany, France and Switzerland on behalf of the Swedish State Railway Electrification Committee.

It is proposed to carry out the electrification of all the main lines in Sweden, and it was almost decided to employ single-phase a.c., excellent results having already been obtained with that system on the section, Gellivare-Riksgränsen. But when the engineers were considering the next portion to be electrified, i.e., Stockholm-Gothenburg, the possibilities of danger to the telephone system, the lines of which follow the railway, were refused, and it was desired to consider the practicability of employing direct current. This was the main object of Mr. Rossander's tour, with the study of mercury rectifiers as a special inquiry.

Mr. Rossander visited the works of Messrs. Brown, Boveri at Baden and at Mannheim, rectifiers being constructed at both factories. He also inspected the apparatus under working conditions at Berne, and in the Cologne district. The plants in both cases had been in use for two years, were designed for 600 volts, and were employed for tramway work, with excellent results. The German A.E.G. and Siemens concerns were reported to have taken up the manufacture of mercury rectifiers seriously.

For the purpose of the Swedish State Railways a pressure of 600 volts was insufficient, in fact 3,000 volts would be desirable, but no mercury rectifiers have yet been constructed for such a high pressure.

Mr. Rossander ascertained that Messrs. Brown, Boveri had undertaken to supply a number of rectifiers for 1,500 volts pressure for an electrified railway in the South of France, under the severe condition that if they did not function entirely satisfactorily they would be rejected. The makers felt confidence in their ability to carry out the contract satisfactorily.

Mr. Rossander reports finding the question of railway electrification exciting wide interest abroad. In France the matter is mainly in the planning stage, although attempts at standardisation are being made, and systems previously employing alternating current have been converted to direct current at 1,500 volts.

In Switzerland electrification is in rapid progress, the single-phase system being used almost exclusively.

Mr. Rossander had an opportunity of inspecting the power station at Lyons, whence power is distributed to three power stations and two sub-stations, all coupled in series. Direct current at from 70,000 to 100,000 volts pressure is employed, and the whole system has been found exceedingly reliable. The French Company, Société Anonyme des Ateliers de Secheron, makes a speciality of this class of business, and is at present co-operating with Messrs. Brown, Boveri in working out a scheme for electrical power transmission from Norway to Denmark, which is thought to be practicable at 300,000 volts d.c.

Dyke's Automatic Electric Buoy Lamp.—Since the repair of the first submarine telegraph cable, the need of adequate means of illumination for mark buoys during night operation has been felt by all repairing ships. At the present time the original type of oil lamp, with a few improvements, is still in use, but is far from satisfactory; therefore, with these defects in mind, an automatic electric buoy lamp was produced, and was patented in America in August, 1919.

The following description of the lamp and its method of operation is abstracted from the *T. and T. Age*:—

The lower part of the lamp consists of a circular, watertight, galvanised sheet iron can.

The top closure plate contains an opening in its centre, around the upper edge of which is a small metal collar housing a circular dioptric lens. A second closure plate, having a similar metal collar on its under side, covers the top of the lens, rubber gaskets being used to make the junction of the lens and the closure plates watertight. The can contains a wooden carrier supporting eight dry cells and an eight-day clock, the gearing of which is so constructed that the arbor of the clock revolves once in 24 hours, and is provided with a timing disk, which is made of insulating material and is secured in position on the arbor by a wing nut. The face of the disk is divided into twenty-four hours, the numbering of the divisions being in two groups of twelve hours each. A portion of the periphery of the disk is slightly cut away and a segmental metal contact plate inset, the length of which depends on the number of hours the light is required to burn. A pair of contact fingers are mounted on a small insulating block on the frame of the clock at the side of the disk. The ends of the contact fingers rest firmly on the periphery of the disk, and the tips of the contact fingers and also the segmental contact piece in the disk are gold plated to prevent corrosion by the sea air and to give as perfect a contact as possible. The eight dry cells are connected in series-parallel to give from 5 to 6 volts, the lamps being 5.5-volt ones, taking .30 ampere each.

The method of operation is as follows: Assuming that an eight-hour disk is being used having the contact piece inset from 8 p.m. to 4 a.m., if the lamp is being placed on the buoy at 2 p.m., the wing nut holding the disk is loosened and the disk turned until the division marked 2 p.m. comes directly under the point of contact of the two fingers. The wing nut is then tightened, and the lamp assembled and made ready for use. The method of attaching the lamp to the buoy staff is immaterial so long as it is securely held in place. As the contact fingers now rest on the insulated portion of the disk periphery, there will be no circuit between the battery and the lamps, but as the disk revolves, the contact piece will come under the contact fingers at 8 p.m., and the lamp will then light and continue thus until 4 a.m., when the contact piece will pass from under the fingers, thus extinguishing the light. This cycle of operations will continue until the timing mechanism stops, which occurs generally on the tenth day. Experimental models of this lamp have been supplied to the Commercial Cable Co., the French Cable Co., and the Western Union Cable System, and have proved satisfactory in operation.

The Bastian Electric Co., Ltd.—The adjourned petition of W. F. N. May and Another for an order for the compulsory liquidation of this company was again before Mr. Justice P. O. Lawrence in the Companies' Winding-up Court on Tuesday. Negotiations for a settlement with the petitioners have been going on for some weeks, and it was now stated that no settlement had been reached yet. But a certain sum had been found, and that was the inducement to ask for another week's adjournment. This was granted.

INSTITUTION NOTES.

Institution of Electrical Engineers' Conversazione.—The following is a list of the principal guests present at the conversazione of the Institution, at the Natural History Museum, South Kensington, on Thursday last week:—

Sir William Barrett.
Sir Tom Callender, J.P.
Sir G. H. Collier.
Sir Robert Elliott Cooper.
Sir H. J. Creedy.
Sir Philip Dawson.
Sir G. K. B. Elphinstone.
Sir Arnold B. Gridley, K.B.E.
Sir S. F. Harmer.
Sir A. W. Watson.

Brigadier-General Sir W. T. F. Horwood.
Sir Herbert Jackson.
Rear-Admiral F. C. Learmouth.
Sir Gerard and Lady Muntz.
Sir Philip Nash.
Sir A. M. J. Ogilvie, K.B.E., C.B.
Vice-Admiral Sir Laurence Power.

Delegates of American Engineering Institutions:—

Mr. Ambrose Swasey.
Colonel A. S. Dwight.
Mr. Charles F. Rand.
Dr. Ira N. Hollis.
Mr. John R. Freeman.

Mr. Charles T. Main.
Mr. Robert A. Cummings.
Mr. Jesse M. Smith.
Dr. F. B. Jewett.
Mr. William Kelly.

Members of Council:—

Mr. W. A. Chamen.
Mr. H. W. Clothier.
Mr. J. R. Cowie.
Col. R. E. Crompton, C.B.
Mr. W. Cress.
Sir James Devonshire, K.B.E.
Dr. W. H. Eccles.
Mr. S. E. Fedden.
Dr. C. O. Garrard.
Mr. F. Gill, C.B.E.
Mr. J. S. Highfield.

Mr. P. V. Hunter, C.B.E.
Sir William Noble.
Mr. O. C. Paterson, O.B.E.
Dr. A. Russell.
Mr. W. M. Selvey.
Mr. Roger T. Smith.
Mr. C. P. Sparks, C.B.E.
Mr. A. A. C. Swinton.
Mr. O. H. Worthingham, C.B.E.
Mr. P. F. Rowell, Secretary.

The president, Mr. L. B. Atkinson, and Mrs. Atkinson, with the Council of the Institution, received the guests, who numbered in all about 1,500. An excellent programme of music was provided by the string band of the Royal Engineers, under Lieut. Neville Flux, F.R.A.M., and a concert in three sections was given by Miss Phyllis Carey-Foster and Miss May Peters, with the Allied String Quartet. At 10 o'clock the gathering was called to attention by the notes of a bugle, and the President introduced Mr. Ambrose Swasey, chairman of the deputation of American engineers in this country, referring to his great achievements in connection with the construction of the largest telescopes in the world, as well as Dr. F. B. Jewett, Vice-President of the American Institute of Electrical Engineers, and chairman of the electrical branch of the delegation, who recently gave a lecture on research before the Institution, and is at the head of the largest research organisation in the world. Mr. Swasey expressed his admiration at the manner in which the British nation had come through the war, and still maintained its upright and resolute attitude in the face of the many difficulties with which it had to contend; he expressed the firm solidarity between the United States and the British Empire, and advocated the utmost possible co-operation between the two nations, in the best interests of the whole world. Dr. Jewett, after heartily endorsing these sentiments, read a letter from Mr. A. W. Berresford, President of the American I.E.E., to the same effect, the message being greeted with enthusiastic applause.

The offer of Mr. E. M. Hughman, of Bombay, to give a donation of £250 to the Benevolent Fund of the Institution of Electrical Engineers, on condition that 19 similar amounts were contributed by June 30th, has been extended by him to December 31st, 1921.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

MR. H. L. KIRBY JOHNSON has commenced business at 68, Gordon Street, Glasgow, and has been appointed representative for Scotland for Messrs. Drake & Gorham Wholesale, Ltd., of London. For the last eight years Mr. Johnson has been supply department branch manager for Scotland with the Metropolitan-Vickers Electrical Co. Ltd., Trafford Park, and on severing his connection with this company, he was the recipient of a silver cigarette and cigar box from his colleagues in Glasgow and Manchester.

Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., have secured the services of Mr. R. P. Tod, M.I.Mech.E., M.I.Met., in connection with their hydro-electric work. Mr. Tod has been at the British Aluminium Co.'s Works, at Kinlochleven, since 1907, and readers who have visited these works will know him as having been originally in charge there of the erection of the pipe lines and turbines of 30,000 h.p. Until recently Mr. Tod has been manager-in-chief over the whole of the British Aluminium Co.'s undertaking at Kinlochleven.

COL. and MRS. CROMPTON recently celebrated their golden wedding, and several of Col. Crompton's old pupils (through the instrumentality of Mr. Llewellyn Foster) took the opportunity to present them with a small token of their esteem, affection and goodwill. This gift, which has been suitably acknowledged by Mrs. Crompton, was accompanied by an album containing the signatures of those who contributed.

After considering 190 applications for the position, the Wallace Electricity Committee is recommending the appointment of Mr. B. T. HAWKINS, electrical engineer to the St. Helens Corporation, as electrical engineer and manager of the Wallace undertaking, in succession to Mr. J. A. Crowther who resigned. The salary recommended is £1,000 per annum, or £900 if the electrical engineer is allowed to take two trained pupils.

Darwen Town Council has been recommended to increase the salary of Mr. PERCY TAYLOR, assistant electrical engineer, from £250 per annum to the basic salary of £427, rising by three instalments to £471, with the usual bonus from November 20th last, in accordance with the schedule of salaries of the National Joint Board.

MR. JOHN McDONALD, late of the Telegraph Department, Post Office, Aberdeen, who left this country a few months ago to take up a post under the Colonial Government, has been appointed traffic manager for the telegraph system of East Africa and Uganda, with headquarters at Nairobi.

MR. B. A. WATSON WATT, Brechin, has been appointed superintendent of the Radio Research Board Wireless Station, Aldershot. The Wigan Corporation has appointed Mr. W. M. MILNES, of Coventry, tramway manager, at £700 a year.

MR. W. S. ASKHAM (of 17, Regent Park Terrace, Hyde Park, Leeds) announces that he has severed his connection as North Country representative with Messrs. J. H. Tucker & Co., Ltd., after 17 years' service, and has joined Messrs. J. A. Crabtree & Co., Ltd., of Walsall.

We understand that Mr. CHARLES L. TOMLINSON, late sales manager for primary and secondary batteries to the Edison and Swan Co., Ltd., has recently vacated an engagement he had taken up with the Hart Accumulator Co., Ltd.

MR. W. N. Y. KING, A.C.G.I., A.M.I.E.E., until recently associated with the Austin Motor Co., Ltd., has entered into

partnership with Mr. BRAZIER, under the style of Brazier & King, engineers, of 14, New Street, Birmingham; the firm will deal with electric power and lighting installations, factory equipment, steam plant, &c.

MR. H. C. LONES, of the Shropshire, Worcestershire, and Staffordshire Electric Power Co., whose marriage to Miss Nellie L. Tregg, took place last week, has been presented by the staff with a clock.

MR. GEORGE HALLY, of Birmingham, has been appointed chief works manager of the engineering side of the Edison Swan Electric Co., Ltd., Ponder's End. We understand that Mr. Hally has had a wide experience with some of the leading firms of engineers in this country and abroad.

WILL.—MR. R. J. WEST, a director of the New General Traction Co. and the Norwich Electric Tramways Co., left £50,705.

NEW COMPANIES REGISTERED.

Alliance Wholesale Electrical, Ltd. (175,447).—Private company. Registered June 24th. Capital, £30,000 in £1 shares. To carry on the business of wholesale suppliers and manufacturers of and dealers in all machinery and apparatus used in connection with the generation, distribution, supply, accumulation, and employment of electricity, &c. The first directors are: W. F. White, 98, Hamlet Gardens, Ravenscourt Park, W.6; H. J. Grant, 89, Carlton Mansions, Maida Vale, W.9; Elizabeth McArthur, 11, Dorset Road, Merton Park, S.W.19. Secretary: E. McArthur. Solicitor: W. P. Scott, 150-151, Fenchurch Street, E.C.

The Hugh Stanley Co., Ltd.—Private company. Registered in Dublin June 27th. Capital, £1250 in £1 shares. To carry on the business of mechanical and electrical engineers, &c. The first directors are: D. Harrison, 76, South Circular Road, Dublin; A. R. Eliassoff, 75, South Circular Road, Dublin; H. Stanley, 17, Angelsea Street, Dublin. Registered office: 44, Temple Bar, Dublin.

Alexander Marshall & Co., Ltd. (11,772).—Registered in Edinburgh June 24th. Private company. Capital, £30,000 in £1 shares (15,000 preference). To acquire the business of a boiler and accessories maker carried on by A. Marshall, and to carry on the business of ironfounders, engineers, tube manufacturers, &c. The subscribers (each with one share) are: A. Marshall, Murrayfield, Motherwell, boiler maker; A. Marshall, junior, Murrayfield, Motherwell, boiler maker; J. Marshall, Murrayfield, Motherwell, boiler maker; J. Piteathly, Glenparag, Hamilton, engineer; W. A. Campbell, Murrayfield, Motherwell, clerk; A. B. White, 1, Holyrood Crescent, Glasgow, boiler maker. The first directors are: A. Marshall, A. Marshall, junior, J. Marshall, J. Piteathly, W. A. Campbell, and A. B. White. Qualification: 500 shares. Registered office: Coursington Road, Motherwell.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Frederick R. Butt & Co., Ltd.—Satisfaction to the extent of £24,000 on October 18th of debentures dated March 23rd, 1920, securing £10,000 (notified June 24th, 1921).

Rawlings Bros., Ltd.—Satisfaction to the extent of £7,200 (balance) on March 31st, 1921, of charge dated December 4th, 1918, securing £8,750.

Lyell, Ltd.—Issue on June 17th, 1921, of £500 debentures, part of a series already registered.

Western Electric Co., Ltd. (106,921).—Return dated June 6th, 1921. Capital, £400,000 in £5 shares, 99,995 shares taken up, £155,975 paid, £344,000 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Great Northern Telegraph Co., Ltd., of Denmark.

In their report for 1920, to be submitted at the meeting at Copenhagen on July 16th, the directors say that the whole of the year passed without the minefields having been swept at the places where one Franco-Danish and one Anglo-Danish cable, as well as the cable between Petrograd and Libau, were broken, and repairs had consequently been impossible. There was, however, some prospect of the two first-mentioned cables being put in working order before long. Eight of the company's other European cables had been subject to 16 interruptions, whilst 19 interruptions had occurred in six of the Far East cables. The Wladivostok and Kiachta routes are still closed so far as the transmission of traffic between Europe and the Far East is concerned, but the company's offices at Wladivostok and Kiachta, as well as at Irkutsk, have throughout the year been worked by Danish staff who have transmitted the Siberian correspondence to and from Japan and China and beyond via the Wladivostok-Nagasaki cables and the Irkutsk-Kiachta-Peking line respectively. The general conditions in Siberia are as yet not quite settled; at times it has proved difficult to furnish cash for the staffs at Irkutsk and Kiachta. At the beginning of 1921 the Kiachta-Peking line became interrupted

in Northern Mongolia, where Russo-Mongolian forces dislodged the Chinese troops and captured the town of Urga. It is impossible to predict when telegraphic connections between Kiachta and Peking may be re-established. The traffic over the company's cables both in Europe and the Far East has been satisfactory. The economic and industrial crisis, however, caused a decrease in the traffic carried over the company's European cables during the latter half of the year, and this decrease has continued during the early part of the current year. Compared with the corresponding period of 1920 the decrease is estimated at approximately 30 per cent. In the Far East the traffic carried during 1920 shows, on the other hand, an increase compared with that of 1919, but the reaction has set in also there, and the enormous traffic dealt with during the war and the period immediately after is gradually attaining more normal proportions. The negotiations with Poland have been continued. The object has been the laying of a cable between Denmark and a point on the Polish coast near Dantzig, and the working of the cable by the company's staff at Warsaw by means of an aerial wire to the landing place. It is very doubtful whether the negotiations will be brought to a successful issue, because the terms for laying and working the proposed cable, which the Polish Government has hitherto thought it possible to offer, are unacceptable to the company. The company had to close down in European Russia in April, 1918, when the company's routes became interrupted owing to the state of war between Russia and her western neighbours. It is important for both parties that the company should recommence its operations in Russia. The negotiations are being continued, and the board hopes that before long an arrangement will be arrived at which will make it possible for the company to reopen its station at Petrograd—where all the instruments are intact—as well as to take its proper share in the transmission of the traffic between Europe and the Far East via the Russian landlines to Irkutsk and Wladivostok. Last year the directors expressed the opinion that the financial results of the year 1920 would not be as favourable as those of the year 1919. This forecast has proved wrong, the reason being the depreciation of the value of the Danish crown taken in relation to sterling, Mexican dollars, and yen, the currencies in which the principal income of the company is received. Whilst the company's receipts from the traffic between Europe and the Far East have decreased considerably owing to the continued interruption of the Siberian line, the satisfactory development of the telegraphic correspondence in 1920 taken as a whole has, to a certain extent, acted as a set-off. There appears no prospect of such compensation in the current year, and from the general nature and scope of the company's operations it is clear that it must feel the full effect of the world-wide stagnation of commerce, industry, and shipping. The proposed increase of the international telegraph rates, by which also the company should benefit, has been postponed *sine die*, and no important reduction in the enormous expenses under the heading "salaries, &c.," may be expected to take place until a general decrease in the cost of living has set in; therefore the immediate future is not very promising. It is proposed to distribute a total dividend and bonus of 24 per cent., or 2 per cent. more than for each of the previous three years, £285,892, or £144,285 more than last year, is carried forward.

J. G. White & Co., Ltd.

The directors in their report for the year ended February 28th, 1921, say that during a considerable portion of the period the company was faced with difficult and anxious conditions. The result of working was a net profit of £4,207, which, with £15,286 brought forward, shows a credit in the profit and loss account of £19,493. In January last an interim dividend was paid on the 7 per cent. preference shares, absorbing £6,300, but in view of the general conditions obtaining to-day the board has come to the conclusion that the final dividend on the preference shares should not be paid at present, and recommends that the balance of £13,193 be carried forward. The nominal capital was increased to £500,000, and £150,000 of the reserve fund was capitalised in the form of ordinary shares, the issued amount of which now stands at £200,000. The conditions during most of the period under review were adverse to the contracting and construction business, but construction contracts on satisfactory terms, the results of which do not, however, affect the past year's trading accounts, have recently been entered into. J. G. White Commercial Co., Ltd., whose share capital is held by this company, has had to meet a period of almost complete stagnation in the South American trade, where confidence was severely tried by the effect of the break in prices on a market over-stocked with commodities. Since the autumn of last year there has been a continuous decline in market prices which has resulted in considerable losses to the Commercial Co. The precise extent of the loss cannot be gauged at the moment, but the position should be cleared by the end of the year and a sounder condition of things re-established.

The annual general meeting was held in Lisbon Electric Tramways, Ltd. London on June 29th, Mr. Ludwig Breitmeyer (chairman) presiding. The chairman said that the report covered two years—1919 and 1920, the collapse of the exchange in 1920 rendered this necessary. The company had sustained severe loss by the restrictions placed by the Portuguese Government upon remittances from the country, and also from the high price

of coal which had reached 42s. per ton. Increased fares had been sanctioned, but these were insufficient to balance the rising costs. At present the lowest fare was equivalent to 1d. About a per cent. of the traffic receipts had been paid to the Government, in addition to a tax upon tickets. The net result of working during the two years was a loss of £45,500. No provision had been made for depreciation since 1917, these arrears would have to be made good as soon as circumstances permitted. Every endeavour was being made to procure further tariff increases and to cut down expenditure to the lowest economic limit.

Mexican Light & Power Co., Ltd.

A meeting of the holders of the company's 5 per cent. first mortgage gold bonds was held on June 29th, Mr. Harold G. Brown, representing the trustee (National Trust Co., Ltd.), presiding. Mr. E. R. Peacock (chairman of the Bondholders' Committee) dealt with the position of the undertakings under the régime of Presidents Diaz, Carranza, and Obregon, and stated that of late the position had been difficult owing to acute labour disturbances. He said that no arrears of interest were being paid at present, but it was hoped that the works in hand would result in ability to pay off the arrears on the first mortgage bonds. There was a prospect of several years' waiting before interest on the second mortgage bonds was available. A claim for damages amounting to 19,000,000 pesos had been lodged with the Government, and there was a reasonable prospect of this being paid. The working of the hydro-electric plants had been prejudiced by the scarcity of rain during last autumn, and the irregularity of the supply of fuel oil had also handicapped the steam reserves. Money for reconstruction purposes was not available; their efforts to secure payment of 7,000,000 pesos owing by the Government and the Mexico City authorities had been unsuccessful. Mr. Peacock was hopeful that in the future the position of the companies would steadily improve, although Mexico had many financial, social, and political difficulties to overcome.

Edmundson's Electricity Corporation, Ltd.

The annual meeting was held on June 30th, at Winchester House, E.C., Mr. P. D. Tuckett presiding. The chairman congratulated the shareholders on the improved accounts, which enabled them to recommend the resumed payment of the cumulative preference dividend. In most cases their prices still lagged some way behind their costs, but they eventually succeeded in securing substantial increases in their authorised maximum rates, the relief so obtained, combined with the removal of the lighting restrictions and an increased power demand, enabling them to realise the better results shown, despite a further enormous increase in their wages and fuel bills. Apart from the Lancashire Power Co., their wages bill increased by over £40,000, and their fuel bill by over £64,000, yet the various undertakings managed to increase their gross profits by nearly £100,000. Of that increase about £17,000 appears in their profit and loss account, the balance having gone to outside shareholders or been applied in increasing the reserves set aside and the amounts carried forward by the sub-companies. The gross trading profit was increased by £1,800. In the earlier part of last year the contracting business was very active and the trading conditions were exceptionally favourable, whereas they had recently become the very reverse, so that for the current year they were likely to see a substantial drop in that item. With the balance of £10,090 brought forward there was a total available profit of £26,143, £12,000 of which they proposed to apply in the payment of one year's dividend on the cumulative preference shares, carrying forward £14,143. That still left the cumulative preference dividend one year in arrear, but under the present uncertain conditions, and in view of the necessity of making provision for the repayment of the three-year notes, they felt it would be imprudent to commit themselves prematurely to the wiping out of these arrears. So far as it was possible to forecast the future in these anxious and difficult times, they confidently believed that they had definitely turned the corner, but, until they enjoyed a return to more normal conditions and secured the regulation of their selling prices on a more permanent and rational basis, they could not be sure of the steadily improving results to which they looked forward. Proceeding to refer to the conditions governing their authorised rates of charge, which were still far from satisfactory, he said that most of their maximum rates had been granted, and with very few exceptions any further adjustment of them could only be made under the powers of the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, which restricted profits to an amount sufficient to yield three-quarters of the average pre-war ordinary dividend. A more stupidly unfair and utterly uncommercial restriction to impose on a progressive industry it was difficult to imagine, and he entirely failed to understand how it was supposed that any healthy progress could be made under such conditions. It condemned them to a smaller return than they were earning before the war, despite the fact that their connected load had increased by over 80 per cent. in the intervening seven years, and that plant which was then only partially loaded was now in many cases overloaded. Under such circumstances what inducement could there be to extend the business by the expenditure of further capital, even if the cost of capital were not now nearly

twice what it was? The increased rates, which they had been granted, materially eased the position with which they were confronted last year, but under existing conditions of cost they were still in most cases quite inadequate to afford a reasonable return on capital. Small undertakings had been far more seriously affected than the larger ones by the conditions which the war had brought about. Speaking generally, they were called upon to bear increased costs relatively twice as great as those which the larger undertakings were carrying. Before the war 8d. per unit was the general authorised maximum rate for large and small undertakings alike, irrespective of the character of their areas of supply. That afforded the smaller undertakings a sufficient margin over the lighting rates which they actually required to charge, whilst it gave the larger undertakings a more than ample margin over theirs. As it was, the smaller undertakings had no longer any margin, and consequently their maximum rates had practically become their standard lighting rates, in order that they might recover from the more remunerative consumers the losses they were obliged to incur in supplying the less remunerative. It was a miserably unsatisfactory state of things that they should be forced to conduct a commercial business in such a way, with no freedom to vary prices in accordance with the varying conditions. His own feeling was that the whole system of control by maximum rates was wrong. Either they were high enough to be inoperative, as before the war, or by their inadequacy, as at present, they ran counter to every economic law and so destroyed the very basis on which the development of the business depended. Last year they promoted a Bill, under which they sought power to establish a sliding scale of prices and dividends. He thought it was a great pity that it failed to receive more sympathetic consideration from Parliament, for he could not help believing that the principle which it embodied, securing a reasonable latitude in the matter of prices, would be in the best interests of the consumer no less than in their own, and would prove entirely practical and fair. However, they had to deal with the situation as it existed, and they would naturally wish to know what hope there was of getting the paralysing conditions, to which he had referred, removed. First there was the possibility, and he hoped the probability, of costs falling, and this would, of course, afford far the most satisfactory means of enabling prices to overtake costs, but even so, they would still require the removal of the statutory restriction now imposed on their earning powers. Provision was made for that in the Electricity (Supply) Bill now before Parliament, but, as other clauses of the Bill dealing with the setting up of Joint Electricity Authorities were likely to meet with strenuous opposition, he feared the Government might sacrifice their needs to the exigencies of the political situation, and fail to secure for the Ministry of Transport the enlarged powers with regard to prices which it was so vital for them to possess. The position in which the smaller companies were at present placed was, however, so manifestly and flagrantly unfair, besides being so detrimental to the interests of the districts they served, that it was impossible to believe that it could be allowed to continue indefinitely. It had already been remedied in the case of the gas and other public service undertakings, and he felt sure that the Electricity Commissioners would endeavour to get it remedied in their case also with as little delay as possible. The gross profit increase of nearly £100,000 on the various undertakings was gratifying in so far as it went, but it was also a measure of the crippling loss which they were most undeservedly called upon to suffer as the result of their unrelieved distress, or at any rate of the utterly inadequate and belated relief which they received, during the two previous years, for, even now, despite their largely increased load, they were not as well off as before the war. Omitting the Lancashire Power Co., the connections showed an increase of 8,358 kW. compared with 7,356 kW. the previous year, and capital expenditure an increase of £125,176, as compared with £149,476. For the current year, and in future, until they were once more allowed to conduct the business on a commercial basis, both these figures would show large reductions.

**India-Rubber,
Gutta Percha &
Telegraph Works
Co., Ltd.**

The directors have communicated with the shareholders as follows, under date June 29th: "As the circular letter of 28th ult. appears to have given rise to some misunderstanding, the directors desire to make the matter clear by a brief statement of facts which have occurred since the last general meeting, and which again render it impossible for them to recommend the payment of any dividend on the ordinary shares for the same reason given at the annual general meeting, viz., the shortage of cash. In the chairman's speech at the last general meeting the cause of the then cash shortage was explained in detail, and the belief expressed that the cash position would be greatly improved within the next six months. But such, unfortunately, has not been the case, owing in a great measure to the extraordinary slump in trade generally and the tire section in particular. This condition of trade left us with stocks difficult to move, and financial commitments which had to be met, with the result that the cash position has not improved. We have realised a considerable amount of our colonial stocks, but our home market has not been able to consume enough of our Persian manufactured articles to greatly influence the return to England, by means of the sale of these goods, of the capital which had been deflected to France during the war.

Labour unrest generally, culminating in the present coal strike, has caused throughout the country an extraordinary dislocation of industry of far-reaching effect, difficult to measure and not easy to cope with. Under the existing conditions of disorganised trade, it is difficult to forecast the future, but a clear line of action is indicated along which the company must work, and that is to produce and sell goods at a price within the consumer's reach, and to readjust the present inflated wages to such a figure as will enable us to do so on a profitable basis. Your directors are pleased to inform you that our workpeople at Silvertown are looking wisely at the economic position as it affects them, and we have already been able to make an arrangement with them which has brought about a preliminary reduction in wages. In the near future we expect to meet considerable competition from those countries where the rate of exchange and cost of living make cheap production possible. Nevertheless, your directors have a feeling of confidence that the company will be able to steer through the troublous times ahead—aided by new methods and by economical and efficient labour and administration. With all hands pulling together in the true interests of the company, as is their duty, we may perhaps be able to look back at the coal strike as a blessing in disguise, however hard the country may have been hit by this action of gross economic folly."

**West India
and Panama
Telegraph
Co., Ltd.**

At the meeting held on June 29th, Sir A. F. King, who presided, said that in the report of a year ago they said that 1919 had been the most disastrous year in the history of the company. They then hoped, and thought, that the company had touched bottom; but they were wrong, for in the year now under review the company sank even lower. They had, after several previous forecasts, been led to expect that the company's cable steamer would be released from the Trinidad Dock by the end of June last, that was after 17 months' detention; she came out only in October, more than 20 months after she was handed over; and the cost of her survey and repairs, which had originally been estimated at about £10,000, came to as much as £74,252, nearly three and a half times the reserve of £21,589 which had been accumulated to meet her depreciation. But this heavy bill was only one of the unfortunate results of the long detention of the cable ship at Trinidad. In normal times with the ship available to effect quick repairs of interrupted cables, the company would have had funds in hand from traffic and other receipts with which to meet at any rate a considerable part of the excess of £53,000 over the ship's accumulated reserve; but, in the absence of the *Henry Holmes*, they found it impossible to get the cables repaired quickly, and naturally the traffic receipts fell off, so much so that they were in 1920 more than £30,000 less than in 1919. Consequently, to find the money for discharging their debt to the Trinidad Dock, for paying for the hire of cable ships, for buying new cable and for meeting increased expenses generally, they had been obliged to sell most of the company's investments—at a loss, owing to the state of the money market, of £30,555. They had also taken an opportunity which offered of issuing during this current year one hundred more debentures of £100 each. This third survey of the cable ship had in all cost the company: £74,252 payments to the Trinidad Dock and purchase of materials, £38,000 for hire of cable ships over and above what the cost would have been if the *Henry Holmes* had done the work, £31,370 reduced traffic receipts, £30,555 loss on sale of investments, £12,450 forfeited subsidies, totalling £186,627, of which about £137,134 was proper to the year 1920. The speaker went on to refer to the various items in the accounts. We published the directors' report in our last issue. In conclusion, the chairman said that they were told that it was the intention of one of the large American cable companies to lay a cable from Porto Rico to Cuba, whence they already had cables to New York. This cable, when it began working, could not fail to be a serious rival to the company, and it must have considerable effect on their revenue in Porto Rico.

**French
Companies.**

The Société du Matériel Isolant, of Lyons, reports that its factory for the manufacture of "clematite" is fully equipped for meeting requirements in insulating materials, and that the net profits of 302,000 fr. in 1920 permit of the payment of a dividend of 60 fr. net per share.

The Compagnie Générale de Constructions de Locomotives (Batignolles-Chatillon) reports net profits of 303,000 fr. for 1920, which amount has been carried forward. Apart from steam locomotives, the directors state that foreseeing that the projected electrification of the railways would be capable of providing work for the shops, they had entered into an agreement with the *Société de Construction des Batignolles* and the *Société Oerlikon* for the construction of electric locomotives.

The report of the *Société Anonyme des Etablissements Industriels de E.C. Grammont et de Alexandre Grammont*, which was submitted at the special meeting held on June 18th, stated that thanks to the development of new manufactures it had been possible for the company advantageously to guard against the general industrial crisis, and that despite a strike in March and April, 1920, the value of the turnover in 1920-21 was greater than in the preceding year. The participations had been extended in various associated undertakings, and the company in connection with its subsidiaries

had formed an export department which had already negotiated foreign transactions, which required large capital resources, owing to the long periods of transport and of credit. In order to deal with the considerable orders expected, particularly from public authorities, for the construction of long-distance telephone cables, it was necessary to have a basis as large and sound as possible from the financial point of view, especially in order to place the company on a level with its most direct competitors. Having regard to these circumstances the directors proposed and the shareholders sanctioned an increase in the share capital from 30,000,000 to 50,000,000 fr.

The *Société des Ateliers de Constructions Electriques du Nord et de l'Est* (Jeumont), at the general meeting held on June 18th, reported that all the manufacturing shops could now be considered as having been practically reconstructed, the equipment had been improved and augmented, and the productive capacity was substantially greater than in 1913. So far the company had not suffered from the industrial crisis, although the volume of new business being booked was diminishing in the case of electrical plant of low capacity, while the orders for large machines would ensure activity for a long time forward. As net profits the accounts for 1920 show a total of 4,619,000 fr., permitting of the payment of a net dividend of 25.25 fr. per registered share, 18.70 fr. per bearer share, 13.50 fr. per partly-paid share, and 38.80 fr. per profit share. At the conclusion of the ordinary proceedings a special meeting was held, when it was decided to amalgamate the company with the *Forges et Ateliers de la Longueville* under the title of the *Forges et Ateliers de Constructions Electriques de Jeumont*, with a share capital of 80,000,000 fr.

German Companies.

The *Land und See-Kabel Werke A.G.*, of Cologne-Nippes, which has a paid ordinary share capital of 7,500,000 marks, reports that the works was satisfactorily employed in 1920, and orders have also been favourable in the new financial year. The net profits amounted to 2,700,000 marks, as against 1,040,000 marks in 1919, and the dividend is increased from 15 per cent. in the latter year to 20 per cent. for 1920.

The *A.E.G.-Schnellbahn, A.G.*, of Berlin, the construction of whose high-speed railway is being delayed owing to the cost of construction and disputes with the municipal authorities, has ceased paying interest on the shares during building as the guarantee expired in 1919. On the other hand, the A.E.G. is paying 50 marks per share on the preference shares for 1920.

The *C. Lorenz A.G.*, of Berlin, after writing off 2,709,000 marks for depreciation in 1920, as against 1,151,000 marks in 1919, reports net profits of 2,742,000 marks, as compared with 1,568,000 marks. It is proposed to pay a dividend and bonus of 35 per cent., as contrasted with 20 per cent. in 1919, and to increase the share capital from 10,125,000 to 20,250,000 marks.

The report of the *Elektrizitäts A.G. vorm. Lahmeyer & Co.*, of Frankfurt-on-Main, dealing with the year 1920-21, states that the electricity supply industry was able to resume and continue satisfactory development, although the profits realised were not high, having regard to the depreciation of currency and the extraordinary expenditure for maintenance, renewals, and new works. On the other hand, the situation of the tramways was substantially more unfavourable than the supply works, most of them yielded no profits, and it was at present doubtful whether any change in this direction would take place in the future. The accounts show net profits and balance forward amounting to 4,388,000 marks, as compared with 3,015,000 marks in 1919-20, and the dividend is at the rate of 10 per cent. on share capital of 40,000,000 marks, this contrasting with 8 per cent. in the previous year. It is proposed to increase the capital to 60,000,000 marks in order to finance new undertakings and provide for the future needs of subsidiary companies.

The directors of *Felten & Guilleaume Carlsberg A.G.*, of Cologne and Mulheim, state that in general 1920 was a quiet year. The scarcity of coal, specially in the first quarter, prejudiced the company, as it prevented all departments from being kept in full operation so that it was impossible to meet the market requirements. Quantitatively the production was about half of that turned out in 1913, the reduction being due to the manufacture of more highly finished products, but more particularly to the shorter working shift and the decreased hourly efficiency, which represented 86 per cent. of the efficiency in 1913. The number of workmen employed averaged 5,763, and had thus reached the pre-war level. After setting aside 1,106,000 marks for depreciation, as against 1,418,000 marks in 1919, the accounts record net profits of 25,992,000 marks, as compared with 10,139,000 marks, and the dividend is increased from 15 per cent. in 1919 to 20 per cent. last year. At the recent general meeting it was stated that with an increased turnover of 30 per cent. in the five months ended with May, 1921, the invoice values were about the same as in the corresponding period of last year. The degree of activity in telephone and telegraph cables was satisfactory, but was less so in heavy cables.

Canadian General Electric Co., Ltd.—Dividend of 20 per cent. on the common stock.

Nairobi Electric Power & Lighting Co., Ltd.—Interim dividend of 5 per cent. for the year ended December, 1921.

Stock Exchange Notices.—Application has been made to the committee to allow the following to be officially quoted:—
Hudhills, Ltd., £1,000,000 7½ per cent. 10-year first mortgage debenture stock.

Mississippi River Power Co.—71,179 6 per cent. preferred shares of \$100 each, fully paid (stamped); and 8,128 6 per cent. preferred shares of \$100 each, fully paid (unstamped).

The undermentioned have been ordered to be officially quoted:—

Mather & Platt.—313,660 ordinary shares of £1 each, fully paid (Nos. 1,050,001 to 1,363,660).

Mississippi River Power Co.—71,179 6 per cent. preferred shares of \$100 each, fully paid (stamped).

Shanghai Electric Construction Co.—4,510 shares of £10 each, fully paid (Nos. 32,001 to 36,510).

Shawinigan Water & Power Co.—90,000 shares of \$100 each, fully paid.

Westinghouse Brake & Saxby Signal Co.—£350,000 8 per cent. first mortgage debentures (Nos. 1 to 200, £500), (201 to 1,700, £100), and (1,701 to 3,700, £50), (registered).

Brazilian Traction, Light & Power Co.—Revenue received under contracts with subsidiary companies for 1920 totalled \$7,036,824, plus interest on investments and miscellaneous income \$206,618, together \$7,243,443, less general and legal expenses, administration charges and depreciation on securities \$313,782, interest and charges on secured gold notes and other loans \$674,537, provision for general amortisation \$260,000, leaving net revenue \$5,995,122. Dividends on preference shares at 6 per cent. per annum absorb \$600,000, leaving surplus of \$5,395,122, plus \$2,587,008 brought forward, making \$7,982,131. Approximately \$4,900,000 has been utilised towards meeting capital expenditure on properties, leaving \$3,082,131 to be carried forward. The board are much disappointed that they have been unable to authorise resumption of payment of dividends on ordinary share capital. This has been due to extremely unfavourable exchange conditions which have prevailed and still continue, and stringency of money which has made it impracticable to finance necessary capital expenditure by sale of securities.—*Financial Times*.

Calcutta Tramways Co., Ltd.—Revenue for 1920, including interest on investments and deposits, less tax, £222,121, plus £55,959 brought forward, making £278,080, less debenture stock interest £15,750. Preference share dividend £12,500, interim dividend on ordinary shares, free of tax, £24,081; E.P.D. for 1919 £36,672, leaving £189,075. The directors propose to pay a final dividend of 3s. 6d. per share, making 7 per cent., free of tax, placing to reserve for depreciation £40,000, to taxation reserve £80,000, to staff provident fund £2,402, carrying forward, subject to Indian super tax, £42,591. Reserve for depreciation now stands at £144,619. Owing to the increase in salaries and wages made in 1920, the full effect of which will not be felt until the current year, it has been necessary to consider the adoption of a scheme for a higher scale of fares which, however, has not yet been brought into operation.

Crompton & Co., Ltd.—The net profit for the year ended March 31st, 1921, after providing for depreciation, interest on debentures, directors' fees, &c., and a reserve estimated to cover E.P.D., Corporation Profits Tax and Income Tax for the year, is £66,292, plus £18,177 brought forward, making £84,469. There is to be put to general reserve fund (making it £75,000) £19,500; 10 per cent. is paid on the preference shares for the year, and a dividend of 10 per cent. per annum on the ordinary shares (£32,677), leaving £18,370 to be carried forward. In order to cover the abnormal fall in prices of material, an exceptionally large sum has been written off stocks. Annual meeting July 14th.

New Issues.—**North Metropolitan Electric Power Supply Co.**—The list was to close to-day (Friday) in an issue of £238,460 7½ per cent. debenture stock at 95 per cent., the proceeds of which will be applied to the discharge of outstanding loans from the bankers and the general development of the company's business. The list, however, was closed within an hour or two of opening on Monday morning, but country applications were being considered up to the following morning.

Horseley Bridge & Engineering Co., Ltd.—The result of trading for the year ended March, 1921, is considered satisfactory. Additions and improvements to the buildings and plant have been made out of the proceeds of the new capital, and they are now thoroughly modern and efficient. Dividend 8 per cent., free of tax, for the year; £10,000 to reserve; carried forward £12,385.

Provincial Tramways Co.—Owing to the industrial unrest, increased wages, and the coal strike, the directors are unable to recommend an interim dividend on the ordinary shares in respect of the year ending September 30th, 1921.

General Electric Co., Ltd.—Profit for year ended March, 1921, £790,149, against £630,143 for previous year. Dividend for the year 10 per cent., free of tax, on the increased ordinary capital. £348,094 carried forward.

Anglo-American Telegraph Co., Ltd.—Dividends of 15s. per cent. on the ordinary and 30s. per cent. on the preference stock, less tax, for the quarter ended June.

Companies struck off the Register. The following companies have been struck off the register, and are dissolved:—
Carbonoid, Ltd.
Colston Electric Works, Ltd.
Globe Associated Cable & Telegraphic Services, Ltd.
Star Telephone Co., Ltd., Ltd.

Taunton Electric Traction Co., Ltd.—Receipts for 1920, including £214 brought forward, £5,478; after deducting all expenses and debenture interest, £611 is carried forward.

Marshall, Sons & Co., Ltd.—Dividend of 5 per cent., less tax, on the ordinary shares for the year. £65,499 carried forward.

National Electric Supply Co., Ltd.—Interim dividend 2s. 6d. per share, less tax, on the ordinary shares.

STOCKS AND SHARES.

TUESDAY EVENING

THE resumption this week of work by the miners has given the Stock Exchange more hopefulness if not a greater volume of business. The markets for industrial shares are generally better. There was a scramble for the underwriting of the North Metropolitan Electric Power debenture stock, and the issue is said to have been staged fairly extensively. Some of those who applied for the 7 per cent. Extension debenture stock recently issued by the Metropolitan Electric Co.—the price is 5 premium—are said to have been selling this in order to exchange into the new North Metropolitan 7½ per cent. debenture stock offered at 95. The amount is the comparatively small total of £228,460, and the subscription-lists were open for less than two hours. General Electric new debenture has improved to 23s. 4d. discount, and the other recent new issues in the electrical world are very steady. The new form of Government borrowing came rather as a surprise.

Siemens 10 per cent. preference remain at 22s., but the ordinary rose to 22s. 6d. Mond Nickel 8 per cent. debentures are 5 premium, City of London Electric new ordinary stand at 23s., and the new preference at 21s. 6d., while Central Electric Notes, which came out at 97, are now 102. The effect of the 6 per cent. Bank Rate is beginning to make itself more felt, and now that the half-year has turned, people with money on deposit at the bank are asking whether it is worth their while to keep their capital in the banks at 4 per cent. when they can get 7 per cent. on a first-class security.

The railway market is better, the steam stocks recovering on a mere modicum of investment buying, while the Undergrounds have continued to improve, with Central Londons still to the fore, at rising prices.

Prices of cable shares show a disposition to weaken. This is so much of a change from the usual conditions in the market that it is worth noticing by those who have been on the look-out for an opportunity to buy such sound investments as the Eastern group, for instance, is able to offer, provided the prices are reasonable. Westerns are 5s. down, Eastern ordinary has lost 2 points, Globes are 16½ ex dividend, while Eastern Extensions remain unchanged at 16½. It is said that a certain amount of "dead" stock has recently come in, and that this is the reason for the unusual appearance of dullness which overspreads the list. If either of the stocks in this quartette go back to the level 16 (equal to 160 for Eastern Telegraph ordinary), it will be worth picking up by those who value security and six per cent., free of tax, on their money.

Everybody is asking what prospect there may be of the Income Tax coming down in the next Budget, and the general view carries little consolation to the Income Tax-payer. This is in itself an indirect factor for keeping prices good in such cases as those where the dividends are paid free of tax. Anglo-American deferred is 4 lower at 16½, following its fall of 15s. last week. Indo-Europeans have not recovered from their £5 drop. Shares changes hands at 26 early in the present week. West India & Panama have fallen still further to 6s. 3d., on the disastrous report, while the first and second preferences are still quiet about 50s. The last recorded transaction in the first preference took place on May 3rd at that price, but no business has been marked in the second preference since the middle of August, 1920, when shares changed hands at 24.

The protest raised against the sending out by the London & Suburban Traction Co. of an invitation to tender, together with a letter stating that the last recorded transaction in the Stock Exchange took place at 61, whereas the present price is 66-70, elicited an apology from the Company, together with a notification giving the current quoted price. As it is at this time of the year that companies are apt to invite these applications for tender of stock from proprietors, it may be worth while to repeat that the safest course for the stockholder to pursue is to require of his stockbroker what is the market position. Experience goes to show that the stockholder need not be afraid of putting a temporary high price on his tender if he wishes to sell, though there is, of course, no obligation for him to part with the stock. If the company does not buy the stock at the price proposed by the stockholder, the latter is left with his security, and is in none the worse position. It may be doubted whether the system is a good one, though

candour will compel the admission that any other procedure which may be adopted will be found to have its disadvantages.

The foreign group is irregular. Brazilian Tractions fell again, but rallied sharply. The recent report, however, has disappointed those holders who looked for early resumption of the quarterly dividends of 1 per cent. Of such resumption there seems to be little immediate probability, and it is obvious that Brazil is passing through a difficult time. The 6 per cent. preference shares are changing hands fairly freely on the basis of 74½. British Columbia Electric Railway stocks show good rises. The Mayor of Vancouver, who has been over here on a visit, did no little good by his frank exposition of the manner in which points of friction which have hitherto arisen, between this side and the other, can be negotiated by the exercise of a little goodwill on the part of the British board of directors and the customers in Vancouver. His remarks as to the steady prosperity of the municipality and of the province have encouraged fresh confidence in the minds of those financially interested. Mexicans are inclined to be heavy, owing to the non-arrival of the coupon-money which some had expected would be paid on July 1st in respect of the Mexican Government 5 per cent. Loan. This has disturbed various Mexican prices, although those in the utility group show no quotable changes. The Argentine list is steady. Anglo-Argentine first preference are now quoted ex the dividend of 3s. 9d. per share due at the end of last month.

Electricity supply shares are unchanged, beyond the recovery of the dividend on Metropolitan preference. English Electrics are sixpence harder, and General Electrics 7½d. lower. Henley's and Callender's have come together at the common price of 28s. 9d. Engineering issues keep steady, and the armament group is a little better, on the end of the coal strike. Rubber shares are the turn harder in consequence of a trifling rally in the price of the produce.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.				
	Dividend	Price		Yield.
	1919, 1920.	July 5, 1921.	Rise or fall.	p.c.
Brompton Ordinary	12 12	6	—	10 0 0
Charing Cross Ordinary ..	7 8	8½	—	10 6 6
do. do. do. 4½ Pref. ..	4½ 4½	8	—	7 10 6
Chelsea	18 14	18½	—	9 4 8
City of London	18 14	18½	—	11 16 0
do. do. 6 per cent. Pref. ..	6 6	17½	—	7 1 2
County of London	8 8	8½	—	9 17 0
do. do. 6 per cent. Pref. ..	6 6	8½	—	7 7 8
Kensington Ordinary	7 9	4½	—	10 13 2
London Electric	2½ 2½	1	—	7 10 0
do. do. 6 per cent. Pref. ..	6 6	2½	—	10 18 2
Metropolitan	6 7	2½	—	10 0 0
do. 4½ per cent. Pref. ..	4½ 4½	2½	—	7 13 0
St. James' and Pall Mall ..	12 12	6	—	10 0 0
South London	8 7	2½	—	9 2 10
South Metropolitan Pref. ..	7 7	16½	—	9 17 10
Westminster Ordinary	10 10	6½	—	9 10 6
TELEGRAPHS AND TELEPHONES.				
Anglo-Am. Tel. Pref.	6 6	80½	—	7 9 9
do. Def.	1½ 1½	16½	—	9 1 10
Chile Telephone	6 6	5	—	6 0 0
Cuba Sub. Ord.	7 7	7½	—	9 6 8
Eastern Extension	10 10	16½	—	7 1 8
Eastern Tel. Ord.	10 10	16½	—	6 1 7
Globe Tel. and T. Ord. ..	10 10	16½	—	6 2 2
do. do. Pref.	6 6	24½	—	6 1 6
Great Northern Tel.	22 22	80	—	8 1 8
Indo-European	10 10	80	—	8 6 8
Marconi	25 —	2½	—	—
Oriental Telephone Ord. ..	13 13	2½	—	6 16 9
United R. Plate Tel.	8 8	8	—	7 2 3
West India and Panama ..	Nil Nil	6½	—	Nil.
Western Telegraph	10 10	16½	—	6 2 4
HOME RAIL.				
Central London Ord. Assented ..	4 4	49½	+1	6 1 1
Metropolitan	13 1½	26	+ ½	6 15 5
do. District	Nil Nil	18	—	Nil
Underground Electric Ordinary ..	Nil Nil	22	+ ½	7 13 0
do. do. "A"	Nil Nil	7½	—	Nil
do. do. Income	4 2	8½	—1	2 9 4
FOREIGN TRAMS, &c.				
Anglo-Arg. Trams, First Pref. ..	6½ 12½	29½	+ ½	10 0 0
do. do. 2nd Pref.	Nil 6½	6½	—	9 11 4
do. do. 5½ Deb.	5 5	6½	—	7 12 8
Brazil Tractions	Nil Nil	8½	+1	Nil
British Columbia Elec. Ry. Pfd. ..	6 5	67½	+1½	8 13 10
do. do. do. Preferred	5 4½	67½	+ ½	9 8 9
do. do. do. Deferred	8 8	58½	+ ½	9 18 2
do. do. Deb.	4½ 4½	60½	—	7 2 10
Mexico Trams 5 per cent. Bonds ..	Nil Nil	62½	—	Nil
do. do. 6 per cent. Bonds ..	Nil Nil	99½	—	Nil
Mexican Light Common	Nil Nil	11½	—	Nil
do. Pref.	Nil Nil	15½	—	Nil
do. do. 1st Bonds	Nil Nil	70½	—	Nil
MANUFACTURING COMPANIES.				
Babcock & Wilcox	15 16	22	—	6 14 6
British Aluminium Ord.	10 10	16½	—	12 14 0
British Insulated Ord.	15 15	18½	—	9 12 0
Callenders	15 15	16½	—	10 8 6
do. 6½ Pref.	6½ 6½	17½	—	7 8 7
Crompton Ord.	10 10	16½	—	12 6
Edison-Swan	10 10	11½	—	—
do. do. 6 per cent. Deb. ..	5 5	68½	—	7 7 1
Electric Construction	10 10	16½	—	12 6 2
English Electric	8 8	12½	+6d.	12 16 0
do. do. Pref.	6 6	16½	—	8 0 0
Gen. Elec. Pref.	6½ 6½	16½	—	8 16 8
do. Ord.	10 10	10	—	10 18 8
Henley	15 15	1½	—	10 8 8
do. do. 4½ Pref.	4½ 4½	8½	—	6 18 6
India-Rubber	15 15	1½	—	—
Mess. Vickers Pref.	8 8	1½	—	8 16 10
Siemens Ord.	10 10	14	+ ½	9 17 10
Telegraph Con.	20 20	30½	—	6 17 0

* Dividends paid free of Income Tax.

THE NEW OPPORTUNITY FOR BRITISH FIRMS IN THE CANADIAN ELECTRICAL MARKET.

[Communicated.]

THE Emergency Tariff of the United States has now gone into effect, and British firms could do much worse—now that the coal strike has been settled—than to study the possible results of that measure upon the prospects open to them for developing business in the Dominion in competition with American manufacturers at present holding such a large proportion of that valuable market. For some time past, of course, the British sovereign has been depreciated in Canada, and this depreciation in sterling has, coupled with the tariff preference, been a considerable incentive to exporters in the United Kingdom. At the same time, the Canadian dollar has undergone a corresponding depreciation when purchasing goods from the United States, and wholesalers in the Dominion have experienced endless annoyance and difficulty in connection with the financing of purchases south of the international boundary line.

As the result, however, of the exchange situation between Canada and the United States, the Canadian producer of grain, livestock, dairy produce and other natural products—disappointed with the prospects in the British market owing to the cessation of Government buying last autumn—marketed great quantities of his produce in the United States, so much to the alarm of the American farmer that influence has been brought to bear on Congress resulting in the imposition of such heavy duties on Canadian farm products that a trade worth about \$160,000,000 a year is almost certain to be entirely killed. The obvious result of this manoeuvre on behalf of the agriculturists of the United States must be to increase the sale of Canadian agricultural produce in the United Kingdom, further encouraged by the reversal of the British Government's agricultural policy, and a resultant further discount on sterling funds when eastward shipments are resumed next Fall; and a heavy drop in the value of Canadian funds in the United States, vastly increasing the existing difficulties experienced in purchasing American goods. The decision of the Canadian authorities to assess duties on American goods at the face value in the United States of the consignments *plus the exchange margin* increases the burden carried by American exporters immediately by 15 per cent. of the duties payable, and will operate during the next few months—as exchange rates tend to fluctuate still further against him—as an almost insuperable bar to sales of goods which can be obtained from Canadian or from British manufacturers. British manufacturers of electrical goods should therefore make every effort to meet the demand of Canadian importers seeking alternative supplies, and from the statistics quoted below, it will be seen that, although the market is largely supplied by the domestic manufacturers, there is still a considerable trade to be secured by exporters here who can seize the opportunity in time. Canadian imports of electrical goods during the fiscal year ended March 31st last amounted in value to \$16,918,568, and of this trade the United States secured \$16,095,283, leaving only \$572,673 for British imports of every description of electrical apparatus. No reliable information is available regarding home production in the boom period of 1920 but during 1919 Canadian manufacturers produced electrical apparatus worth \$31,187,658, exports amounting to only \$651,161 last year, and to \$424,476 in 1919-20. The Canadian market for electrical goods is therefore worth in the neighbourhood of twelve million pounds sterling, with a prospective expansion during the next few years to a very much higher total, in view of the phenomenal development of hydro-electric energy in the Dominion, amounting already to between two and three million horse power. Last year

there was in process of installation in the Dominion some 650,000 h.p., about half a million horse power being in Ontario alone, and with the prospective completion of the Queenston-Chippawa power canal and the coming into operation of the first sets at the new Niagara power station, a great increase in the use of power by industrialists, farmers, railways, and other consumers is to be expected.

Taking the Canadian imports of electrical goods seriatim, we find that during the twelve months ended March 31st, 1921, the Dominion bought from abroad electric primary batteries worth \$64,783, in addition to 89,341 electric storage batteries valued at \$1,361,456, practically all from the United States. The domestic production was worth, according to the 1919 figures, \$1,767,094 for primary batteries, and there was an output of \$561,974 worth of storage batteries. Imports of dynamos and generators reached last year \$1,323,661 (only \$93,766 from this country); the Canadian production in 1919 amounting to \$1,804,687. Electricity meters worth \$24,620 came from the United Kingdom, and imports from south of the international boundary reached \$352,348, the domestic production of meters not being stated in the returns. Canada imported electric light fixtures and metal parts thereof worth \$668,475 and manufactured herself (1919) goods worth \$1,248,640. Imports of electric arc lamps amounted to \$28,742, and of electric incandescent lamps there were imported from the United Kingdom 52,045 lamps worth \$8,952; from the United States, 3,372,608 worth \$970,163; from Japan, 777,207 worth \$58,770; from the Netherlands 832,590 worth \$141,536; and from other countries, 13,019 worth \$5,083; a total of 5,047,469 lamps valued in all at \$1,184,504, as compared with the domestic output (1919) of 7,971,105 lamps worth \$2,424,720. Imports of electric cooking and heating apparatus amounted to \$129,575, compared with a domestic production worth \$1,009,353 in 1919. Electric motors worth \$2,628,734 were imported last year, this figure being greatly in excess of the 1919 domestic production amounting to \$1,629,823 (representing 4,076 motors). Imports of sockets reached \$304,160, the 1919 domestic production being \$769,382. Telegraph instruments and wireless apparatus were imported to the total of \$121,298 home production reaching only \$15,677; the corresponding figures for telephone apparatus being respectively \$922,357 and \$1,835,979. Imports of transformers amounted to \$167,427, home production to \$1,502,261, and the returns included electric apparatus, not otherwise provided for, totalling \$7,633,425; the domestic production (1919) of which \$1,011,837 was for switchboards, panel boards, and cabinets; carbons, \$1,244,641; insulated wires and cables, \$8,536,126; electric irons and fans \$453,085; fuses, \$313,550; and other electrical apparatus and supplies \$5,009,514, apart from parts of dynamos, generators, motors, batteries, &c., worth altogether \$636,963. The Canadian electric apparatus industry comprises 35 works capitalised in 1919 at \$45,956,399, and employing then 9,560 persons, at wages or salaries amounting to \$9,685,705, the industry being centred almost entirely in Ontario and Quebec.

Electrified Sugar Mill.—The new sugar mill of the Su'a Sugar Co., at La Lima, Honduras, will be the largest electrified sugar mill in Central America. Power will be developed by a 1,000-kW turbo-generator set with an auxiliary set of 200-kW for lighting and general purposes. The United States Consul reports that all the electrical equipment will be furnished by an American company and installation will be made by the same American company as is constructing the mill. The fuel to be used for running this system is cane fodder and scraps.

THE OUTLOOK IN THE NEAR EAST.

Market Conditions in Greece and Egypt.

Greece.

No hope of an early revival in the Greek market can be drawn from a general survey of conditions there. In fact the prospects of developing business lie in the distant future. Such is the only conclusion that can be reached after a study of a report by H.M. Commercial Secretary at Athens, which has recently been issued by the Department of Overseas Trade (H.M. Stationery Office, price 1s. 6d.). Since the report was penned events of a political nature have further postponed the recovery which the British manufacturer would like to see. Depreciated exchange is the main difficulty. The Commercial Secretary shows how this has been a contributory cause of the accumulation of stocks, including, amongst general merchandise, gas engines. Should the political situation be cleared up, he says, local currency will immediately improve in value. In the meantime, the market is gradually becoming depleted of stocks, and when the exchange again becomes more or less stable, there should be a renewed demand for British goods.

Foreign Competition.

The general position in Greece, while reacting unfavourably on British trade, has to a large extent given German and Austrian goods the needed opportunity of recovering their former influence in the market. Very considerable quantities of German goods are now in Greece, and continue to arrive by every steamer. In view of the low quotation of the German mark, German manufacturers are in a position to supply their products to Greece at prices ranging from 40 to 60 per cent. cheaper than those of British manufacturers. The principal products arriving are chemicals and drugs, which are re-establishing their former position in the market; engines (Diesel, semi-Diesel, gas, and oil), motor cars, small machines, ice-making machines, pumps, tools, hardware, paper, pianos, leather goods, &c.

Local opinion attributes the difficulties in the way of developing British trade, first, to the great rise in the exchange value of the £; secondly, to the fact that British manufacturers and firms do not send their wares on consignment basis even to first-rate firms in the country, and they give no facilities in general as to payment, while German manufacturers and firms do; thirdly, to the fact that the British never, or rarely, send travellers round the principal towns, and do not advertise to any extent in the local Press or otherwise, important points never neglected by the Germans.

It can hardly be doubted, however, that there is still a strong local predilection for British goods and British agents, and that, given anything like a return to normal industrial conditions at home and normal financial relations between the two countries, British trade would have little to fear from competition from whatever quarter it came.

Engineering Developments.

The Electric Co. of Volos, which bought up the Electric & Gas Co. some years ago, since when, for reasons connected with the war, gas has no longer been produced, has been preparing to supply it again from the existing plant. It was expected to be available, for houses already possessing installations, by April, and owing to the inferiority and high price of charcoal will be extensively used for cooking purposes. Were it not for the present rate of exchange, there should be, in this connection, a good demand for British cooking and other domestic appliances.

Messrs. M. C. Stamatoopoulos Fils are engaged in various engineering activities, including electric lighting at Trikkala and Karditza. They are also undertaking for next year the lighting, by hydro-electric power, of Makrynitza. This firm has offices at Athens and other centres.

Before the war Patras was lighted by gas, and a tramway service, with electric power, linked up the town. Both these concerns belonged to the Société Thomson-Houston of Athens. They were discontinued during the war, and have not since been resumed, negotiations between the company and the municipal council for a resumption having failed. Electric lighting for the town is supplied by a private concern. The light is poor and costly and the installation crude.

A company was formed in 1919 to utilise the water power of the river Glaucus which falls into the plain of Patras at a distance of some five miles from the town. Surveyors have estimated that sufficient power could be obtained for the whole of the electric supply of the town, i.e., lighting, power to the various works, and for the running of the tramways. The proposals of the company are being considered by the Government.

The report contains some indications regarding methods of business, terms of payment and the appointment of agents and commercial travellers. These will repay study during the time when operations in the Greek market may be profitably resumed.

Egypt.

Little encouragement to cultivate the Egyptian market is contained in the recent report of H.M. Commercial Agent at Cairo (H.M. Stationery Office, price 1s.).

He records the series of crises through which the country passed last year, resulting in a complete reversal of the exceptionally favourable trade balance of 1919, and summarises as follows the disabilities under which import trade is suffering:—

(1) The enormous stocks held in the Egyptian bonded warehouses; (2) the present shortage of ready money due to the cotton crisis; (3) the number of small local manufacturers of various classes of goods which sprang into being during the war and are now, naturally, competing with United Kingdom products; and (4) the increase in the number of firms of doubtful character which is the usual aftermath of war.

Complaints with regard to the high prices demanded for machinery by the British exporters, whose goods are admitted to be the best on the market, are made on every possible occasion, and in the majority of cases it is the cheapest price that is preferred to superior quality of material, sometimes even in the case of Egyptian Government contracts. Large orders for railway material and rolling stock, steel work, dynamos, &c., have thus gone to foreign firms because the British quotations have been too high, added to the fact that the date of guaranteed delivery was not satisfactory.

Return of the Teuton.

It is unfortunate that, owing to German firms being able to accept such very low prices, they have succeeded in wresting fairly large contracts from United Kingdom exporters for railway material required by the Egyptian State Railways, and other kinds of material and plant required by other Government Departments; e.g., light railway permanent way for use in connection with oil workings by the Department of Mines on the Sinai Coast. Unless British steel firms are prepared to make a big sacrifice, in spite of prices at present ruling in Sheffield, and to guarantee within a specified period, in order to keep their hold on the market for Egyptian Government contracts, they must not be surprised to see all future orders secured by German, Austrian, or Belgian firms, particularly for railway material and rolling stock.

German ("Bosche") dynamos have been arriving in great numbers and were quickly sold owing to the low price demanded, and also to the fact that either United Kingdom exporters had apparently overlooked the Egyptian market for some months, or had not delivered them in sufficient quantities for its needs, as British dynamos appear to be very scarce at present.

Quantities of German fittings and spare parts are returning to this market.

As in pre-war days, the Germans are pinning their faith to advertising efficiency, a steady flow of propaganda, both printed and verbal, and the excellent quality of their samples. The rate of exchange is so much in their favour as regards competition abroad that they are now in a position to undersell both the United Kingdom and other Allied and neutral countries in most manufactured articles.

It is to be regretted that the efforts of the British Chamber of Commerce to hold a trade exhibition and create a permanent sample room of British goods should so far have met with failure owing to lack of support from the United Kingdom. There is no gainsaying the value, from the point of view of advertisement and commercial propaganda, of enabling native and European buyers, particularly the former, to see the actual article with their own eyes, instead of being left to form vague and often erroneous impressions about it from a catalogue, which may not even be in a language they understand.

Advertising and Commercial Propaganda.

Failing a trade exhibition, there is a good deal to be said for advertisement in the Press and elsewhere, and for commercial propaganda by films as well as by the more ordinary media such as trade journals, articles in the local European and native Press, monthly or quarterly booklets, &c.

Advertising is done extensively by means of drop-curtains at theatres and cinema houses, and of programmes, &c., and it is to be regretted that very little advertisement is done in this way by United Kingdom firms, in view of the extent to which it is used by German, French, Italian, and Greek firms.

The cinematograph appeals to all nationalities, and is very popular with the natives, and it is to be hoped that United Kingdom manufacturers will make the most of the medium now employed by one enterprising local firm for advertising its goods, viz., short and amusing films thrown on the screen during the half-time interval or between two long films.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New London Showroom.

THE SLOAN ELECTRICAL CO., LTD., has recently opened a fittings showroom in newly acquired premises adjoining its London office in Golden Lane. The room is designed with oak panels, green ribbed canvas wallpaper, and polished parquet flooring with a few Oriental rugs, the furniture being of the Jacobean period. The accompanying illustration will convey some idea of the artistic taste displayed in designing the showroom. The firm has been appointed agent in London, the South Coast, and the East Coast of Scotland by Messrs. Peyton & Peyton, Ltd., of Birmingham, manufacturers of decorative electrical fittings and art metal work. This firm has had a wide and varied experience in the design and

willful damage excepted. The fuse strip is made of zinc, which combines the advantages of low melting temperature and minimum explosive effect. These fuses are made in sizes up to and including 600 amps. normal current capacity.

For larger currents, Messrs. Sprecher & Schuh manufacture a horn-type fuse. This apparatus consists of a movable arm, which at its upper end carries a horn-shaped sparking tip. The main fuse strips are carried by substantial contact pieces below the horn-gap. The movable arm is held in its closed position by means of a second fuse strip of small capacity, which is connected in parallel to the main strips. The switch-arm having a tendency to fall to its lower position, will keep this auxiliary strip under a mechanical strain.



FIG. 1.—THE SLOAN ELECTRIC SHOWROOM.

manufacture of fittings for theatres, kinemas, and public buildings, having recently equipped the Futurists' Theatre, Birmingham, and the Manor Park Kinema. In addition to this class of work it manufactures a comprehensive range of fittings for ordinary domestic lighting, comprising many exclusive and new designs in dining and dressing room pendants, indirect lighting bowls, and other items. The fittings are well lacquered to withstand the various climatic and atmospheric conditions met with. All the classic styles and periods such as Louis XIII, Louis XIV, Adam, Empire, Georgian, &c., are represented, as well as a choice selection of bronze figures and porcelain table standards.

In the showroom is also a full range of heating and cooking apparatus of the "Slonetric" type, in addition to vacuum cleaners and other labour-saving devices, ready wired for demonstration and display.

In our issue of June 10th (p. 764) we described the "Phillips" night lamp, of the neon gas type, which has been placed on the market by the Sloan Electrical Co., Ltd. We have obtained from that firm the accompanying illustration (fig. 2) showing the construction of the lamp—two helical electrodes, without any metallic connection between them.

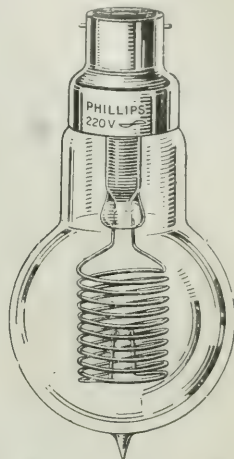


FIG. 2.—THE "PHILLIPS" NIGHT-LAMP.

When the fuse blows, the main fuse strips will melt through, throwing the entire load on to the auxiliary strip, which will rapidly melt through, releasing the switch-arm, which will fall to its open position. During this action the arc set up by this auxiliary strip will be taken up by the horn-shaped

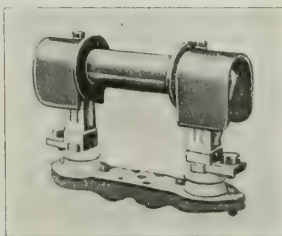


FIG. 3.—MEDIUM-PRESSURE SWITCH-FUSE.

New Switch-Fuses.

MR. J. B. RUDKIN, of 212a, Shaftesbury Avenue, W.C.2, has enabled us to inspect some switch-fuse gear made by his principals, Messrs. Sprecher & Schuh, of Aarau, Switzerland.

The fuse shown in fig. 3 consists of a stationary part and a removable carrier. The stationary part is designed for fixing to central iron or tubular framework. The contacts are carried on porcelain insulators, the latter being fixed to a cast-iron base. The contact pieces are fixed mechanically to the supporting insulator, which in its turn is also held by suitable clamps in the cast-iron base. All cementing, which so often gives rise to disturbances in the service and supply of power, has been carefully avoided. This mechanical fixing of all parts enables rapid exchange of porcelains, or any other details to be made. The contacts are composed of copper clips fixed in brass sockets, and are also supplied with bolts for switchboard mounting. These parts are massive, and have a dull nickel finish. The fuse carrier consists of a tubular handle with suitable detachable hand-shields, and is made of a tough, non-combustible, and arc-resisting material. This material, under ordinary working conditions, is indestructible,

spark tips, and it will be rapidly extinguished owing to the breaking distance being thus rapidly increased. These fuses are particularly designed for very heavy currents, and are made in sizes up to 8,000 amps. Mr. Rudkin claims that they fulfil all the requirements set out by "A Central-Station Engineer" in his article "Fuses in Sub-stations" (ELEC. REV., April 15th, 1921, p. 468).

"Lamlök" Sealed Locking Ring.

As new needs arise, new devices are produced to cope with them, and Messrs. "LAMLOK," LTD., of 36, Rushall Avenue, Chiswick, W.4, who have demonstrated their fertility of resource on previous occasions, have again had occasion to solve a problem. The rapid development of electricity supply to small houses for lighting at a fixed charge per lamp per week or per quarter, in connection with housing schemes, has drawn attention to the necessity of a device which will not only prevent a customer with lax views on morality from replacing the lamps originally installed with lamps of higher wattage—a function efficiently performed by the ordinary "Lamlök"

... but will also enable an inspector to ascertain at a glance whether the lock has been tampered with. For the ingenuity of the unmoral is notorious, and if a consumer by the possession of a key, he can change the ring and lock them again, leaving no obvious indication of the substitution.

Even in this case, the firm has made a slightly modified ring which, at a trifling increase of cost, provides an effective check. Instead of the ordinary round boss on the ring, a

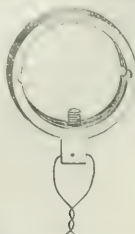


FIG. 4. "LAMOK" LOOKING RING WITH PROVISION FOR SEALING.

square boss is used, through which holes are drilled for the insertion of a wire to which a lead seal can be attached. So long as the seal and wire are intact, which can be readily verified by the inspector, it is certain that the original lamp is still in place. The sealing ring is illustrated in fig. 4.

THE NATIONAL PHYSICAL LABORATORY.

ANNUAL VISITATION.

THE annual visit to the National Physical Laboratory of the members of the general board took place on June 28th, when a large number of guests was invited, who were received by Prof. C. S. Sherrington, president of the Royal Society, the chairman of the board, and by the director of the Laboratory, Sir Joseph Petavel.

An interesting ceremony preceded the visit, when a bas-relief in bronze of the late director, Sir Richard Glazebrook, was presented to the Laboratory. The presentation was made by Sir Joseph Thomson, Master of Trinity College, Cambridge, and was received on behalf of the Laboratory by Prof. Sherrington. The bas-relief is the gift of a large number of friends of the late director, including many past and present members of the general board, and has been placed in the hall of the administration building. The artist is Mr. J. Cluysenaar, of Brussels, who has produced a most successful and striking likeness of Sir Richard Glazebrook.

It is now over 18 months since Sir Richard was succeeded by Sir Joseph Petavel, who has carried on very actively the work of his predecessor. Building operations are still in progress at Teddington, indicating that the work of the Laboratory continues to increase in magnitude and importance, and the Admiralty has erected a research laboratory within the N.P.L. grounds, so that much of its special work may be carried on in close co-operation with the N.P.L.

All departments of the Laboratory were on view, and many interesting experiments were performed and apparatus demonstrated in the various departments.

ANNUAL REPORT FOR 1920.

The report of the Executive Committee for 1920 refers to the continued growth of the activities of the Laboratory which will render further extensions necessary in the near future.

During the year the fees charged for testing have been completely revised in relation to the increased cost of the work. The number of optical and electrical instruments sent for test is appreciably less than before the war, but there is a tendency towards recovery. The number of tests in radiology decreased by 75 to 77; tests of electrical measuring instruments decreased by 228 to 473; in electrotechnics a decrease of 1,124 to 2,131 tests is shown; and in photometry a decrease of 1,282 to 1,275. On the other hand, the total number of tests increased by 353,558 to 1,656,872 during the year. The following are abstracts of the several sections of the report:

Chemical Department. *Radiology.* Radium preparations have been examined by comparison with the British radium standard, which contains the equivalent of about 30 milligrammes of $\text{RaCl}_2 \cdot 2\text{H}_2\text{O}$ in bromide, but is not very suitable for the standardisation of amounts of the order of a milligramme. Several tests were made of a small subsidiary standard of pure bromide, and several tests of the same small amounts have been standardised by comparison with it. To obviate the use of the British radium standard as a working standard two additional subsidiary standards were purchased this year, containing respectively about 10 and 13.5 milligrammes of very pure hydrated radium bromide. By using these standards in conjunction with the minute standard, single quantities of

radium up to at least 120 milligrammes of hydrated bromide can be tested with accuracy at the Laboratory.

The two γ -ray methods of standardisation at present in use at the Laboratory are the Rutherford direct method and the Rutherford and Chadwick balance method. The four standards have recently been thoroughly intercompared by these two methods. They were grouped together so as to give nine different combinations, and the value of each ratio agreed by the two methods to within about 0.5 per cent. A third γ -ray method, due to Madame Curie, is to be added to those already in use. In this case the radium is placed on top of a large circular plate condenser, consisting of two sheets of lead about 80 cms. in diameter and 5 mm. in thickness. An insulated aluminium plate situated between the lead plates with a clearance of about 2 mm. on either side serves as the electrode. The ionisation current produced is balanced by means of a quartz piezo-electric. The relative saturation currents produced by the test and standard preparations afford a definite measure of the quantity of radium present.

Some work has been done on the estimation of the radium content of luminous compounds. Several modifications were made in the method of procedure, and investigation showed that the absorption coefficient was the same before and after mixing the radium with the sulphide. In addition to zinc sulphide other salts were examined, the values of the absorption of radiation in which will be useful in a number of directions. An investigation is at present being undertaken in conjunction with the electrotechnics department on various points connected with the production of luminous compounds. The Laboratory is co-operating in this work with the British Scientific Instruments Research Association.

A research on the absorption and scattering of penetrating γ radiation from radium C in different metals has yielded interesting results. The apparatus employed for this work is entirely different from that used for the absorption of γ -rays in salts. In the case of aluminium, zinc, tin and lead, a selective or "fluorescent" absorption was observed. Both the "forward" and the "backward" scattering coefficients were also measured. The latter is difficult to measure, even with this improved method, which was made sensitive by the use of a special ionisation chamber and a tilted gold-leaf electroscope. The value of the total scattering coefficient of γ -radiation in light substances is comparatively high, so that it is important to take scattering into account in radium measurements. A light object, such as a wall, is a powerful scatterer of γ -radiation, and for this reason apparatus for standardising radium should, whenever possible, be situated in the middle of the room, so that the intensity of the scattered radiation from the walls should be reduced to a minimum in the neighbourhood of the measuring apparatus.

The examination of materials by X-rays is now carried out on a routine basis.

The X-ray spectrometer for the measurement of the absorption qualities of materials used for protective purposes in radiography is nearing completion. The instrument, which reads to 5 seconds of arc, is designed so that a portion of the beam reflected at the crystal face may be used as a standard of reference whilst the remaining portion is used for the measurement of the absorption, so that errors due to the variable output of the bulb will be eliminated. A battery of X-ray tubes is being obtained for use with the instrument. These will have anticathodes of palladium, rhodium, silver, copper, nickel, platinum, and tungsten, and will supply a number of standard wave-lengths which will be employed for standardising purposes.

The method of measuring the intensity of an X-ray beam depending upon the change of colour of barium platino-cyanide pastilles produced by the rays has been thoroughly examined and a number of useful results have been obtained. The dose of X-rays measured by the pastille has been compared with the ionisation produced in a gold-leaf electroscope placed in a fixed position relative to the bulb. The following quantities have been varied, and the effect of these variations on the time of dose as measured by the pastille has been studied: (1) Voltage on the tube, (2) current through the tube, (3) rate of interruption of primary current of the induction coil, (4) length of time of "make" of primary current, (5) type of interrupter. The pastille used throughout was the original Sabouraud pastille. The investigation is now being extended to pastilles supplied by other makers.

The thermometry division had for some time been exercised as to the degree of vacuum prevailing in the bulb of the solar radiation thermometer which the Laboratory uses as a standard. Any method involving the opening of the bulb would result in a dislocation of continuity in the measurements made in the test work. The radiology division thought that the only safe method was that of the electrodeless discharge. Accordingly a bulb of the same dimensions as that of the thermometer was constructed and an electrodeless discharge was passed simultaneously through the two bulbs. The experimental bulb was connected to a Gaede pump and a pressure gauge capable of reading pressures to the nearest 0.02 mm. The two bulbs were placed side by side and the pressure in the one altered until the colour of the discharge through it matched that through the bulb of the radiation thermometer. The mean of a number of readings of the pressure in the experimental bulb when the colours of the discharges were

the same gave an approximate value of the pressure inside the thermometer bulb. Another inquiry on much the same lines came from the electrotechnics department. In this instance the approximate pressure was required inside the bulbs of certain electric lamps which formed the subject of a particular investigation. An estimate of the pressure was made along similar lines to that described above, and a simple piece of apparatus to accommodate any shape of bulb has been constructed which will facilitate the carrying out of this test in future.

Oscillograph records of the secondary potential of an induction coil, taken with the Taylor Jones oscillograph, proved useful in explaining certain discrepancies which arose during the course of the investigation on the measurement of intensity of X-rays. An improved design of ordinary gold-leaf electroscope has been put into use. The insulation of the gold-leaf system has been effected by means of an ebonite plug into which a broad sulphur ring is fitted. In an instrument having a leaf about 4.5 cm. long, the end of the leaf falls through 0.11 mm. in an hour when its initial potential is 280 volts, and a change of potential of 1 volt on the leaf moves it through 0.51 mm. It has kept at this rate of natural leak and sensitivity for over four months and has worked throughout that period satisfactorily. The chief feature of the instrument is the arrangement for charging the leaf system, which is undoubtedly superior to that previously employed. A number of tilted gold-leaf electroscopes to new designs have been constructed.

The War Office X-ray laboratory developed during the war a method of testing the definition of X-ray tubes which were classified as having fine, medium, or broad focus. The test can now be carried out at the Laboratory by means of a simple apparatus which has been constructed for the purpose.

The observation that different types of mercury arc varied greatly in their suitability for interference work led to an investigation into the causes of these variations. As a result a lamp was designed to strike the best compromise, for general interference work, between the mutually incompatible properties of high intrinsic brightness and homogeneity of the spectral lines. A lamp to this design has been constructed and found very satisfactory. Its intrinsic brightness lies between that of the ordinary laboratory quartz arc, in which the spectrum lines are much broadened, and that of the ordinary long tubular glass arc used for workshop lighting, which gives fairly homogeneous lines, but is not bright enough for some purposes, while its homogeneity is similar to that of the latter.

(To be continued.)

JOINT ELECTRICITY AUTHORITIES.

London and Home Counties Inquiry.

(Continued from page 10.)

On Wednesday morning, June 29th, Mr. FLADGATE'S cross-examination was resumed.

In reply to Mr. Paddon, who asked whether he would have any objection to the Port of London Authority having direct representation upon the joint body under the companies' scheme, Mr. FLADGATE said he regarded them as large consumers, and they might come in under that category. He would, however, raise no objection to their direct representation.

In reply to Mr. Tyler, witness said he would be extremely glad if the railway companies were represented. Their coming in would react on the success of the scheme. He could not go into the question of the representation of the railway companies, however, until the railway companies had decided what they really wanted. If they were represented on the Joint Board they would be useful, in that they and the other undertakers would render mutual assistance to each other, but apart from that he did not think the railway companies would do the scheme any good.

Mr. Morse questioned the right of an electric lighting authority to lease any part of its undertaking to the Joint Authority under existing statutes, and contended that this could not be done unless express powers were obtained. Witness, however, said there was nothing to prevent a company leasing a generating station.

It was pointed out that Clause 22, Sub-section 1, of the 1919 Act, would probably meet that point.

With regard to administrative expenses, assuming there was no revenue in the early part of the scheme, witness said these would have to be met out of capital. With regard to the suggestion in the scheme that the Joint Authority might get a grant from the Exchequer, witness said he did not expect this, but would get it if possible.

The CHAIRMAN said he understood that the revenue would come from the nucleus companies and local authority undertakers which it was hoped would join together to form a working body.

Mr. FLADGATE at this point left the inquiry owing to urgent business. His cross-examination will be resumed later.

Sir ALEXANDER KENNEDY (executive engineer to the London Electricity Joint Committee (1920), Ltd.) then gave evidence,

and corroborated the statement made by Mr. Kennedy in his opening speech. Speaking with regard to the scheme proposed under the present scheme, he said that it was a surprise it was found that practically the whole of the area within the area provisionally delimited by the Commissioners came within the smaller area defined by the companies. It was not only desirable, but essential, that the greatest possible number of undertakers should come into the scheme under some joint technical control if the highest degree of efficiency was to be obtained. It was the opinion of the engineers that that control should be very complete. The difference between generating costs in the existing stations when enlarged and improved and the cost of energy generated and transmitted from capital stations was not now nearly so much as it would have been a few years ago. In the past economy in some London stations had left much to be desired, but the additional 250,000 kW of plant which the Commissioners had recently sanctioned was to be plant which would ensure the highest degree of economy. As to the capital expenditure, he and Mr. Partridge had worked out some supplementary particulars based on assumed reductions, in cost of plant, rate of interest, &c. They had assumed that the rate of interest would be reduced from 6½ per cent. to 5 per cent., the cost of extra plant would be reduced by 30 per cent., coal to 25s. per ton, and other costs reduced by 25 per cent. On these assumptions, the new capital required, for the first stage, instead of being £1,050,000, would be reduced to £945,000, and the new capital in the second stage would be reduced from £8,450,000 to £7,115,000. It would be more advantageous to develop existing organisations for the time being under central control than to put down capital stations at once. The conclusion he drew from the figures was that when the time came for the erection of the capital stations he did not think it would be desirable to spend £5,000,000 on existing stations, as the difference between the cost of enlarging the existing stations and of erecting capital stations would be so small.

In answer to the chairman, Sir ALEXANDER said that the action of the Commissioners in authorising the erection of additional plant with a capacity of 250,000 kW by existing London undertakings, had made it unnecessary at present to erect new capital stations.

The CHAIRMAN said the Commissioners had sanctioned that additional plant because the undertakings concerned would not have been able to meet their statutory obligations otherwise.

Continuing, Sir ALEXANDER KENNEDY referred to the engineers' estimates of future demands. The increase for the six years following the year 1919 was based on an increase of 26,000 kW per annum, which was 26 per cent. more than the maximum obtained during the previous six years. For the next five years they had assumed an increase of 36,000 kW per annum. With regard to grouping and interconnecting, they had endeavoured to provide for an increase of load where this would occur. It would probably be six or seven years before the capital stations would be necessary. In three or four years the capital stations would probably have to be designed and their erection decided upon, and at that time those responsible would have a much better chance of seeing what the future demand was likely to be. If after four years the engineer to the Joint Authority had made up his mind that the capital station would be required in another three years, he would still have, under the estimates set out in the supplementary particulars, a sufficient margin of reserve plant to carry him on for those three years. As to the railway companies, in the technical scheme provision had been included for the electrification of the South Eastern, Great Eastern, and Brighton Railways. The South-Western and North-Western Railways proposed to meet their own demands by extending their existing works. There were other railways which had no intention of electrifying their systems. Afterwards it was found that the Great Eastern and Brighton Railways were putting forward proposals to the Commissioners. The Great Eastern Railway had a particularly advantageous site of its own for the generation of electricity, and had expressed its willingness to sell any surplus electricity generated to the Joint Authority. The Great Eastern, North-Western, and South-Western had allowed him to say that under proper arrangements they would be quite willing to supply surplus electricity, if desired.

He had prepared a diagram of the diversities factor which would be obtained if all the London undertakers, both local authorities and companies, the tramways, and the railways, were worked from one single station. The engineers had been given the maximum demand on two winter days in the hour, and added together the total demand at each hour, and had separately added up the maxima at each particular undertaking which occurred at different hours. The result was that, taking the aggregate instantaneous demand, this was 319,000 kW, and the aggregate sum at the maximum, 344,000 kW, the ratio between those being 1.07. His interpretation of that was that at the whole of these companies and local authorities, including tramways and railways, were all worked from one station, the difference between the sum of the maxima and the actual instantaneous maximum demand would be 7 per cent. Without the railways the instantaneous maximum would be 214,000 kW, and the sum of the maxima 222,700 kW. The ratio between them was 1.04 and 1.05

with the railways, so that, taking the winter load, the difference was only 3 per cent. That 3 per cent. would be swamped up by a number of other considerations.

Mr. TURNER, cross-examining on behalf of the Conference of Local Authorities, referred to the question of control. Under the companies' scheme it was proposed that there should be complete control, whereas under the local authorities' scheme there would be some measure of control, but not complete control. In the companies' scheme only those undertakers who agreed would be controlled. Assuming that only the nine companies which constituted the Joint Committee came into the scheme, which would be more likely to improve the supply? The nine companies under complete control, or the whole of the undertakers in the area under the measure of control suggested in the local authorities' scheme?

WITNESS said that if only nine companies came in they must be taken as a nucleus of a much larger authority.

Further discussion on the point of the degree of control to be exercised by the Joint Authority, as provided for by the two schemes, was terminated by an intimation from the chairman that this was a matter which could be dealt with by counsel in their closing observations.

Mr. TURNER then dealt with Clause 24 of the companies' scheme, which provided that when the generating station and main transmission lines of an undertaker were leased to the Joint Authority, the latter body should supply to the undertaker energy to meet his statutory obligations at a price at which the equivalent price per unit sent out should not be greater than the cost at which the undertaker would have been able to generate and send out if the lease had not taken place. In addition, Clause 34 provided that the prices charged by the Joint Authority should be fixed with a view to securing that the receipts therefrom would meet the liabilities on revenue account and provide a reserve fund for depreciation and renewal of plant, &c. Mr. Turner suggested that there would be no funds available when the Joint Authority came to apply to Clause 34.

The CHAIRMAN said that Clause 24 referred to the cost of energy at the undertaker's existing stations, and as soon as the maximum loads were reached, the obligation imposed under that clause, as he understood it, would cease in respect of supplementary units. It was unreasonable to expect any new authority to undertake for all time and under all circumstances to supply at prices which were possible with plant at pre-war prices. If the plant had to be extended at present-day prices, the costs would go up.

Mr. KENNEDY said the intention of the clause was as expressed by the chairman.

The CHAIRMAN pointed out that the whole object of the scheme was to provide electrical energy more cheaply than it could be supplied under existing conditions, and instanced the case of the Central Co., and its arrangement to supply to the Westminster and Pall Mall Co., which was an example of what it was hoped to bring about under the proposed scheme.

The economy to be effected by the operations of the Joint Authority was further discussed, the conclusion of Sir ALEXANDER KENNEDY being that a substantial saving would be effected. The extent of this saving could only be ascertained by an investigation into every one of the present undertakers' accounts.

Mr. RIDER and Mr. WORDINGHAM here said they were unable to give any figures in this connection, but Mr. DONALD, for the Poplar scheme, said he would be able to give actual figures when his scheme was dealt with.

Mr. DONALD, cross-examining, asked a number of questions with regard to the effect of the rental clause in the present scheme on the figures submitted in the supplementary particulars, and the extent to which that clause modified the figures. Sir Alexander, however, could not deal with this point, which, it was pointed out, Mr. Fladgate had said would be dealt with by the engineering witnesses. In the end it was agreed that if Mr. Fladgate could not deal with the point on Thursday the promoters would bring forward another witness to deal with it.

Sir HERBERT NIELD, on behalf of the Surrey County Council, suggested that the companies should confine their area on the north and south to the London County area, so that Surrey could bring up its own scheme to deal with the county. The South-Western and Brighton railways had generating stations in the county, and the South-Western Railway was willing to consider the installation of additional plant at its station in order to help with the supply so long as this did not interfere with its own railway supply. Supposing terms could be arranged with the railway companies in the reasonably near future, would it not be reasonable to ask that the whole of the county of Surrey should be left out of the present scheme, so that the county could bring up its own scheme? Sir ALEXANDER replied that if such a scheme could be brought up there might be something to be said for it.

In reply to Mr. Tyler, WITNESS said the load factors taken by him for traction were, for the L.C.C. tramways, 47.46, Lots Road, 47.4, North-Western Railway, 34.01, Metropolitan, 32, Great Western, 33, and he put it at an average of 40 per cent. He admitted that the load factor would be improved by goods traffic, a good deal of which was worked during the night, but he did not think the diversity factor would be very much affected.

The inquiry then adjourned until Thursday.

Mr. FLADGATE was recalled towards the end of the Thursday morning session for further cross-examination, Sir Alexander Kennedy's cross-examination having been concluded without throwing much fresh light on the question.

Mr. DONALD, for the East London scheme, questioned Mr. Fladgate at length on the supplementary particulars of the nine companies, with a view to showing that the finance of the proposal was unsound. The point was that under the revised scheme, with the smaller area, the financial position could be changed, and counsel wished to get at the exact quantity of the change.

Mr. FLADGATE found himself unable to answer, and it was left to the financial expert who is to be called.

Sir JOHN SNELL said that if it was intended by the scheme that the rent of 7 per cent. on the cost of the plant less depreciation should continue for 60 years, it might be that it would have to be paid long after the life of the plant in the station at the time of the acquisition. Therefore, the Joint Authority would be paying upon plant which it did not have the use of.

Sir HARRY HAWARD, on the other hand, said the position was that the rental of 7 per cent. was in lieu of a lump sum, and it did not matter over what period the rental was paid. At the same time he said none of the tables in any of the three schemes showed precisely what the financial position of the Joint Authority as a separate entity would be.

Mr. DONALD said the effect of the rental scheme for acquiring the generating stations had not been taken into account in the tables in the scheme, because this method of acquisition was not before the engineers when they drew up the technical scheme upon which the finances were based.

Answering Mr. Baker, for the North Metropolitan Electric Power Co., Mr. FLADGATE said he personally saw no reason why the power areas of the North Metropolitan and Metropolitan Co.'s should not be excluded from the area, because it was hoped to make satisfactory arrangements with the power companies.

Mr. BAKER said that was precisely the North Metropolitan Power Co.'s position and, moreover, there was already the necessary statutory provisions to enable that to be done. He asked for the exclusion of the whole of the company's power area, as well as the Willesden power station, which was not in the Power Co.'s power area.

Mr. HENDERSON, for the L.C.C., said he was anxious to understand the legal questions involved in the proposed leasing or hire purchase scheme. A company had no powers to transfer its generating station without a special order or an Act of Parliament.

WITNESS said he was not divesting himself of any of his powers. He was only transferring his plant, and could erect a station elsewhere.

Sir JOHN SNELL suggested that the point might be met by the last words of Section 14 of the Act of 1919, which said a company could divest itself of its powers by a Special Order or Act of Parliament. The Commissioners could make the Special Order in setting up the Joint Authority.

Mr. HENDERSON said it depended on the true interpretation of the words in question. Did it mean that where a company was constituted by a Special Order, such a lease could only be granted by a Special Order, and where a company was constituted by an Act of Parliament any transfer of the powers must be by Act of Parliament. His point was that there was a doubt whether the Commissioners had any powers to authorise companies to lease their stations, without there being special statutory authority to do so.

Mr. KENNEDY, for the companies, said he agreed there might be legal difficulties, but they could be got over.

Mr. HENDERSON said that under the L.C.C. scheme there was only an acquisition of the generating stations for which there existed statutory powers, but there were no statutory powers authorising a lease in the way suggested in the scheme.

Mr. FLADGATE said that if such a proposal could be carried through, it would save a very great deal of movement of money. If the scheme was so good in its merits that the Commissioners recommended it for acceptance, whatever difficulties there might be he could not imagine Parliament would not grant the necessary permission. It would certainly be necessary, in his opinion, to go to Parliament for permission to extend the tenure of the distributors and the powers to lease the generating stations could be dealt with at the same time.

At the conclusion of his cross-examination, Mr. FLADGATE was questioned by the Commissioners. Asked by Sir Harry Haward why the constitution of the Joint Authority set out in the original scheme had been abandoned, Mr. Fladgate said that gave representation to authorised distributors, because they were authorised distributors, but the revised scheme only gave representation to those authorities which were financially or in some other way interested in the Joint Authority.

Sir HARRY HAWARD said that on the system of representation now suggested, the Joint Authority might consist of 81 members if the Commissioners' area were taken or 62 if the companies' area was taken, and that would make a very large body.

Mr. FLADGATE said that was the reason why it was proposed to delegate the work to the Technical and Finance Committees and no doubt others would be appointed. He considered 29 or 31 working members as in the case of the L.C.C.

scheme, and even in that case there would have to be committees. If the general body of members was increased, and the work done by committees, he considered there would be greater efficiency, because of the greater choice. Even 20 or 25 members as working members of an authority such as this was too large if any practical work was to be done.

Sir HARRY HAWARD said that as he saw the matter at present, the introduction of the financial qualification for membership of the Joint Authority would create considerable complication.

Mr. FLADGATE said the object of the scheme was to get something done soon. For that purpose, the Joint Electricity Authority required stations and money. The hope was that the local authorities would come in, and that the Companies would find the money necessary for the first few years, and in that event he felt a great deal would have been achieved for the benefit of London. It was the first step which was important, and when that first step was taken, the rest would follow, and the Electricity Authority would be handed over an undertaking which could be developed on the right lines.

Discussing labour representation on the Joint Authority, Mr. FLADGATE said he had no objection, but he did not think for practical purposes it would be of any advantage. Payment of the chairman of the Finance and Technical Committees was touched upon by Sir Harry Haward, who suggested that this was not necessary, but Mr. Fladgate thought the duties would be very onerous, and should be paid for.

Answering further questions, Mr. FLADGATE agreed this was a private company enterprise scheme, and the companies were prepared to find £1,200,000 necessary for the initial stage. That was, he contended, evidence of the *bona-fides* of the companies. So far as capital was concerned, he agreed that in existing circumstances there would be a difference of at least 1 per cent. in favour of the L.C.C. over a Joint Authority without the security of the rates. Unless the Joint Authority had complete control of the generating stations in some form, he believed it would be absolutely impossible to effect any improvement in the present conditions.

Sir HARRY HAWARD compared the proposal of the companies as regarded purchase with that of the L.C.C., and pointed out that the L.C.C. scheme did not propose to take over obsolete plant, whereas the companies did.

Mr. FLADGATE said the L.C.C. suggestion would have the effect of the stations being acquired at different periods, which would be most unsatisfactory. He would prefer that the companies should hand over their generating stations in, say, three or four years, which would give the Joint Authority an opportunity of doing the important work of linking-up, the companies being meanwhile under the control of the Joint Authority.

The term of years for extension of the distributing rights was next discussed. Sir Harry Haward pointed out that whereas the L.C.C. did not propose any term of years, the companies now proposed that the period should be 50 years from 1931. Mr. FLADGATE said that somewhat similar terms were proposed by the L.C.C. in its Bill of 1914, but that was a proposal to form a new operating company which should have a concession for 50 years.

Mr. HENDERSON said it would have to be a matter of bargaining between the L.C.C. and the companies.

As to the mode of payment, Mr. FLADGATE said he had no objection to the L.C.C.'s paying off the capital sum by giving notice instead of paying 7 per cent. for the whole period. Personally, he felt that 6 per cent. might be a sufficient sum for the rental figure.

Sir HARRY HAWARD appeared to think that the purchasing authority should have the right of paying off the cost of the generating stations and mains if it desired, and witness saw no objection.

Mr. PAGE referred to the representation on the Joint Authority, and Mr. FLADGATE said the intention was that authorities giving financial assistance should have a greater representation, by increasing the financial assistance given, than an authorised distributor entering into an agreement to take a supply from the Joint Authority. The latter could only have one vote in any event, whereas the former would have one vote for every £100,000 subscribed or guaranteed.

On Friday, July 1st, Mr. G. W. PARTRIDGE (Chief Engineer to the London Electric Supply Corporation) gave evidence in support of the Companies' scheme. He referred particularly to an arrangement which had been made with the Governor of the Gas Light & Coke Co. with regard to leasing part of that company's site at Beckton. The advantages which would accrue from generating electricity on this site would result in effecting large economies. Arrangements had been made with the Gas Light & Coke Co. to lease part of its site to the Joint Authority for 99 years—although, of course, a binding agreement had not been entered into. The site would accommodate a generating station with a capacity up to 200,000 kW. It was not proposed to erect the station all at once, but in sections, as the demand grew.

Dealing with the advantages of such an arrangement, Mr. Partridge said that in the first place the cost of fuel would be largely reduced, owing to the large quantity of coke and coke breeze available on the site. This would be burned in boilers specially designed for the purpose, and there was no difficulty in burning it. There would also be a great saving in capital outlay, because of the existing wharves, piers, rail-

way sidings, &c., which were available, and the fact that the river would not need to be dredged. There were three means of getting fuel. The first was the coke breeze and coke from the gas works; secondly, the coal required for the generating station would be handled by the existing piers and other facilities; and thirdly, the coal contractors had an unloading jetty immediately alongside of the site, so that colliers could be unloaded, and special railway sidings or transporters would be installed connected directly to the power station. The contractors had facilities, he believed, for unloading about 5,000 tons of coal on one tide. The Gas Light & Coke Co. was handling about 2 million tons of coal per annum at this site, and the additional coal required for the generating station would not be a very great amount. There would also be no difficulty in housing the employees of the power station, and there were tramway and railway facilities. The joint working of the two companies could be a further advantage in connection with the utilisation of coal. If any further improvements were made in the carbonisation of coal, or if the utilisation of waste heat or by-products became practicable and economical in the future, such improvements could be utilised for the mutual benefit of the two companies. Again, there was an advantage due to the close proximity of the northern outfall sewer, which would be of great value in connection with the laying of transmission lines, and would save a considerable amount of money in the re-opening and repair of public streets.

Mr. Partridge added that Sir Alexander Kennedy, Mr. Rider, and Mr. Wordingham thoroughly endorsed all he had to say in this matter.

Cross-examined by Mr. DONALD, for the Poplar scheme, witness said the saving in connection with the provision of jetties would be approximately anything from £300,000 to £400,000 in capital cost.

Mr. PAGE, one of the Commissioners, pointed out that the electricity authority would have to pay for the use of the jetties.

Mr. PARTRIDGE agreed. Continuing, he said that the figure he had mentioned would include the cost of dredging the river, and the erection of piers, railway sidings, gantries, &c., for a 100,000-kW station. The figure was a conservative one. He could not estimate the annual saving which would be effected by the use of the special facilities at the Beckton site, but it would be considerable. The saving with regard to the disposal of ash would also be considerable.

Mr. DONALD then dealt with the three capital stations which it was proposed to erect in the eastern part of the area under the scheme, and suggested that these were too near each other. Also two of the sites were chosen primarily in order to deal with the railway load. Mr. Partridge said the particular sites were chosen because the densest part of the load was in that district. In addition to the railway load, there was also the load on the south side of the river, which would be dealt with by the suggested capital station on the south side. Mr. Donald pointed out that by putting the stations lower down the river, out of the London area, there would be a saving in rates.

Sir HARRY HAWARD referred to the difficulty of holding possible sites for, say, seven years, because it was not proposed to build capital stations until then, and it was a difficult thing to hold options over sites which would not be required for seven years.

Mr. PARTRIDGE said he thought the Governor of the Gas Light & Coke Co. would be prepared to leave the matter over.

Sir HARRY HAWARD expressed some doubt as to the advantage of erecting a costly generating station on a leasehold site, but Mr. Partridge said he thought there was no disadvantage in doing this.

Continuing, Sir Harry said that if the station were erected and the plant installed by the Joint Electricity Authority, they would probably have paid off the whole of the loan raised for that purpose in, say, 60 years. What was to be the position for the remainder of the lease? Surely it would be impossible to put in new plant if the whole building were to become the property of the Gas Light & Coke Co. in the end? Mr. Partridge said that the saving effected by using the Beckton site would be such that in his opinion it would be worth while erecting the station. Moreover, he should imagine that in 60 years gas and electricity would, at any rate, be produced by entirely different methods. In reply to a further question by Sir Harry, witness said there were some London stations erected on leasehold lands.

Replying to Mr. PAGE, Mr. PARTRIDGE said the electricity authority would pay for the privilege of using the various facilities already existing at the Beckton site, but he did not anticipate that this would amount to very much. The amount saved on fuel would depend on the cost of coke. The average cost of the coke would be slightly less than that of coal, but the cost of the coke breeze would only be half that of coal. They would not get the same efficiency in burning breeze as with coal. He had burned a great deal of breeze, and although there had been a certain amount of trouble, he was burning it very efficiently to-day.

In reply to Mr. LACKIE, one of the Commissioners, Mr. PARTRIDGE said the coal storage would be independent, and there would be room for about 30,000 tons.

Mr. D. MILNE WATSON, Governor of the Gas Light & Coke Co., was then called, and said he had had many interviews with Sir Alexander Kennedy and Mr. Partridge, two of the engineers for this scheme, with regard to the erection of a

power station on the Gas Co.'s site at Beekton, and the site had been reserved for the Gas Co.'s engineers, with a view to seeing that an electric arrangement was possible. Personally, he considered it would be very advantageous from the point of view of his company and the supply of electricity for the districts which had been outlined by Mr. Partridge. He would be prepared to give his Board, if a satisfactory arrangement could be made, to grant a lease to the London Electricity Joint Committee (1920), Ltd., for 99 years for the purpose of erecting an electric power house and working in conjunction with the gas supply. Such a lease would not require statutory authority.

Sir HERBERT NIELD, who appears for the Hertfordshire County Council in opposition to the electrical schemes, asked if Mr. Milne Watson had not some apprehensions as to what might happen if he got into such close contact with an electrician. Mr. MILNE WATSON said he had none whatever.

Mr. NIELD: I should have thought it was a case of the young lady who went for a ride on the tiger.

Mr. WATSON: It depends on who is the tiger.

Mr. HARRY HAWARD (one of the Commissioners) raised the question of presenting the building and plant for the lessee at the end of the term, supposing them to have a value.

Mr. MILNE WATSON said it would all depend on the terms of the lease. If the Gas Co. was going to lose the right to take over the plant at the end of the lease, it would be necessary for the terms to be different from what they otherwise would be.

Mr. BOOTH (one of the Commissioners), taking up the point dealt with by Sir Herbert Nield, said he had heard Mr. Watson give evidence on another occasion to the effect that he had satisfied himself that the time had come when the cut-throat policy as between gas and electricity supply had gone. He imagined Mr. Watson was of opinion that there was no reason why the gas and electrical industries should not work side by side, and that the field was big enough for both of them.

Mr. MILNE WATSON agreed, and said that such a scheme as this would be in the national interest. Indeed, it would be in the national interest to bring both industries together generally. The gas companies had a large amount of solid fuel which had to be disposed of, and if it could be disposed of close at hand it was better for both parties; it saved the transport and possible double handling of large quantities of bulky solid fuel. It was not a question of one swallowing the other, but of their helping each other.

Answering Mr. Page, Mr. WATSON said there was always a surplus of coke available. A good deal of it was exported at present, and there would be no difficulty in always having sufficient for an electricity generating station.

Sir JOHN SNELL (chairman) said he gathered that there would be no difficulty, in Mr. Watson's view, in the electricity works having the use of the cooling facilities at Beekton, and that such use would not interfere with the gasworks.

Mr. WATSON said arrangements could easily be made for taking fuel in without interference with the gasworks. Coke could be taken direct from the gasworks retorts into the other works.

Sir JOHN SNELL said he presumed that the Gas Light and Coke Co., with its great organisation, was watching the question of improved methods of carbonisation, and if any process of low-temperature carbonisation became practicable it would be possible for the Gas company to carry it out.

Mr. MILNE WATSON replied that that was so, and if such a development did take place, an electric power station was one of the best means for utilising the gas so produced.

Mr. W. A. PEARMAN, secretary to the Westminster Electric Supply Co., was next called, and handed in a table dealing with the proposal by which the Joint Authority will purchase the generating stations of the companies and local authorities. Great difficulty was experienced in understanding the purport of it, and it was arranged that Mr. Pearman should be called at a later stage to be cross-examined with regard to it. Mr. Pearman's explanation may be summarised as follows: The Joint Electricity Authority should purchase the generating stations and transmission mains on the basis of a 10 per cent. depreciation, either by payment of a lump sum or by the form of a rental calculated on the basis of 7 per cent. per annum of the ascertained value, plus a sinking fund to wipe out the capital cost at the end of a period corresponding with the termination of the companies' extended tenure of the stations, say, 99 years from 1921. According to the calculations the value of the plant to be purchased in the year 1921 by the companies' scheme is at present 10.5 millions sterling, this figure including companies and local authorities. In 1931, the value would be reduced to 4.75 millions sterling.

Sir JOHN SNELL said it was quite impossible to judge the effect of the proposal unless the companies' undertakings were kept separate from the local authorities, and Mr. Pearman was called to further state these figures.

Mr. ARTHUR COLLINS, city treasurer of Birmingham, was called to give evidence in support of the London and Local Authorities' scheme, and was presented by witnesses from attending when this scheme was previously before the Commissioners. He said that the Joint Authority should be empowered to take over the plant without the sanction of the local authorities, and that the plant should be paid for out of the profits of the plant and the income it would have

This should be 2 per cent. better than the railways would be able to raise money at for erecting generating stations. At the beginning, the Joint Electricity Authority would not need to raise much money, and he strongly urged that the Commissioners should recommend the Treasury to assist in the early period with a loan. Under the Act of 1919, the Treasury could advance money to the Ministry of Transport for the erection of generating stations, and he should think the Joint Authority could be assisted in this way. It was true that such loans to the Ministry of Transport could only be for a period of two years, but under the No. 2 Electricity Bill it was proposed to increase that period to five years, and that should be sufficient for the early needs of the Joint Authority. With regard to meeting the administrative expenses of the Joint Authority, as a result of the evidence given to the Commissioners, he was of the opinion that these expenses should be met by the distributors who took supply, in proportion to the units taken, by the authorised distributors who did not take supply, in a smaller ratio, and on some basis by the other authorities, so that all parties concerned contributed. He put such contributions to the administrative expenses on the same basis as a subscription to the I.M.E.A. or the Municipal Tramways Association, or the Association of Municipal Corporations, in that the Joint Authority would have in its charge the general good of the electricity supply in the whole area. The terms of purchase of the local authorities' undertakings should be either the transference of the stations with outstanding debts or the payment of capital cost less depreciation, whichever was the greater.

Answering Mr. Henderson, for the L.C.C., Mr. COLLINS said that authority should pay a substantial share of the administrative expenses of the Joint Authority.

On Tuesday, July 5th, Mr. COLLINS was cross-examined by Mr. Donald on the estimates of the scheme, and admitted that the figures concerning the Conference scheme did not give any estimate of the cost of electricity at any particular stage of the undertaking.

Sir JOHN SNELL put a number of questions on this point, and suggested that it would have been an advantage to have had figures of this character. It rather seemed that the promoters had not given consideration to the matter, yet it was a most important one.

Mr. COLLINS said that although he had put in similar figures in other inquiries held by the Commissioners, and the terms of the Commissioners' notice with regard to the present inquiry called for such figures, he must frankly say that in the case of London the conditions were such that it was impossible to put forward such figures.

Counsel then asked questions about the proposed purchase terms in the companies' scheme. Mr. COLLINS said that although this was not his proposal, he was willing to discuss it. After a great deal of argument, it was again made clear by Mr. Kennedy that the companies wanted the cost of the plant paid either as a capital sum or by instalments in the form of a rental.

Sir JOHN SNELL asked if it were the intention of the Companies that the amount paid to them should not be greater than the interest and sinking fund charges payable on the debt. If that were so, it was a simple issue which he could understand.

Mr. SYDNEY MORSE, for the County of London and other companies, said he did not understand the proposal in that way.

Sir HARRY HAWARD said he thought the position was clear so far as the Companies were concerned, if they wanted a certain sum either as a lump sum or in instalments. The position, however, was different from the point of view of the Joint Electricity Authority, because if the amount was paid by instalments over, say, 50 or 60 years, it would happen that some of the plant, if not all the plant, would be worn out before the instalments to the Companies were paid, and it would not do to have another loan running while the instalments were unfinished.

Eventually, it was agreed that the financial experts should confer and try and arrive at a definite scheme for the purchase of the generating stations and transmission mains, in order that it could be seen in figures exactly what the financial result would be. As drawn, the scheme was ambiguous, as already pointed out.

Mr. HENDERSON, for the L.C.C., said that if the statement of the companies' position made by Sir Harry Haward was accepted, it would remove many of his objections.

Mr. KENNEDY said that at the moment he thought that statement did explain the position, but he would like an opportunity of consulting with his clients, and the Companies would also be very willing for their financial experts to consult with the experts of the L.C.C. on the point.

Discussion of the question was therefore postponed until such a conference was held. Cross-examination of Mr. Collins, on other matters, however, proceeded.

Sir HERBERT NIELD, for the Hertfordshire County Council, sought to get an expression of opinion from witnesses that such a scheme would be confined to very country areas, and that therefore the present scheme should be restricted to London.

Mr. COLLINS said his opinion would not be worth anything. The area must be left to the Commissioners, and he had sufficient faith in the people behind the Conference scheme to

At convenience this practice of expressing shillings and pence as a decimal fraction of the £ could be adopted in home trade as well as in foreign trade without any further alteration of coin values. The old problem of completing the decimalisation of the £ would thus be solved in easy stages.

(NOT YET PUBLISHED.)

17,115. "Pair of self-induction coils for charging duplicable four-line tele-
phone systems according to the Pupin system." F. Eiten & Guillaume Card.
June 22nd. Germany, June 25th, 1920.

17,116. "Apparatus for transmitting devices for selective signaling systems."
Western Electric Co., Inc. June 22nd. U.S.A., June 23rd, 1920.

17,128. "A device for electric control of electric circuits." J. A. L. June 22nd,
1920. U.S.A., June 23rd, 1920.

17,148. "Apparatus for controlling devices for electric machines." V. Brode and A. West
& Co., Ltd. June 22nd.

17,162. "Prevention of interference in wireless circuits." E. W. Whiston.
June 22nd.

17,179. "Electric controlling-devices for prime movers." C. Laifer. June
23rd. Germany, July 5th, 1920.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

11,088. "Process and apparatus for the separating of suspended bodies from electrical insulating fluids, more particularly gaseous fluids." Moller. Jul 31st, 1914.

4,726. "Telephonic systems." E. A. Graham. February 25th, 1919.
164,368. "Printing apparatus suitable for reproducing in ordinary printed characters the pre-recorded messages." Creed & Co., Ltd., and F. G. Creed. August 6th, 1919. (164,370).
20,820. "Telegraphic receiving perforators." Eastern Telegraph Co., Ltd., and Fraser, K. L. Wood and F. C. Smith. August 25th, 1919. (164,373).
45,553. "Metal electrodes for use in the welding or deposition of metals." E. A. Atkins and Rylands Bros., Ltd. July 19th, 1920. (164,380).

1920.

3,492. "Sparking plugs." Soc. Internationale Pour l'Exploitation De La
Brev. "Sol." July 31st, 1919. (148,756).

3,497. "Electric incandescent lamps and the like." A. Woussam (Naam-
schied. (164,415). "Holland." February 3rd,
1920.

3,500. "Telephones." R. L. Murray and Telephone Manufacturing Co.
Feb. 1st, February 5th, 1920. (164,421).

3,722. "Dynamometer for generating and/or delivering alter-
nating current of adjustable frequency, suitable for controlling and
adjusting the speed of alternating current machines applicable for controlling and
Patents, Ltd.). February 8th, 1920. (164,422). W. J. Meleher-Jackson
3,641.

4,417 "Manufacture of negative electrodes for electric accumulators." A. Pouchin. February 10th, 1920. (164,427.)

4,418 "Negative electrode for electric accumulators." A. Pouchin. February 10th, 1920. (164,431.)

4,419 "Negative electrode for electric accumulators." A. Pouchin. February 10th, 1920. (164,432.)

4,420 "Manufacture of negative plates for electric accumulators." A. Pouchin. February 10th, 1920. (164,433.)

4,421 "Negative plate for electric accumulators." A. Pouchin. February 10th, 1920. (164,434.)

4,422 "Safety-controlling gear for electrically-propelled vehicles." R. J. Barrett & Sons, Ltd., and H. R. Simpson. February 27th, 1920. (164,437.)

4,423 "Interlocking device for electrically-propelled vehicles." R. J. Barrett & Sons, Ltd., and H. R. Simpson. February 27th, 1920. (164,437.)

1368. "Method of and means for electric control of tipping gear upon
trucks." P. F. Smith, E. H. Dine and F. R. Stocks. Match 4th, 1920.
1,464.
1,439. "Electric radiator." C. H. Verity. March 5th, 1920. (164,472).
1,438. "Electric circuit-breakers and the like." J. Hall. March 8th, 1920.
1,490.
1,491. "Miners' safety and other electric hand lamps." O. Oldham, G.
J. Oldham. March 9th, 1920. (164,496).
1,492. "Electrodes for electric welding." Premier Electric Welding Co.,
and J. H. Patterson. March 11th, 1920. (164,507).
1,452. "Electric signalling and the like." J. H. Patterson. March 11th, 1920. (164,507).

401. "Construction of random to 132,818" (164,510).
 1920. (164,326).
 114. "Electric candle lamps." C. A. Damey. March 18th, 1920.
 424. "Electrically-heated soldering-irons." G. F. Joseph and H. N. H.
 1920. (164,543).
 782. "Electric-ignition apparatus with constant ignition tension and auto-
 matic variable moment of ignition." Landis & Gay, Abt. Gen. (160,793).

Protective devices for electric circuits and apparatus." British
 1981. "Electrical switches, sockets and the like." H. J. Cash and G.
 1906. "Telegraph circuits." A. Orling and Orling's Telegraph Instru-
 2000. "Signalling apparatus." W. M. Ralph. April 22nd, 1920. (164,582).
 1906. "Electric lamp holders." W. A. I. Booth. April 30th, 1920.
 1981.

437 "Vacuum cleaner electric cord take-up," R. J. Tamarin, May 6th, 1920.
(144,592)
438 "Signalling systems," Position Light Signal Co. July 13th, 1914.
439 "Means for cooling electrodes for use in vacuum electric discharge
status," Siemens-Schuckertwerke Ges., June 4th, 1918. (144,295)
440 "Insulating electrical resistances," Heriot, Ltd. November 8th
(147,746).

July 10th, 1918.	"Refracting systems."	British Thomson-Houston Co.,
July 10th, 1918.	"Electrically-driven vehicles."	British Thomson-Houston Co., Ltd
July 10th, 1918.	"Electrodes for electric searchlights."	Optische Anstalt C. P. Goerz
September 19th, 1918.	"Telephone receivers intended to be inserted into the auditory"	Siemens & Halske Akt.-Ges.
July 24th, 1919.	"Electric lighting systems for motor vehicles."	General Electric Co.

1921.
 "Negative electrode for electric accumulators." A. Pouchain. Feb.
 6th, 1920. (Divided application on 164,431.) 164,695.

"Means for improving the current-carrying capacity of existing alternating current cable systems." A. M. Taylor. September 1909. (Divided application on 23,324/19 and 29,862/19. Cognate applications 1,403/21.) (164,689.)

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ELECTRICAL REVIEW. THE CURSE OF PERCENTAGE.

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A STUPENDOUS gain that has been achieved by electrical engineers is the ability to work out efficiencies with accuracy. Compared with marine engineers, electrical men seem faddy to a ridiculous extent, but they have proved their case. The older marine men could tell when they made a really big advance, as when they went from compound to triple-expansion engines, but they were in a somewhat confused state when it came to finding out what arose from changes in detail, and indeed sometimes altered their engines in a way which reduced their efficiency, without knowing what had happened.

Nevertheless, the time has come when electrical men must make a new step forward. They have got into too rooted a habit of working on the percentage and similar bases, and good as this may be in a general way, it is possible for a good custom to hamper progress. Years ago, designers tried to work out steam engine consumptions on the b.h.p.-hour basis, but they stuck over it. At no load the engine was using steam, without output, so that the consumption per b.h.p.-hour was infinite. It came down as the load came on, and reached its minimum somewhere about full load. Designers drew out curves, but they did not seem to lead to anything. Then Willans threw over the "per" basis, plotted the total steam consumption against output, and got his straight-line law, which threw a flood of light on the whole matter.

In the March number of the I.E.E. Journal, Prof. Miles Walker puts forward suggestions which, if followed up, may have results not less important than the Willans straight-line law. He points out that by spending £600 on a certain 20,000-kW generator, it is possible to reduce the loss by 40 kW. Now if one were to put this forward to the ordinary designer, he would look up in an abstracted way and say that on 20,000 kW, 40 kW is 0.2 per cent., and he would state that he could not see his way to alter the standard patterns to make a saving which one could not trace in a steam consumption test. True enough, one could not. Yet 40 kW, if saved for 4,000 hours per annum, would amount to 160,000 kWh, and that is worth saving! The upshot of the argument, then, is this: First of all, one should design a generator to give as good results as possible, on ordinary lines, and subsequently one should revise the design to make savings, even though they cannot be recognised on the percentage basis, savings which cannot be measured even on careful steam consumption tests. As Prof. Miles Walker points out, we must not let the desire to get the utmost out of the materials prevail too much over us. What we want is to get the utmost commercially, and that may even mean that we must work the materials at a point below their limit. This may have the additional advantage of making the generator more reliable, an important consideration.

Prof. Miles Walker's point is so weighty that one hopes it will speedily be recognised. One knows, of course, that designers, in large factories, are necessarily tied down by their shop practice, and one can hardly expect them to work out the problem whether 40 kW can be saved on a 20,000-kW set. This work should properly be done by men of Prof. Miles Walker's stamp. It is, indeed, just the kind of work that our colleges should encourage their technical staff to take

up, with benefit to everyone. A practice of this kind would also help the financial side of a professorship, besides keeping the holder of the position in touch with actual work.

One may add a word here on the choosing of professors for our colleges. The selecting committees sometimes think that they have done a good stroke in getting a man who has been a designer in large works. While experience of this kind is invaluable, it is not enough. A professor should first of all be able to impart knowledge to the average student, a most difficult thing, be it said. The man who has been designing in a factory for many years may have a profound knowledge of a certain subject, but he may also be narrow, and incapable of understanding the student mind. He may even have become afflicted with the disease of keeping things secret, a disease not unknown in large factories, and that is fatal to good teaching. The man who has profound practical and theoretical knowledge, and who also can teach, is rare, but, when caught, everything should be done to keep his wits alive. A certain amount of consulting work on the above lines will act as an admirable stimulant, and the students will reap the benefit.

Foreign Patents and the Peace Treaty.

A CASE is reported which seems to show that those who drafted the Peace Treaty were not fully alive to the interests of persons in England who had made use of enemy patents. We refer to *Cooksley v. Crowthorne Engineering Co.*, which came before Mr. Justice Peterson on June 29th. As our readers are aware, a patent lapses if the renewal fees are not paid. This accident happened to many German patents during the war, and English manufacturers, as they lawfully might, not unnaturally began to avail themselves of enemy property. It is obvious, however, that a patented article may be a thing of some complexity which cannot be made or perfected in some cases for many years. When the Peace Treaty was under consideration, as it was realised that patents belonging to Englishmen in Germany might have lapsed during the war, a clause was inserted giving the patentee the right to renew, but subject to the protection of the interests of those who had infringed between the date of the lapse and the date of the renewal. Rules have been made to carry this provision into effect, but as the facts of the case under consideration seem to show, they are not sufficiently wide to protect and indemnify a person against loss incurred owing to his reasonable belief that he was and would remain entitled to work the enemy patent. It appeared that on September 18th, 1917, a certain patent held by a German subject for a mortising machine lapsed, owing to the non-payment of renewal fees. An English company thereupon commenced to manufacture parts of the machines. It was provided, however (in effect), by a clause in the Peace Treaty, which came into force on July 31st, 1919, that within a year after the signing of that document a German subject might pay the renewal fees, and have his patent renewed, "but subject to such conditions as each Power may deem reasonably necessary for the protection of persons who have manufactured or made use of the subject matter of such property while the rights had lapsed." In March, 1920, the German patentee paid the renewal fees, and thereupon became entitled to his patent, subject to the rights of persons who had infringed since September, 1917. After the renewal of the patent, the defendants manufactured some parts and assembled 32 machines, mainly of the parts already made at the renewal date; the patent was for the combination. In these circumstances they were sued for infringement by or on behalf of the patentee. They relied on a "restoration order" dated March 20th, 1920, whereby it was provided that no action should be commenced in respect of the use or employment of any mechanism or the sale or use of any article in the United Kingdom made in infringement of the re-

newed letters patent "after September 18th, 1917, and before the date of this order." Mr. Justice Peterson, however, held that this did not protect the defendants, inasmuch as, the patent being for a combination, the use of that combination constituted an infringement of the patent, and that such user, after March 20th, 1920, could be restrained by injunction.

It appears to us that the learned judge arrived, or was compelled to arrive, at a somewhat harsh conclusion. Had the defendants known when they first began to manufacture parts of the patented article that their ultimate user in the finished machine might be prosecuted by the patentee, they would never have embarked upon the enterprise.

The Problem of Getting a Job.

THE difficulty of securing employment in industrial life after leaving it for a period is often brought home to us by letters which, though by no means despairing—our correspondents almost always retain a spirit of inexhaustible optimism and confidence in the future, we are glad to say—often tell a tale of persevering effort unrewarded by success, which makes us wish we had an unlimited number of vacancies to place at their disposal.

The question is particularly pressing in the case of Service men, who before all ought to be installed in suitable situations. Many of them are highly skilled in electrical work, but cannot readily gain admission into a trade union except as "auxiliaries" or "improvers" at a low wage—if, indeed, they are lucky enough to secure a berth. For instance, one who writes us describes himself as having initiative, "conscientious, willing to be told, ambitious, and cheerful under all circumstances." Apart from technical qualifications, that is the sort of man that anyone would be glad to engage. Yet, somehow, it is surprisingly difficult for the would-be employé to find the willing employer. We can only hope that the period of depression through which the country is passing will soon give place to renewed activity, when everyone willing to work will find work waiting for him.

The I.M.E.A. Convention.

AFTER a variety of vicissitudes, unprecedented, we believe, in its history, the annual Convention of the Incorporated Municipal Electrical Association is to take place next week, in London. It is true that the function is called the annual meeting, and at first, when the Dundee Convention was abandoned, it was intended that the proceedings should be limited to the annual general meeting and the annual dinner; but apparently this was not agreeable to the members, and the programme has gradually been extended until it includes all the usual items except "visits to works and places of interest." It is, in fact, a severely professional meeting—during working hours; the members may be trusted to see that the tension is relaxed between-whiles, and if the Council's deliberations have shown a certain amount of indecision and "cut and try" that we have not hitherto associated with the I.M.E.A., we can congratulate both the Council and the members on arriving at last at a very satisfactory solution of the problem. Major Richardson, deprived by fate of the privilege of presiding over the Convention at home, has our sympathy and, we are sure, that of the Association as a whole; apart from that misfortune, we see no reason why the proceedings should be less profitable or less enjoyable than usual.

The papers deal with two subjects—the financial and commercial aspects of electricity supply, by Mr. C. W. Charlesworth and Mr. E. Cross, and boiler-house practice, by Mr. D. Wilson and Mr. W. M. Miles—questions which are in the forefront to-day, and should afford abundance of material for discussion. Incidentally, we inferred from the programme that the London and Home Counties Inquiry was expected to conclude by Wednesday next. We hope it will—but unfortunately a doubt has arisen, and the meetings may have to be held at the Institution of Mechanical Engineers.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD.—TRAFFORD PARK WORKS.

VISIT BY THE PRINCE OF WALES.

BRILLIANT weather prevailed last week when His Royal Highness the Prince of Wales, accompanied by Lord Derby and suite, toured Lancashire. He was received with enthusiasm and accorded a wonderful welcome wherever he went, and it is not surprising after the experience of the first day that the programme of the tour had to be modified. Certain visits to industrial establishments had to be omitted, and at Manchester on July 7th his tour of the Trafford Park Works of the

produced. This was entirely apart from the normal manufactures of the company, which attained a total of 92,000 tons during this period, and were used almost exclusively for war purposes in munition factories and base depôts.

Conspicuous features of the organisation are the educational facilities provided for the various grades of apprentices employed, numbering about one thousand, and the large number of associations formed by the employés for mutual aid, instruction, or recreation. Sixteen such associations are now active. The War Relief Committee has collected a total of £71,900, and distributed a total of £55,200. The balance is being distributed to the widows and orphans still on the books at the rate of £50 per week. The Works Committee was inaugurated in January, 1917, by the company, and so anticipated the recommendations in the Whitley Report.

Over 100 truck loads of finished goods are dispatched from the works every month, and in addition to the Trafford Park works the company also has control of the electrical departments of the River Don works at Sheffield, and the works at Brimsdown, where the "Cosmos" lamps and heating and cooking appliances are manufactured.

The works at Trafford Park possess unusual facilities for transport by means of rail, canal or steamship. A new building has recently been completed which contains the warehouse and traffic department

and also a works canteen, where 2,000 men can be accommodated simultaneously. At one end of the main machine shop is situated the firm's private power station, wherein turbines and gas engines drive generators delivering a total of 7,500 h.p., both d.c. and three-



FIG. 1.—H.R.H. THE PRINCE OF WALES PASSING THROUGH THE TRAFFORD PARK WORKS.

Metropolitan-Vickers Electrical Co., Ltd., was materially curtailed.

Nevertheless, after luncheon on Thursday afternoon the Prince was received at the North Gate of the works by the directors of the company, represented by Capt. R. S. Hilton, managing director, and Col. Montague Cradock, C.B., C.M.G. Following the presentation of certain members of the managerial staff and members of the Stretford Urban District Council, in whose area the works are situated, the Prince inspected 1,300 ex-Service men who were lined up in charge of Lieut.-Col. Maxwell, D.S.O. On leaving the works, His Highness proceeded down the main avenue to the South Gate, fig. 1, passing the new Research Department building on the right, and recording the time of his visit by "clocking on" in the same way that his father, H.M. King George V, registered the time of his visit to the works in May, 1917.

The foundation stone of the company's works was laid in 1901; they are now amongst the largest of their kind in this country, the principal products comprising complete equipments of every description for the generation and application of electricity. The works occupy an area of 70 acres, 35 of which are roofed in, with canteen accommodation for mid-day meals for over 4,000 people. The number of men at present employed is 10,000, and that of employés who enlisted during the whole period of the war 3,522; 326 men made the supreme sacrifice, and 2,000 ex-Service men, including a large number of disabled, are at present employed in the works.

During the years 1914 to 1918 the company was extensively engaged on munition work. Shells from the 3.3-in. high-explosive up to the 15-in. howitzer type were made, besides Diesel engines for submarines, Ricardo engines for tanks, mines, paravanes, gun carriages, magnetos, time fuses, &c., to mention only a few items. In all 16,000 tons of war material of every description was



FIG. 2.—MAKING A 30-TON CASTING IN THE FOUNDRY.

phase energy, for the various power requirements of the works. Adjacent to the site the company has purchased 55 acres of land for future developments, and within the space occupied by the works there are some 15 miles of standard railway track, which links up directly with the Manchester Ship Canal Co.'s system in Trafford Park and also with the Cheshire Lines Railway.

A special staff of engineers is engaged upon the question of the standardisation of all parts that can be made interchangeable or common to more than one type of

apparatus, and one of the most interesting developments taking place at the present time is the erection and equipment of a block of buildings to be devoted entirely to research work. The buildings, which have been located as far away as possible from the noise and dirt of the works, consist of a two-storey office block, the ground floor of which will be used for administrative purposes and the first floor as a research library, together with three single-storey buildings specially designed and equipped for chemical, mechanical, physical and electrical research, one building being reserved entirely for testing different manufacturing processes on a small scale. Very careful consideration has been given to the

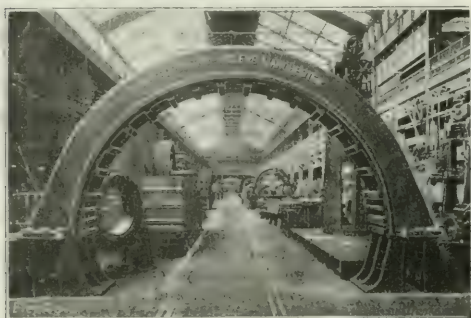


FIG. 3.—STATOR OF A LARGE MOTOR FOR ITALY.

design and equipment of these buildings; each is designed on a unit basis and is easily capable of extension. At a later date a laboratory will be erected for carrying out investigation work on extra-high-pressure transmission, and will have a specially prepared outdoor area connected to it for research work on outdoor sub-stations.

A large number of the employes have to travel considerable distances every day to and from home, and it will be readily appreciated that it is no small under-

taking to provide catering facilities for such a large number of people. The canteen buildings include stores for vegetables, &c., and refrigerating plant. The ventilation and heating are carried out by means of the "plenum" system, which combines heating or cooling and ventilation and gives a complete change of air one and a half times per hour on the canteen floor, once an hour elsewhere in the building. Protection against fire is given by the sprinkler system, also employed in the works; lighting is effected by means of gasfilled Reflex pattern lamps, and electric cooking apparatus is employed.

Two well equipped ambulance rooms are also provided, one for men and one for women, in addition to the numerous first-aid stations throughout the works, together with a motor ambulance, and the company claims to have anticipated the advent of welfare work.

The Works Committee has done a great deal of useful service in providing a means for bringing workers into direct contact with the management. The successful work accomplished by this committee led to the formation of a Staff Committee conducted on similar lines. The foremen have also banded themselves together to form an association for their mutual benefit, and there is no doubt that the foremen themselves, as well as the management, realise that there are very great advantages to be obtained by the interchange of experience and ideas. The management meets the works officials and foremen at frequent and regular intervals for the purpose of discussing any suggestions which may be put forward.

Referring to the illustrations, fig. 1 is a view of the passage of the Prince of Wales through the works, while fig. 2 was reproduced from a photograph taken in the foundry as a 30-ton casting was being made for a 25,000-kW turbo-alternator set destined for the Manchester Corporation's power station now in course of erection at Barton; the cast was intended to be carried out by means of remote electrical control. Fig. 3 shows one half of a stator of one of the 1,200-h.p. a.c. motors which are being built for Italy, at the north end of the electrical erecting department. A similar arch was formed at the south end of the aisle. The inspection of the work passing through the shops proved of very great interest.

THREE-PHASE SUPPLY TO SCOTT-CONNECTED TRANSFORMER BANKS UNDER VARIOUS CONDITIONS OF TWO-PHASE LOADING.

By G. W. STUBBINGS.

IN view of the increasing use of Scott-connected transformer banks for the supply of one-phase low-pressure networks from three-phase alternators, a discussion of the nature of the three-phase supply to such transformers under various conditions of two-phase demand is not without interest. In actual practice the two-phase side of Scott-

may be met with, in the hope that this may be of interest to engineers who have charge of Scott-connected transformer banks.

The elementary theory of the Scott connection is simple. Consider, in fig. 1, the primary of a transformer connected between phases B and C of a three-phase system. It is clear that, if v be the phase voltage, the pressure between phase A and the mid-point tapping on the transformer winding will

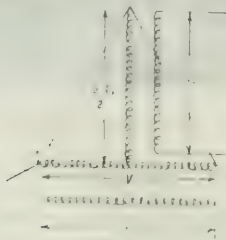


FIG. 1.

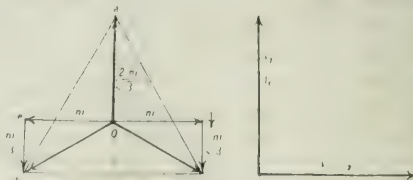


FIG. 2.

connected banks is rarely balanced, the currents usually being dissimilar in the two phases, and the power factors not always being identical. The writer gives below a simple investigation of some of the conditions of unbalancing that

be $v \times \sqrt{3}/2$. If the primary of a second transformer, having $\sqrt{3}/2$ times the number of turns of the first, be connected to the points A and D, the potential of D will remain unaltered. If the secondaries of these transformers have an

equal number of turns, then the ratio of transformation in the transformer B C being n , its secondary voltage will be $n v = v$, and the ratio of the transformer A D will be $2n/\sqrt{3}$, and its secondary voltage will be $v \times \sqrt{3}/2 \times 2n/\sqrt{3} = n v = v$. The secondary voltages will be equal, and it is at once seen from the diagram that they will be in quadrature.

When equal currents, considered for the moment at unity power factor, are drawn from the two-phase side, the currents in the primary windings required to balance the magnetic effects of the secondary currents will be different. If each secondary current be i , the current in the primary of the transformer A D, or the teaser transformer, as it is often designated, will be $2ni/\sqrt{3}$. The current required in the primary winding of the main transformer B C to balance the secondary current will be ni . The vector diagram of these currents is given in fig. 2. The current in

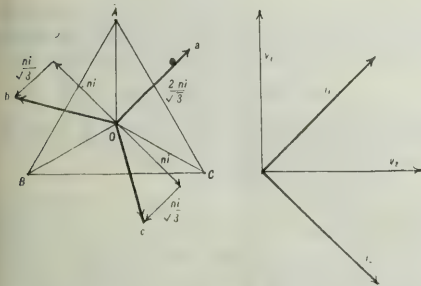


FIG. 3.

the teaser transformer is in phase with the star voltage O A. The current in the main transformer is the resultant of two components. The first component is ni required to balance the secondary current. In addition to carrying this current, the main transformer forms a return path for the current in the teaser transformer primary, this current dividing into two halves at the mid-point tapping D, one half flowing in each direction. In fig. 2 $e b$ and $f c$ are the two halves of the teaser primary current, whilst the components $e o$ and $o f$, being opposed both in phase and direction form a one-phase current through the transformer primary. It will be noticed that the components $e o$ and $o f$ are identical in phase, but flow in opposite directions from the mid-point. These components, therefore, produce no magnetic effect in the core of the transformer.

The currents in lines B and C are each $ni\sqrt{1 + \frac{1}{3}} = 2ni/\sqrt{3}$, the angle $e O B$ is also clearly $\sin^{-1} \frac{1}{2}$ or 30° . The line currents are, therefore, equal and symmetrical for a balanced two-phase load at unity power factor.

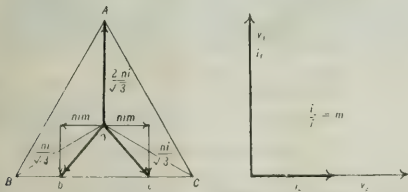


FIG. 4.

If the two-phase load remains balanced, but of a power factor less than unity, the vector diagram for the three-phase side is shown in fig. 3. The main transformer carries a current, it is seen, which is the resultant of that balancing the secondary current, and the two halves of the teaser primary current. It is readily seen that in these circumstances the three-phase supply is still balanced, and the phase angle on this side is the same as that on the two-phase side.

The fact that the main transformer carries the resultant

of two separate currents has a bearing on the rating of the transformer bank. The power factor of the main transformer with balanced secondary load of unity power-factor is seen to be 0.866. For a given factor w in each phase on the secondary side, the kVA in the primary windings will be $w(1 + 1/0.866)$. The ratio of the three-phase kVA to the two-phase power will be 2.15/2, or 1.07. The rating of the main transformer must be increased by 15 per cent. when used for Scott connection.

The case may now be considered of a secondary load of unity power-factor, but unbalanced in magnitude. Let the ratio of the load drawn from the main transformer to that drawn from the teaser transformer be m , m being less than 1. The vector diagram for this condition is given in fig. 4. It is evident from the diagram that the currents in lines B and C are each $ni\sqrt{m^2 + 1/3}$, whilst the phase angle of the current in these lines is $\tan^{-1} (1/\sqrt{3} m) - 30^\circ$, being

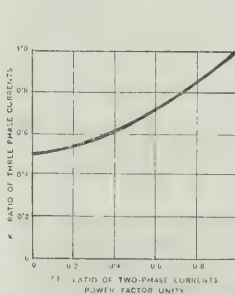


FIG. 5.

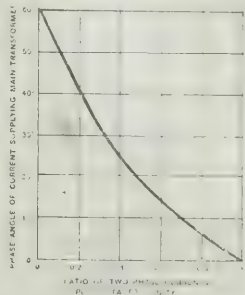


FIG. 6.

leading in line B and lagging in line C. A curve showing the ratio of the current in lines B and C to that in line A for various values of m is given in fig. 5, and fig. 6 shows the increase of phase angle as m diminishes from 1 to zero. The condition $m = 0$ corresponds to a single-phase load being drawn from the secondary of the bank, in which circumstances the load on the three-phase side must be single-phase only.

As a numerical illustration the case may be taken of the load on the main transformer being 0.4 of that on the teaser transformer. In these circumstances, the ratio of the currents in lines B and C to that in line A is 0.61, whilst the phase angle of these currents is about 25° —

$$\text{Two-phase power} = i v + 0.4 i v = 1.4 i v.$$

Three-phase power

$$= \frac{2ni}{\sqrt{3}} \cdot \frac{v}{\sqrt{3}n} + 2 \times 0.41 \times \frac{2ni}{\sqrt{3}} \times \frac{v}{\sqrt{3}n} \times \cos 25^\circ$$

$$= \frac{2}{3} i v (1 + 1.22 \cos 25^\circ) = 1.4 i v.$$

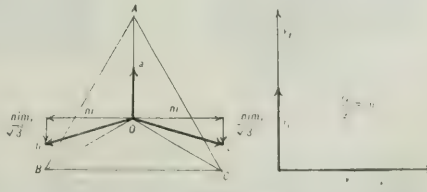


FIG. 7.

If the main transformer has the relatively greater load, the currents in the three-phase lines can be similarly worked out. A typical vector diagram is given in fig. 7. If m be the ratio of the smaller to the larger current on the secondary side, the ratio of the current in line A to those in lines B and C is now $2\sqrt{m^2/(3 + m^2)}$, while the phase angle of the current in lines B and C is $30^\circ - \tan^{-1} m/\sqrt{3}$. Curves giving the ratios of the currents in line A to corresponding currents in lines B and C, and the phase angles of these latter currents for various values of m , are

shown in figs. 8 and 9. When $m_1 = 0$ the load on the three-phase side is single-phase, the line A supplying no current. From the foregoing it is seen that a better balance on the three-phase side for a given amount of two-phase unloading is obtained when the teaser transformer carries the heavier load.

If equal currents be drawn from each phase of the secondary, but these currents be of different power factor, the three-phase supply will no longer be balanced. Two typical cases are shown in figs. 10 and 11. The power factor of the phase supplying the lagging current is the

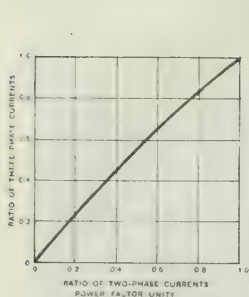


FIG. 8.

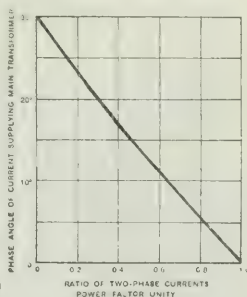


FIG. 9.

same in each case. It is evident from the geometry of these diagrams that fig. 11 can be derived from fig. 10 by rotating the current vectors as a whole through an angle equal to the angle of lag considered, in a positive direction, and then by rotating the vector i_1 symmetrically about its voltage vector in a negative direction through twice this angle. This being so, it follows that the three-phase

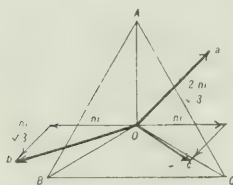


FIG. 10.

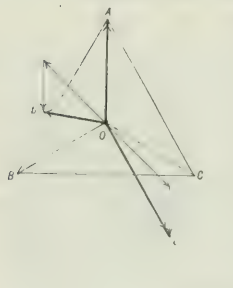


FIG. 11.

loading in the two cases is similar as regards magnitude, excepting that in fig. 11 line c carries the current that in fig. 10 is carried by line B. The magnitudes of the currents for typical cases are given in the following table:—

Equal currents on two-phase side.
One-phase unity power-factor.
One-phase power-factor $\cos \phi$.

	$\phi = 0$	$\phi = 30$	$\phi = 45$	$\phi = 60^\circ$	$\phi = 90$
Current in line A ...	1.15 ni	1.15 ni	1.15 ni	1.15 ni	1.15 ni
" " " " " " " " " "	1.15 ni	1.38 ni	1.47 ni	1.53 ni	1.58 ni
" " " " " " " " " "	1.15 ni	0.87 ni	0.72 ni	0.58 ni	0.43 ni

Cases in which there is out of balance on the two-phase side, both as regards magnitude of current and power factor, are complicated to calculate, and are best solved by

graphical methods. A typical case is shown in fig. 12, in which the teaser is supplying one-half the full-load at unity power-factor, whilst the main transformer supplies full-load current at a power factor of 0.866.

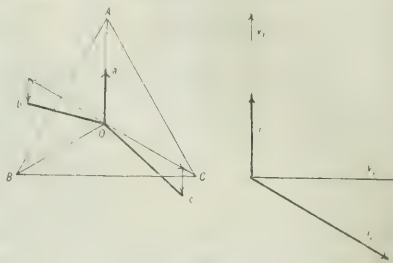


FIG. 12.

It may be well to repeat that the above discussion has been of an elementary character, and that magnetising currents and small disturbing causes have been neglected.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR JUNE, 1921.

ALTHOUGH the imports total for last month was only slightly below May's figure, a serious fall occurred in the total value of exported goods. The difference was over a million pounds, or about 46 per cent. decrease. This decrease was distributed fairly evenly among the constituent items, but exports of submarine cable fell by 92 per cent., but the May total under this head was much higher than usual. The only increases on the previous month's export values were in switchboards and meters. As regards imports, the chief increases were apparent in the cases of batteries, glow lamps, and telegraph and telephone instruments: decreases occurred in the values of insulated wire, electrical machinery, and arc lamps. There were no noteworthy changes in the re-export values.

VALUES OF ELECTRICAL EXPORTS AND IMPORTS FOR JUNE, 1921.

	Exports.	Imports.	Re-exports
Electrical goods and apparatus (unenumerated) ...	£162,568	£49,134	£1,068
Insulated wire ...	228,055	7,570	404
Glow lamps ...	35,905	40,142	609
Switchboards (not telegraph or telephone) ...	19,999	2,749	—
Arc lamps and parts ...	2,572	200	—
Batteries ...	40,488	16,877	—
Meters ...	50,014	11,709	3,169
Carbons ...	1,672	13,416	2,154
Electrical machinery:—			
Railway and tramway motors ...	1,382	—	—
Other motors and generators ...	191,342	—	—
Electrical machinery (unenumerated) ...	138,063	51,463	712
Telegraph and telephone cable and material:—			
Telegraph and telephone wire and cable (not submarine) ...	115,342	8,153	—
Submarine telegraph and telephone cable ...	63,338	—	—
Telegraph and telephone instruments and apparatus ...	157,237	41,509	3,681
Totals...	£1,207,977	£242,922	£14,797

Development in Spain.—The report of the Sociedad Española de Construcción Naval states that the new works at Reinosa have begun to supply to all the company's works special steels, forgings, and castings. Thanks to these works, the Carraca artillery works, and the Sestao engine and boiler works, which complement those of Ferrol and Cartagena, the company is now able to meet all its own requirements for the complete construction of ships of all kinds, war material, and railway material. To promote the latter class of work with responsible guarantees, the company has concluded agreements with foreign firms, as, for instance, the Metropolitan Wagon and Finance Co., and in agreement with other Spanish industries has secured contracts for wagons and other works for the Madrid Railway and other companies. Moreover, in order to be prepared to submit schemes and plans for the electrification of railways, the company has signed guarantee agreements with the American Westinghouse Co., the Metropolitan-Vickers Co., of Manchester, and Vickers, Ltd.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "R.M.R." Triode Valve and "Thermagnion."

An interesting demonstration of some new wireless developments was given by MESSRS. R. M. RADIO, LTD., on June 23rd, at their engineers' offices, now situated at 5, Regent Square, W. 1.

The first exhibit was an entirely new form of triode (fig. 1), which has been designed to give an increased signal strength with the absence of the usual parasitic and microphonic noises. The anode and grid of this triode take the form of hemispheres, nested one within the other, with a substantially uniform gap between them. The filament is of tungsten wire, and is formed into the shape of a semi-circle, and so arranged that it is concentric with the other two electrodes.

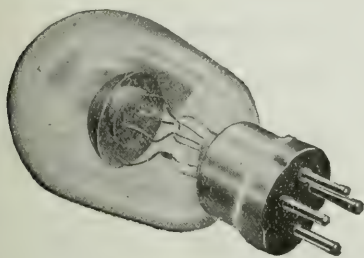


FIG. 1.—THE "R.M.R." TRIODE.

The bulb is so exhausted that there is a slight trace of gas left, so that the triode functions as a soft valve. The superior results obtained with this form of triode are due to the particular construction of the two hemispherical electrodes and can be explained as follows:—

Electrons moving in the same direction and each possessing

ably adjusting the electricity and position of the field, it is possible to produce a magnification of the signals received in the anode circuit.

Another most interesting feature of the "Thermagnion" is that, by further adjustment of the field, it is possible to produce ionic oscillation in the triode itself, so that a heterodyne effect is obtained and C.W. signals are detected.

A new type of recorder was also shown. In this, relays are operated by the "over-balancing" of an arrangement similar to a Wheatstone bridge.

The "Bungalyte" Set.

MESSRS. ARTHUR LYON & Co., 36, Victoria Street, Westminster, S.W.1, have sent us details of their small "Bungalyte" lighting set recently placed upon the market.

This set, which is illustrated in fig. 2, consists of a small 4-stroke air-cooled petrol engine, direct coupled to a 300-watt, 24-volt generator, together with a battery, switchboard, oil tanks, &c. Working on full load, the engine consumes 1 gal. of petrol in ten hours. The dynamo is constructed with laminated fields, and is fitted with a cooling fan. The set is put into operation by a simple mechanical starter.

The battery consists of 12 glass cells capable of lighting six lamps for 10 hours without recharging. The set was designed with a view to portability (the portable type weighs only 55 lb.), and occupies a space of 20 in. by 18 in. by 10 in.

The accessories supplied with the set include everything necessary for a lighting installation such as cables, lamps, switches, blocks, and other fittings.

An Improved Electric Lantern.

We have received from MESSRS. GABRIEL & Co., 4 and 5, A B Row, Birmingham, details of their improved electric lantern (fig. 3) which has been designed principally for the use of police and night watchmen. The light is provided by a 4-V. 4 c.p. lamp, energy for which is supplied by a "Bipol" battery capable of maintaining the light for 14 hours continuously. The case is made of tin or of "Clarus" aluminium alloy. A central combination switch is fitted in the top of the lantern, and in the middle of this is a tapping key for

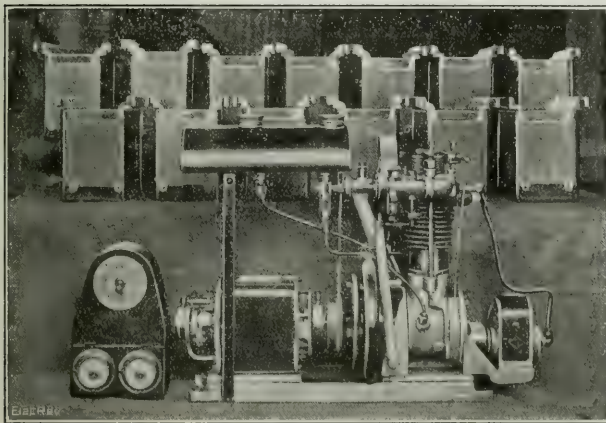


FIG. 2.—THE "BUNGALYTE" SET.

its own field of force, tend to mutual repulsion, so that in the ordinary cylindrical-anode type of triode a large proportion of the electron strain is diverted from this anode. In the case of the hemispherical anode there is a very marked increase in the discharge against the plate, the strays due to repulsion being reduced to a minimum.

Furthermore, the hollow rigid hemispherical form of grid has a natural mechanical period of vibration which is extremely short. In this way any vibration transmitted to the valve and thence to the grid is damped out immediately in the grid itself, and so does not give rise to objectionable microphonic noises so noticeable with the spiral wire form of grid.

The "Thermagnion" which was demonstrated is an entirely new method for magnifying signals, which operation has hitherto been accomplished by the aid of amplifiers and reaction circuits. In this case the simplest one-valve circuit is in no way altered, and the magnification is brought about by the action of a magnetic field exerted on the space occupied by the three electrodes of the soft "R.M.R." triode in such a manner that the positive ions can be controlled to advantage. By suit-

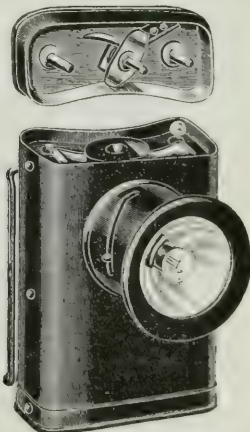


FIG. 3.—GABRIEL'S IMPROVED ELECTRIC LANTERN.

signalling purposes. A special feature of the lantern is a pair of contact sockets into which plugs can be inserted for charging purposes. These sockets can also be used to supply a small auxiliary lamp. The contact plate is of fibre, and is fitted with two contact springs on either side with a plate in the centre; it is arranged to carry a spare lamp bulb. A special focusing arrangement is embodied in the lantern. This consists of two telescopic tubes; the outer one has two slots cut in the top and bottom, and the inner tube bears two springs which fit into these slots. Focusing is effected by the movement of the knob seen in the illustration. The lantern weighs about 2 lb. A charging board is made by the firm to deal with 20 of these lanterns at a time. The board is fitted with a resistance, pilot lamp, voltmeter, ammeter, two-pole switch, fuse, and three terminals.

An Electric Egg Tester.

THE TELEPHONE & MICROPHONE CO., LTD., Throwley Road, Sutton, Surrey, have sent us particulars of their egg tester, illustrated in fig. 4, p. 80.

The case is made of solid oak, varnished and polished, 7½ in.

by 34 in. by 12 in. deep. The aperture for the egg is marked by three radium points, thus enabling testing to be carried on in the dark. The egg, when placed in position, automatically switches on the light, which allows both hands of

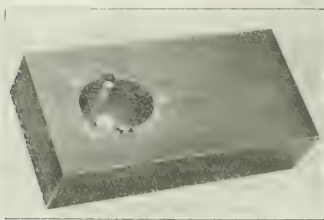


FIG. 4.—AN ELECTRIC EGG TESTER.

the operator to be free and the testing to be done with great rapidity. The lamp is attached to the base of the case, the current being supplied by an ordinary flash lamp battery.

HYDRO-ELECTRIC PROBLEMS IN SCANDINAVIA.

THE annual conference of the Swedish Hydro-Electric Association (Vatten Kraft Forening) was recently held at Stockholm, when Mr. Dahlander, in declaring the proceedings open, stated that during the critical times of the war the Swedes had learned how to appreciate the value of their water power. The time of high coal prices, however, was past, and it was, therefore, of special importance to reduce the costs of erecting hydro-electric works.

Mr. Sven Lubeck then read a paper on water-power questions in 1921. He said that the rapid development of the unfavourable situation of trade had also impressed its mark on water-power conditions in Sweden. Notwithstanding the great demand for water power which was evoked by the scarcity of coal during the critical years, the more extended utilisation of waterfalls was only forced where special reasons existed for doing so. This was due to the rapidly growing cost of buildings and of machinery. The author stated that at the close of 1920 the plant installed in hydro-electric works in Sweden represented about 1,200,000 h.p., while works for a further 360,000 h.p. were in course of construction, of which 235,000 h.p. was for the State and 125,000 h.p. for private owners. These works included the State works at Motala, the Porjus extension, and the Bergslags power station which were approaching completion, whereas the works at Långfossen for the Sandviks Ironworks, and Harsprang, had only progressed to an inconsiderable extent. The ironworks company had applied for an extension of time for the completion of the works in order to be able to do so at a more reasonable outlay, but the Board of Trade had opposed the application for the reason, among others, that by being compelled to construct quickly the company would be prevented from making a profit arising from the situation. Such an argument was actually brought forward, the author remarked, at a time when similar works for State account were for well-known reasons being restricted or suspended. Thus Parliament had decided that the preparatory works at Harsprang were to be completed and the remainder discontinued. Yet it had been proposed to base an electro-chemical industry on the power of the Harsprang works, but this was deemed to be hopeless in the face of foreign competition, having regard to the cost of completing the Harsprang works and the resulting price for energy, the cost of other raw materials and the labour difficulties.

Major H. Johansen, of Christiania, who introduced the subject of inter-Scandinavian transmission of power, pointed out that according to estimates, Norway possessed a water power capacity of 15,000,000 h.p., which would not only meet the requirements of the country itself, but would also permit of the export of a considerable amount of energy to neighbouring countries. By means of tables prepared from his own calculations, the author showed that the price of power imported into adjoining countries from Norway would be as low as 3 ore per kWh, as compared with the present Swedish sale price of about 5 ore per kWh. Direct advantages would be derived by Swedish industries through the import of power from Norway because the industries were dependent in a great measure upon the imports of coal, which were frequently uncertain. The requirements of Denmark could also be met by Norway; Sweden would need all her power resources for herself, and would have no surplus to export.

Mr. B. Borgquist, who dealt with the same question from the Swedish point of view, expressed the opinion, having regard to the long distance of transmission—750 kilometres from Hardangerfjord-Sweden-Copenhagen, that such a line would not prove to be remunerative until a considerably greater load was obtainable than could be procured at the

present time. If consideration were also given to the risks which were incidental to the starting of new works on account of the deflation now in progress, it could be foreseen with great probability that transmission from Norway via Sweden to Denmark would not be brought about for a long period, probably ten years.

The author submitted that there were no opposing factors of practical importance as between Norwegian and Swedish interests concerning transmission to Denmark. Some surplus power was already being supplied by the Southern Swedish Power Co. to Zealand, and it would be possible to deliver power to a greater extent if the main line from Trollehattan were carried down to Skane, but that would have to be postponed owing to the present high cost. In general, the power produced in South and Central Sweden was cheaper than Norwegian, which would have to bear the cost of transmission.

Mr. A. S. Faber, of Copenhagen, discussed the problem from the Danish point of view, and said that a transmission undertaking in Norway would be self-supporting if the sale price of electricity delivered in Denmark could compete with that of coal and other fuels.

THE NATIONAL PHYSICAL LABORATORY.

(Concluded from page 67).

Electricity Department.—Electrical Standards.—Mr. F. E. Smith (now director of scientific research and experiment to the Admiralty) is of the opinion that at the present time the ohm and the ampere, which are the two fundamental electrical units, can be realised with as great an accuracy as the international ohm (by means of mercury columns) and the international ampere (by means of the silver voltameter), and he urges therefore that the time is opportune to revert to the ideal of 1863 and measure all electrical quantities in C.G.S. units. It is now possible to measure resistance, current, and voltage with a precision greater than is required by industry, and unless all values are stated within the limits of accuracy of measurement (not comparison) difficulties will certainly arise in the future. As an instance, it is possible at the present time by means of capacities and inductances to measure the frequency of a tuning fork, but unless the electrical quantities are in C.G.S. measure the frequency does not agree with that calculated from a direct measurement of the number of vibrations in a given time.

The Schuster magnetometer is practically finished, and measurements of the horizontal magnetic intensity will be made in the near future. To make the instrument an absolute one it might be modified so as to include an interior swinging coil; in this way the current could be measured. A design for a vertical force magnetograph has also been prepared.

General Electrical Measurements.—Some investigations on new magnet steel have been made and valuable results obtained. A new simple method has been tried for measuring effective permeability and energy losses in thin sheet-iron at radio frequencies. It consists in making up the thin iron rings into an inductance of toroid form with a single layer winding. The effective inductance and resistance of this wound ring are then measured by insertion in a wavemeter. Corrections for effective inductance of the winding without iron are small and easily made, and the accuracy of the method is within about 1 per cent. for permeability and a few per cent. for losses. A duplicate of the apparatus for magnetic testing has been installed which will allow magnetic research to proceed simultaneously with the test work.

A new method for measuring the effective inductance of four terminal resistances has been investigated which is of greater range than those developed by Campbell, but similar in principle. By comparison with a standard whose effective inductance was calculable, it was found that with a 1 ohm resistance the inductance could be determined to the nearest 0.01 microhenry.

A new method of measuring the capacity of condensers in terms of mutual inductance and resistance was found successful. It avoids the double "kick" obtained with the Carey-Foster method on the ballistic galvanometer; the method does, however, involve comparison of two practically equal throws. The accuracy is about 5 in 10,000.

Regarding wireless standards, an accurate comparison of the standard wavemeter has been made against the Abraham Bloch "multibrator." This apparatus produces a very peaky wave by means of three-electrode valves. Every harmonic from the 40th to the 150th can be picked out by the standard wavemeter. The average agreement over the range (2,000-7,500 metres), using a number of different inductances, was 1 in 10,000, and a report has been made to the Admiralty and will be published in detail shortly.

A new type of variable air condenser is being constructed which, it is hoped, will be an advance on any condenser yet made, from the point of view of permanence and accuracy. Amber insulation is provided, and the condenser will have a range up to 5,000 mmfd. Conjointly a standard self-inductance coil of 20 millihenries has been designed which will have spaced windings to reduce effective resistance and self-capacity. The design is such as to ensure constancy also. These two

pieces of standard apparatus will increase the range of the standard wavemeter to 20,000 metres.

A satisfactory method of measuring at radio frequency the high resistances used in connection with radio amplifiers consists in first shunting the condenser of a tuned wavemeter with the unknown resistance. Observation of the maximum current is made, and the high resistance is then removed and a fine low-resistance wire is inserted in series with the wavemeter and adjusted until the same current is obtained at resonance. Retuning of the condenser may be necessary on account of the capacity of the resistance. When equality of current in the two cases is obtained $S=L/CR$, where S =high resistance; L =inductance of wavemeter coil; C =capacity of wavemeter condenser; R =added equivalent series resistance, and the accuracy of the method is probably within a few per cent.

Apparatus has been installed for the investigation of the characteristics of thermionic valves, and mercury condensation pumps for the exhausting of the valves indicated vacuum pressures of one or two hundredths of a bar (1 bar=0.00075 mm. of mercury). The gauges available, however, do not allow of accurate measurements being made at such a pressure, and an associated investigation is in progress into other methods of measuring extremely low pressures. Valves of the standard types are being carefully measured for characteristics, when filled with various gases at different internal pressures. A research is also in progress into the use of silica in place of glass for the envelope and internal mounting of thermionic valves. The silica bulb will enable it to be raised to a much higher temperature during exhaustion, thus facilitating the elimination of occluded gases and the obtaining of a higher and more permanent vacuum.

Electrotechnics.—Since the a.c. work of a routine character has been very large, little opportunity has been available for special research work. Much of the work, however, is of a research nature. The number of instruments used for acceptance tests of steam turbo-generators continues to increase steadily, and the capacity of the plant for generating the alternating currents and voltages required has been outstripped by the progress of modern electrical engineering. Taking the work on tests of instruments used on steam economy trials of turbo-generators alone, these are now being carried out at a rate of about 100,000 kW a year, while similar tests for other than steam trials amount to practically the same figure.

There has been little opportunity to make a serious beginning on the research on the design of instrument transformers. Mr. Spilsbury has devised a new method of carrying out measurements of this nature, by which much higher accuracy in the measurement of small-phase angles, and of the departure of current transformers from the nominal ratio of primary to secondary current, can be obtained. The method is to use a high-ratio transformer to magnify the departure from perfection, using an electrostatic wattmeter as the indicating instrument. Incidentally the method has demonstrated how important stray magnetic fields are when large currents are used. When placed several feet away from such currents the high-ratio transformer may give quite an appreciable voltage in the secondary without the primary circuit being in use. For tests of this nature the transformer is turned round until the effect disappears. A lengthy series of tests by this method on a special current transformer of the highest quality showed incidentally that the small residual inductances of the standard tubular water-cooled resistances corresponded very closely with the calculated values. Work of this nature gives added importance to the reduction of the inductance of resistances for very large currents to the lowest practicable value.

In furtherance of the advancement of British electrical instruments, especially in foreign countries, the British Electrical and Allied Manufacturers' Association issued a joint publication, descriptive of the capabilities of apparatus made by its members, which was compiled by Dr. Rayner in order to give it the advantage of the experience and impartiality which might be obtained from its association with the Laboratory.

The experience of the staff has been much in request in relation to the work of the British Engineering Standards Association and the Electrical Research Association, and most of this work has fallen to Dr. Rayner. The work has included the drafting of specifications for several varieties of switchgear, the consideration of nomenclature and symbols, and the wave form of a.c. plant, especially from the point of view of avoiding interference with telegraph and telephone communication. The qualities required of oils to be used in insulating electrical plant, such as transformers and switches, have been among the subjects on which assistance has been given to the Electrical Research Association. Dr. Rayner has been chairman of a committee set up to draft a specification for such oils, which is practically finished.

Other committees on which work has begun deal with mica and porcelain. A special joint sub-committee to consider dielectric losses has been formed, and its present aim is to develop standard methods of testing materials at all frequencies used in the applications of electricity from 25 to 1,000,000 periods per second.

Regarding d.c. work, the further programme relating to the buried cables research is being proceeded with, and the information obtained at various times with cables of all kinds

has been used to supply to the Wiring Rules Committee of the Institution of Electrical Engineers complete tables of permissible currents for concentric and three-core i.p. cables used for distribution in buildings. Similar information to meet the special requirements of ship's wiring is now being supplied to the Admiralty. A special investigation has been carried out for the British Aluminium Co. regarding the contact resistance of clamped and bolted joints in aluminium busbars, and also the heating with current of bars and rods of various sizes and sections. Interesting results have been obtained, in particular, with regard to the proper conditions under which a satisfactory joint can be made with aluminium, and a formula was evolved which allows of the pre-determination of the resistance of joints of a given thickness, overlap and contact pressure. Tests have also been made with copper busbars and some switch contacts.

In the photometry section the provision of sub-standards for measurements of gasfilled lamps is still urgent, and the most promising line of approach seems to lie in the direction of a blue glass combination with a vacuum sub-standard. Early in the year the Board of Trade set up a committee to consider the improvement of the regulations dealing with ships' navigation lights, and a large amount of work has been done at the laboratory for the committee. One of the subjects has been the spectral transmission of coloured glasses with the object of attaining greater uniformity of practice and a more satisfactory glass for the starboard light. A design is being prepared for a suitable form of lens for the side and masthead lights.

An extended investigation of the candle-power of existing types of miners' lamps has been undertaken at the request of the Home Office Committee on this subject.

At the request of the Ministry of Transport, a number of motor car headlights, fitted with various devices for the reduction of glare, has been examined at the Laboratory. The method adopted has been that of measurement of illumination distribution along selected lines on a screen placed 72 ft. from the headlight.

At the request of the Director of H.M. Office of Works, the Laboratory has given assistance with regard to certain details of a design got out to suit the special conditions of the lighting of one of the galleries of the National Gallery. The principal objects of the research were to secure adequate illumination on the walls, while avoiding direct sunlight, and to diminish as far as possible reflections of objects and people in the glass covering the pictures. The arrangement evolved for a gallery running E. and W. has a ceiling covering the middle third of the room. Direct sunlight is kept off the pictures on the N. wall by a vertical screen placed outside over the ceiling. By making this of a suitable size and white on the N. side so as to reflect the light from the N. part of the sky, the illumination of the N. and S. walls can be rendered equal for practically all conditions of weather. The scheme avoids direct top light, which illuminates the people, and makes the reflections in the glazing of the pictures very troublesome. At the same time the sensation of glare is much diminished. For a gallery whose length is N. and S. a series of transverse screens is used to keep direct sunlight from falling on the walls.

The assistance of the Laboratory has also been requested by the Office of Works in the matter of the artificial illumination of the Houses of Parliament and public buildings.

The galvanometers, formerly working with Nernst spot lamps, have all been refitted with metal-filament gasfilled lamps which work at 10 volts 3 amps. The energy is furnished from a temporary a.c. supply run round the rooms, the step down from 100 to 10 volts being effected by transformers made in the department.

A satisfactory substitute has been found for Nernst galvanometer lamps in the form of lamp used for the Aldis daylight signalling lamp. This is a gasfilled bulb of 50-mm. diameter containing a double spiral filament capped with an ordinary Edison screw cap, and rated at 10 volts and approximately 24 amperes. The bulb is filled with argon and the lamp is intended to burn upright, though there is no reason to suppose that it will not burn satisfactorily in other positions if necessary. Its life at 10 volts exceeds 1,000 hours. With a lens of 8-in. focus and a galvanometer mirror of 3 metres radius, the "spot" has a brightness of over 1 foot-candle. If two or more of these lamps are used in series for economy of current, it is necessary to select them carefully, as these lamps vary considerably in current rating at the same voltage.

Metrelogy Department.—An investigation into the dimensions of Edison threads for lamp holders and caps has been undertaken for the British Engineering Standards Association. The object of the research is to find an international system of dimensions for lamp holders and caps of Colliath and ordinary sizes which can be adopted with reasonable degree of interchangeability between parts made to the new dimensions and those made to the existing American and Verband Deutscher Elektrotechniker systems.

Two "quiet" electro-magnetic clock units, for silent and balanced step-by-step driving or synchronising mechanism were examined and reported upon for the patentee, Capt. Craig, of Haslemere. This is a very ingenious arrangement, silent in action, and applicable for every second, or any agreed number of seconds. The question of the provision of a more satisfactory type of electric contact on the standard clock, to replace the mercurial one hitherto used, has been under

consideration for some time, and the form finally decided upon has been in use for several months with satisfactory results. It consists of a phosphor-bronze wire bent in a semi-circle and attached to the Invar pendulum rod, to the two horns of which a strip of platinum foil is fixed in tension. The system is pivoted, and moves in a vertical plane, the amount of drop being controlled by a detent. Below it a "gold" watch balance-wheel is fixed on a small adjustable carriage. As the platinum strip is carried to and fro by the pendulum it brushes over a small segment of the balance wheel, thus making a contact, the duration and intensity of which can be closely adjusted.

A "wireless" receiving and recording apparatus has been fitted up in the clock room, and will be a valuable additional help in determining the daily rates of the reference standard clocks.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

E.L.M.A. and Retrospective Lamp Rebates.

Ever since the Osram lamp was put on the market I have been a wholesale lamp factor to the trade, and although in a comparatively small way, my turnover for each of the last two years has been £6,000, entitling me to a rebate of 36 per cent.

To-day I notice that one of my user customers is graded for the ensuing year at 34 per cent., his previous grading being 28 per cent., and his purchases from me last year £1,800 net.

I have no grievance in so far as the new grading is concerned. It is, however, concerning the system of allowing retrospective rebates that I complain, because in the case referred to, a credit will have to be sent for the difference between 28 per cent. and 32 per cent. on last year's turnover of £1,800, which at 4 per cent. on the gross price of the lamps will mean exactly £100.

The same thing arises every year, but it seems unfair that a trader should be called upon to give back, as in this case, what represents nearly the whole of the profits made during the period referred to.

Perhaps the E.L.M.A. will recognise the hardship this causes, and perhaps also it may see its way to remedy this grievance, because in such cases a trader scarcely knows how he stands at the end of his financial year, nor can he possibly know what his annual net profits may be so long as this system of retrospective rebates is allowed to prevail.

Paratus.

July 5th, 1921.

Short-range Sea Horizons for Cable Ships.

During a recent voyage of the Telegraph Construction and Maintenance Co.'s cable ship *Colonia*, I carried out some very successful experiments with short-range sea horizons which I venture to think will be of interest.

In these experiments I was very ably assisted by the navigating officers.

It is well known that at night the horizon, except under very exceptional circumstances, cannot be used for obtaining positions, but by using a calcium light as a short-range sea horizon at a known distance, and manoeuvring the ship so as to get the required star vertically over this light, the altitude can be obtained. This operation repeated with two or more stars will give a very accurate position. In doing this it is best to use port helm, so that the calcium light comes in the clear glass of the sextant before being under the vertical direction of the star. Likewise, in the daytime accurate results can be obtained by a calcium light or a cask with a required interval between observations.

Although similar observations have been attempted before in daylight, the subject does not seem to have been taken up with regard to obtaining positions at night. Owing to the uncertainty of the ordinary sea horizon, the above method should overcome many difficulties.

When the sky is covered with cloud, which is frequently the case, it is impossible to obtain a star position at night, twilight, but the stars often show through a few hours later, and as by that time, the sea horizon has become invisible, excepting perhaps during a favourable moon, observation is still impossible. If by my suggested method a short-range sea horizon is arranged, then, at any time during the night, observations can be taken and position defined, provided that known stars are visible.

I am, therefore, inclined to think that with regard to cable-laying and repairing ships, this method may be of considerable importance.

I am hoping in the near future to have constructed a projectile flare to be thrown from a suitable gun to a known distance in any direction, so that at times when the sea horizon cannot be depended upon, or at night time, accurate

positions can be got without actually stopping the ship or altering course, provided the weather is moderately fine.

My experiments were facilitated by a dip table which has been recently published by Mr. Percy H. L. Davis, late of the Nautical Almanac Office, for the purpose of the correction of altitudes at given distances in yards for use with short-range found sea horizons. I understand that this table will be included in Inman's Nautical Tables.

Victor Campos,
Master, Cable Ship "Colonia."

June 24th, 1921.

A Mysterious Occurrence.

On a small mixed lighting and power plant, 220 volts d.c., two 220-volt lamps of 16 c.p. with carbon filaments, wired in series, with the middle point earthed, are used for earth detection.

Quite frequently one or the other of the lamps bursts with a loud report, and the fuse in circuit with the lamps blows.

On replacing with new lamp and fuse, both lamps give half light as normal.

The question which puzzles me is why the lamp should burst, as at most it only gets 220 volts and is a 220-volt lamp.

A. H.

July 5th, 1921.

Armature Core Bands.

With reference to "Armature's" letter on armature core bands, it is not stated whether he sweated up the bandings with clips of tinned copper, the solder being run in all round the wires on each band.

If not, I am confident that this will prove satisfactory provided the armature is balanced for absolutely steady running, which is very essential with high-speed machines.

With regard to the copper clips, there should be from four to six clips for each band on armatures up to half a metre diameter, and on larger armatures one clip for about every 25 c.m. of periphery.

G. E. W.

July 4th, 1921.

Abnormal Meter Records.

We have noted with great interest the letter from your correspondent, Mr. R. Forrest Preston.

The explanation is not difficult to see, but we think it might be interesting to your readers if a little competition were established. We are prepared to give a small prize to the sender of the first solution received.

We hope you will be good enough to insert this letter, because otherwise the publication of the letter as it stands is calculated to damage the reputation of the Ferranti meter.

Ferranti Limited.

R. H. SCHOFIELD,
Sales Manager.

Hollinwood.

July 11th, 1921.

Sawdust as Fuel.

The sawdust and wood-refuse burning plant to which you refer in your editorial reply to Mr. Schneidau, as carried out under my instructions, is part of the plant of a large saw and wood conversion mill in England, operated by steam power, the steam being provided by burning the wood refuse.

I employed a modified method in two other saw mills, one in England and one in Burmah. If Mr. Schneidau will say how much sawdust he has to dispose of per day or week, and whether it is available as in the case of a saw-mill producing it by machinery operated by steam power, it might be possible to suggest a suitable means of utilising it.

W. Worby Beaumont.

London.

July 11th, 1921.

Charges for Service Mains.

With regard to "Disgusted's" letter in your issue of July 8th, respecting charges for service mains, this is only one of the many annoyances we wiring contractors have to put up with. The reason of the charge is the high cost of material, &c., at present, and the idea that if our clients can afford to have an electrical installation carried out in these times they can afford the extra expense. I, personally, have lost a good many contracts through these charges.

It has been said many times that the use of electricity is in its infancy, and according to the present rate of progress of electrical distribution in this part of the country it will be another century before we get going at all. The well-to-do classes recognise electric lighting, &c., as a necessity, while the working classes, who would be most benefited by it, regard it as a luxury because it is not available. There is more revenue waiting for the supply companies in 100 feet of frontage of working-class property than they will get from a similar

frontage of higher-class property, as the average frontage is 15 feet, two or more families live in one house, rooms are dark, and washing is done at home. The working-class people are the same people who have built up the big multiple-shop concerns, and will do the same for the electricity supply undertaking which will tackle the problem in the right way and cater for them. Of course, there are difficulties in the way, and we cannot think that the gas companies had roses from the start.

The electrical industry in this country seems to be fast asleep, from which it can be assumed that it pays large interests to let it sleep.

Controversies are waged over systems of distribution, methods of interior wiring, pressures of supply, whether a.c. or d.c., and, if a.c., phase and periodicity. No attempt is made to grade classes of interior wiring, or the workmen either, or to standardise accessories or other fittings. We allow other trades to retail electrical goods, while we fail to get the goods of other trades allied to our own at trade terms.

We also allow the newest part of the electrical industry, wireless telegraphy and telephony, to pass into the hands of the Government and its progress to be retarded for years.

In the electrical world there does not seem to be any team work, and it is time we woke up and started business. I have various suggestions to offer to help achieve this, which your readers will no doubt be able to improve on.

J. A. G.

London, N.W.
July 11th, 1921.

LEGAL.

WESTON ELECTRIC LAMP CO. v. STREET.

At the Shoreditch County Court on Friday, before Judge Cluer, the Weston Electric Lamp Co., of 1-3, Sun Street, Finsbury, E.C., sued Mr. Street, of 123, Hill Street, Peckham, dealer in electrical lamps and fittings, for £5 3s. 6d., for goods supplied. Mr. Cripwell appeared on behalf of the plaintiffs. The delivery was proved to Alfred Street, and the man who had been served with the summons said he was that individual. He admitted the signature, but said the goods had nothing to do with him, but were for his son's business. His son was aged 22 years, and dealt in electrical goods, using the front window of his (defendant's) shop to show them off. Defendant was a hairdresser, and always had been, and he knew nothing about electric lamps and bulbs.

Judge CLUER: I see the customer's signature to the order is "B. Street."

Defendant: That is my son. I am a hairdresser, and don't understand the goods.

Mr. CRIPWELL: But you have served customers with them. Defendant: I might have done if my son was away.

In further answers defendant said he did not know exactly where his son lived, but he used the Peckham address. He was sometimes away for months. Certainly he was at home on Sunday, but he did not know where he lived.

Judge CLUER: That is the answer of a hairdresser, and not an honest man. He might just as well say he does not know where a twenty-month-old baby lives because it is out in the pram. (Laughter.)

Continuing, the defendant said that so far as he was concerned, he had nothing to do with the goods, and none of them had been used in his business.

Judge CLUER said it was evident they had got hold of the wrong man, so the summons would have to be dismissed against this defendant, with costs, and it would have to be re-served on the son.

The father promised to do his best to get the son's address.

RIO TINTO CO., LTD., v. BROWN, BOVERI & Co.

As briefly reported in our last issue, in the Commercial Court of the King's Bench Division on July 5th, Mr. Justice Bailhache began the hearing of an important action for damages for alleged breach of contract brought by plaintiff company against defendants, the action relating to the construction of an electric railway in Spain by the defendant company for the plaintiffs.

Sir John Simon, K.C., Mr. R. A. Wright, K.C., and Mr. F. Baber appeared for the plaintiffs. Mr. Douglas Hogg, K.C., Mr. Eustace Hills, K.C., and Mr. W. A. Jowitt represented the defendants.

Sir JOHN SIMON, in opening the case, said the defendants carried on business at Baden, Switzerland. The subject matter of the contract between the parties was the supply, erection and handing over in full working order of all the material and plant needed for working the traffic on a railway which the Rio Tinto Co. had between their mines at Rio Tinto, in the South of Spain, and the port of Huelva, about 50 miles. This railway was extensively used both for mineral traffic and certain kinds of passenger traffic, and it had hitherto been worked by steam.

The question in the case was primarily whether, as the plaintiffs alleged, the contract survived and had been

repudiated by the defendants. The defendants, on their side, said that first of all the people who repudiated were not themselves but the plaintiffs. Then they set up the further defence that the contract had in the circumstances become frustrated by supervening illegality. They suggested illegality by Swiss law, inasmuch as they said that the Swiss law or the operation of the law prohibited the export of machinery and plant of this kind, to which the short answer was that it only did so subject to provisions for licences, and as a matter of fact there was abundant export by this company of this particular plant. Secondly, the defendants suggested supervening illegality by English law, viz., the illegality of the plaintiff company paying anything to the Swiss company if the latter was getting any of its supplies from Germany or Austria—to which the answer was that a very small portion of the whole would come under this stipulation, and in any event, the Rio Tinto Co. was in a position to get the necessary licence supposing that the defendants had been in a position to fulfil their obligations. The Rio Tinto Co. was a company which played an extremely important part in connection with the munitions output in the war, and had been in the closest relations with our own fighting departments, and the authorities here were very anxious to facilitate in every possible way the output of the Rio Tinto Co., for it was by that company's output that the sulphuric acid for the manufacture of high explosives was produced in the necessary quantities.

There was a further defence suggesting that the contract was in some way put an end to by *force majeure*, to which the answer was that there was not a *force majeure* clause in the contract. As a last resource, the defendants brought in a reference to the Courts Emergency Powers Act for relief.

The contract was dated July 3rd, 1914. There were two turbo generators, and they were in fact manufactured. What was rather surprising was that having manufactured them the defendants disposed of them to other purchasers in preference to the plaintiffs. There was equipment for six substations, each containing two transformers. There were to be two complete three-phase transmission lines, complete overhead trolley line equipment, and 12 electric locomotives, and these things were to be supplied and erected in full working order so that the plaintiffs would have a properly equipped electric railway. There were certain things that the Rio Tinto were to do, such as to erect the buildings necessary to contain the electrical plant. These things they had done, and spent some £20,000 in making preparations to receive this plant.

The defendants in Switzerland had made nearly all the plant. They had performed their part of the contract as far as the construction of these things was concerned, but instead of supplying them and putting them up in Spain, they had sold them to other people. The contract price for the work was £153,000 sterling, which was to include delivery alongside the plaintiff company's pier and the complete erection. The contractors undertook completely to deliver up the whole plant so that it was ready for working within 18 months of the date of the contract. That would carry them to the early part of 1916. There was a penalty clause of £400 penalty a week. Also there was to be attached to the contract a list of firms to whom the contractors might sublet part of the work, but they were not to sublet to other firms without the consent of the company. The only reference to *force majeure* began by saying the contractor took the risk of executing the contract, and said it was understood the contractor should not be liable for any damages due to *force majeure*. Also, the contractors appointed Brown, Boveri & Co., of Caxton House, Westminster, as their agents.

For some time, counsel went on, the defendants treated this contract as a thing they were dealing with and pursuing, but the scene changed in the early part of 1916, when they found themselves overwhelmed with orders from other quarters. It was not true that the plaintiffs repudiated the contract, or that the contract had collapsed or been brought to an end by the circumstances of the war. The truth was that down to 1916 the parties were treating themselves as contractually bound to one another. Then it suited the defendants to treat the plaintiffs as people with whom they had no contract, and they rapidly assumed that position.

His LORDSHIP: When do you say the contract was completely broken?

COUNSEL replied that defendants put it on record that they treated the contract as completely broken by letters in 1919. But in 1916 they were taking up the position that they were only prepared to deal with this contract upon the basis that they were given new terms and new prices.

Evidence was then given.

Mr. HOGG, for the defence, submitted that there was no case for him to answer. First of all, this was a pre-war contract. Secondly, it was a contract which by its terms contemplated that some of the work would be sub-contracted, and of course it was manifest that some of the work would be contracted with Germany and Austria. Thirdly, when the defendants told the plaintiffs in terms that the contractors whom the former proposed to employ included not only a very large number of Germans, but with regard to some items, nothing but them, the plaintiffs replied that the defendants were perfectly at liberty to do it. So that from that date they had an express agreement that defendants might supply German material. At the end of 1915 the plaintiffs said in terms, "We

will not pay you for goods of enemy origin." The position then was this: having a contract under which by its terms the defendants were entitled to supply German goods, and being a neutral country they were, of course, at liberty to get German goods, the plaintiffs said, "If you supply goods which under the contract you are entitled to supply and we are bound to accept, we shall not pay for them." That was as clear a repudiation of the contract as one could have. It might be that the plaintiffs could not have paid for them without committing a breach of the law over here. He rather gathered from the plaintiffs' evidence that that answer was not open to them, because they could have got a licence if they had tried, but whether they could or could not, they told the defendants in December, "We cannot and will not perform any part of the contract if you deliver goods which under the contract we know you intend to deliver and are entitled to deliver." The defendants, further, were saying quite plainly in 1916 that inasmuch as both sides could not perform the contract according to its terms, it would have to be modified. It was clear that by the end of 1916 both parties had acquiesced in the position that although the defendants still wanted to do the work when it became possible and the plaintiffs also wanted it to be done, the terms upon which it was to be done were to be a matter of negotiation between them, and these terms had never been arranged. The contract was ended at the latest by the end of 1916.

When the hearing was resumed on July 6th, Mr. Hogg stated that since the adjournment the parties had been discussing the matter, and he thought they had arrived at a settlement. His clients, however, were a Swiss company, and they had to get confirmation from Baden. They therefore wished the case to stand over until Friday, when it was hoped there would be an end of the case.

His LORDSHIP agreed.

HASTINGS CORPORATION AND THE TRAMWAYS CO. THE ARBITRATOR'S AWARD.

MR. WILLIAM WEEKS SZLUMPER, barrister-at-law, and a member of the Institution of Civil Engineers, as arbitrator, has issued his award in the case of the Hastings Corporation and the Hastings Tramways Co. It concerned a point of controversy in the matter of the relighting on the line of tramways on the Front, which the Tramways Co. has to undertake under its Act of last year. The arbitration recently took place at the Surveyors' Institution, Westminster, as reported in our columns.

The Arbitrator states his award in the form of a special case, and explains that he has done so at the request of the Tramways Co. He proceeds to state that the facts were proved before him as follows: The current required for the lamps upon the existing electric standards of the Corporation along the route of Tramway No. 1 referred to in Sub-section 3 of Section 6 of the Hastings Tramways Act, 1920, was conveyed by means of a cable belonging to the Corporation laid in the roadway. The substituted electric lamps necessitated either a new cable or an addition to the existing one. It was contended on the part of the Corporation that the proper legal construction of the said Sub-section 3 provided that the company should at its own expense either lay a new cable or by addition to the existing one render it capable of satisfactorily conveying current to the substituted electric lamps. It was contended on the part of the company that the word "cable" in Sub-section 3 referred only to a part of the connection between the substituted electric lamps and the said cable of the Corporation, and that the provisions of Sub-section 3 did not place upon the company the obligation to lay any cable other than that necessary for connection between the substituted electric lamps and the cable conveying current along the route of Tramway No. 1. The Arbitrator states his decision in the following terms: "I award and determine, subject to the opinion of the Court, that having regard to the fact that either a new cable laid along the route of Tramway No. 1 or a sufficient addition to the existing cable is necessary in connection with the substituted lighting, the provisions of Sub-section 3 of Section 6 of the Hastings Tramways Act, 1920, place upon the company an obligation at their own expense to provide and lay such a cable or such an addition to the existing cable, and I direct (subject to my directions hereinafter made) that the company do pay to the Corporation its cost of the reference to be taxed, and that the company do pay costs of this my award which I have taxed or settled at the sum of £44 15s. 6d.

PRESTON ELECTRICITY UNDERTAKING.

According to the *Manchester Guardian* on July 3rd, the National Electric Supply Co., Ltd. of Preston, applied to Vice-Chancellor R. B. Lawrence, K.C., at the Chancery Court in Manchester, for sanction to be given to a scheme of arrangement with regard to the basis upon which the distribution of the profits and of the assets in a winding-up should proceed as between the various classes of shareholders.

Mr. E. J. Kinn (who appeared for the applicants) said the company was incorporated in 1889 with the object of carrying on the business of electric lighting and of producing and supplying electricity. The issued capital was now 16,545 pre-

ference shares of £5 each, 10,850 ordinary shares of £3 12s. 6d. each, and 100 founders' shares of £3 12s. 6d. each, all full paid. For the year ending December 31st, 1920, the gross profit was £20,052, and the assets shown by the balance sheet amounted to £288,572, against which were liabilities to trade creditors (£41,497) and sums borrowed from time to time on loan (£39,738). By a provisional agreement dated March 30th 1921, the Preston Corporation agreed to buy the undertaking upon terms which, Mr. Kerr said, would work out at a total of £266,000; £61,000 would be paid by the Corporation in cash and the remaining £205,000 would be satisfied by the issue of mortgages secured on the borough rates. At present the agreement was only conditional. Doubts had arisen as to the rights of the various classes of shareholders with regard to the return of capital and participation in surplus assets in the event of a winding up, but a scheme had been approved at the meetings of the shareholders, and his Honour was now asked to give his sanction.

It was stated that a provision for payment of a fixed sum as compensation to the directors had been disclosed to the shareholders. The Vice-Chancellor said the payment was quite regular, but the Registrar must be satisfied that it had been disclosed to the shareholders. Subject to the filing of an affidavit on that point he sanctioned the scheme.

THE BASTIAN ELECTRIC CO., LTD.

PETITION DISMISSED.

THE petition of W. F. N. May and Another for an order for the compulsory liquidation of the above company was disposed of by Mr. Justice P. O. Lawrence in the Companies' Winding-up Court on Tuesday.

MR. DIGHTON POLLOCK, for the petitioners, said that last week they were paid £25, and they had now been paid out, and he asked for the petition to be dismissed.

Counsel for the company said it had been agreed that there would be no infringement of their patents, and that the petitioners would hand over certain management shares.

His LORDSHIP dismissed the petition upon payment of the petitioners' costs.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., v. A. W. GAMAGE, LTD.

MR. JUSTICE EVE, in the Chancery Division on July 12th, heard a motion for judgment in this case.

MR. J. WHITEHEAD, who moved on behalf of the plaintiff company, said that this was a patent action, and the infringement alleged was in respect of the sale and offer for sale of a certain wireless receiving set known as the "Polaris Receiving Set."

The motion was by consent, Mr. Eric Bousfield appearing for the defendants.

The terms provided for an injunction restraining infringement as set out in the settlement of claim, £150 agreed damages, and the destruction of infringing apparatus by dismantling and breaking up into their constituent parts.

Calumet Power Station of the Commonwealth Edison Co.

—The new power station at Calumet, which is designed to contain generators of 180,000 kW, will include the latest devices for economising energy. The boilers are of the Babcock & Wilcox type, built for a pressure of 350 lb. per sq. in., and a superheat of 250 deg. Fah., the temperature of the steam being 635 deg. Fah. Each boiler will be capable of evaporating 150,000 lb. of water per hour. Chain-grate stokers and forced draught will be used. The boiler tubes are 20 ft. long and four inches in diameter, and the total heating surface is 15,089 sq. ft., the superheating surface adding 4,000 sq. ft. The grate surface is 376 sq. ft., and the volume of the furnace 6,700 cu. ft., the head-room beneath the tubes being 20 ft. Induced-draught fans will be provided, and the steel chimneys will have a height of 167 ft. The economisers will have steel tubes and steel headers, of a total heating surface of 9,600 sq. ft. per boiler. The boiler efficiency is expected to be 74 or 75 per cent., to which the economiser will add 7 or 8 per cent. The temperature of the feedwater will be raised to 175 deg. Fah. before entering the economiser, to prevent condensation, with steam derived from the later stages of the turbines. Air heaters may be provided, reducing the temperature of the flue gases from 350 to 250 deg. and heating the air to 300 deg. Fah., but the probability of serious corrosion through condensation renders the use of air heaters doubtful, the coal containing nearly 5 per cent. of sulphur. Two generating sets are being installed, one having a General Electric 7-stage impulse turbine with maximum economy at $\frac{1}{2}$ load, and the other having a Westinghouse tandem compound turbine. Eventually the station will contain six sets of 30,000 kW at 85 per cent. power factor, 12,000 volts, 1,200 r.p.m. The condensers will have a surface of 52,000 sq. ft., and provision will be made for cleaning them whilst in operation. There will be four boilers to each generating set, and the boiler-room occupies two-thirds of the total building area. Fuel costs will be about 86 per cent. of the total operating costs. It is expected that the kWh will be generated with an expenditure of 19,000 B.th.u.

BUSINESS NOTES.

Bankruptcy Proceedings.—*Re* CHARLES AUGUSTUS CARPENTER, electrical engineer, Mason's Avenue, Basinghall Street, E.C.—Creditors under this failure met on July 11th, before Mr. W. P. Bowyer, senior Official Receiver at the London Bankruptcy Court. The chairman reported that the debtor had stated that he commenced business in June, 1917, with stock £100 and cash £50. Previous to that he was partner with Mr. W. R. Fardon, a contracting electrician, and their business was converted into Fardon and Carpenter, Ltd., which went into voluntary liquidation in 1914, the debtor being appointed receiver for the debenture-holder. He next started to make electrical apparatus, and in 1916 he was joined in partnership with Mr. O. Brink, but that partnership was dissolved shortly afterwards, Mr. Brink remaining in possession of the business in consideration of the £200 capital which he had introduced. The debtor next became managing director of C. A. Carpenter, Ltd., which was formed to exploit a patent burglar and fire alarm of his own invention. Twelve months later he resigned that office, and started business on his own account as C. A. Carpenter; the company of that name having changed to Alexander Bruce, Ltd. Early in 1919 the debtor was joined by two partners, and in March, 1921, the assets of that business were sold to C. A. Carpenter, Ltd., a private company, the debtor receiving 800 fully-paid £1 shares, and being appointed managing director, which position he still held. No accounts had been lodged; the debtor estimated his liabilities at £1,200; he had no assets, and he attributed his failure to losses in trading, difficulties with labour, lack of capital, two serious illnesses, the trade slump since December last, and the withdrawal of banking facilities. In the absence of any offer, the case was left to the Official Receiver to be wound up in bankruptcy.

Re JOHN HENRY TOMS, electrical engineer, 16, Cecil Road, Muswell Hill, trading at 13, Gray's Inn Road, W.C., under the style of J. H. Toms & Co.—The first meeting of creditors in this case was held on July 11th before Mr. Walter Boyle, Official Receiver, at the London Bankruptcy Court, when accounts were presented, showing total liabilities £1,985 (unsecured £1,693), and net assets valued at £193. The chairman reported that it appeared from the debtor's statements that in June, 1918, he commenced business as above, but he had no partner; his capital of £75 was raised on a bill of sale for £100 over his household furniture, but that amount proved insufficient, and he had recourse to professional money-lenders. During the first 12 months, the trading did fairly well, and he reduced the amount on the bill of sale, but after the Armistice it dropped away, and requiring further capital, he renewed the bill of sale twice, eventually paying it off out of a loan of £500, the balance of the loan being used in discharging personal debts. The business was brought to a standstill by the action of creditors, who levied execution at the Gray's Inn Road premises. The failure was attributed to want of capital and heavy interest charges. Mr. H. J. de Courcy Moore, chartered accountant, 2, Gresham Buildings, E.C., was elected trustee to wind up the estate in bankruptcy.

K. H. KERR & Co., electrical accessories manufacturers, Barr Hill Works, Dalbeattie.—At the meeting of creditors on July 5th, Mr. W. B. Galbraith gave an account of his investigations. A trading and profit and loss account from June 1st, 1919, to June 30th, 1921, was submitted, the loss on trading during the period being £810. The liabilities were £1,876, and the net assets £1,066. After discussion, the meeting resolved, with two dissentients, to recommend the acceptance of a cash composition of 10s. in the £, and the debtors were allowed 10 days in which to obtain the necessary financial assistance to pay the composition. A committee was appointed to advise with Mr. Galbraith.

WOLLMAN, H. M., electrical factor, lately carrying on business at 9, Gresbro' Road, Parkgate, near Rotherham.—Petition granted at Sheffield, on debtor's own petition, on July 5th. First meeting, July 19th; public examination, August 4th; both at Sheffield.

DALE, B. T., electrical engineer, trading at Erik Street, Newcastle-on-Tyne.—Trustee, Mr. Brittain, 15, Pilgrim Street, Newcastle-on-Tyne.

HEPHER, J. (trading as the Croft Electric Cabinet and Joinery Works), Spital Tongues, Newcastle-on-Tyne.—Trustee, J. A. Gardner, 24, Grey Street, Newcastle-on-Tyne.

SUTOLIFFE, G., Artillery, electrical engineer.—Order made on May 26th, suspending discharge for two years.

Catalogues and Lists.—BRITISH INSULATED AND HELSBY CABLES, LTD., Prescott, Lancs.—Publication P 167. An illustrated catalogue of paper-insulated cables of many types—single, twin, concentric, &c.—and of all sizes. Each type is illustrated, and full details of conductors, dielectrics, &c., are given.

MESSRS. COOKSON & Co., 25, New Oxford Street, W.C.—A leaflet giving prices, particulars, and illustrations of various accumulator accessories, such as hydrometers, india-rubber corks, voltmeters, &c.

THE WHITWORTH ELECTRIC LAMP Co., LTD., 195, North End Road, West Kensington, W. 14.—A priced, illustrated leaflet showing various types of opal glass bowl fittings.

THE VAUGHAN CRANE Co., LTD., Openshaw, Manchester.—A booklet (No. 8) of reproduced photographs of a number of electric crane and hoist installations and views of the company's works.

MESSRS. CLAYTON & SHUTTLEWORTH, LTD., Stamp End Works, Lincoln.—Publication No. 320. A well-illustrated descriptive catalogue of "Clayton" valveless crude oil engines of various sizes, many suitable for driving generators for farm work.

MESSRS. SALTERNS, LTD., Salterns Works, Parkstone.—A catalogue dealing with the development of water power, illustrating and describing several types of turbines and Pelton wheels.

MR. H. C. SLINGSBY, 142-146, Old Street, E.C. 1.—Publication No. 170, giving numerous illustrations and specifications of electric industrial trucks, tractors, &c.

Z ELECTRIC LAMP AND SUPPLIES Co., LTD., 73, Newman Street, W. 1.—A priced and illustrated booklet, advertising the "Electrolux" electric suction cleaner.

W. R. PATENTS, LTD., 8, Old Jewry, E.C. 2.—A folding card, illustrating the "W.R." CO₂ indicator with application card for booklet.

IGRANIC ELECTRIC Co., LTD., 147, Queen Victoria Street, E.C. 4.—An illustrated folder, dealing with various descriptions of coils for electrical purposes, embodying an order postcard.

THE GENERAL ELECTRIC Co., LTD., Magnet House, Kingaway, W.C. 2.—Leaflet O.S. 2,538. An illustrated and priced pamphlet, advertising a case for spare automobile lamps.

MESSRS. MELDRUMS, LTD., Timperley, near Manchester.—A priced and illustrated pamphlet, giving full particulars of the construction and use of the "Sack" portable steam-drier.

MESSRS. F. J. SHENTON & Co., LTD., 68 and 69, Shoe Lane, E.C. 4.—A price-list of silk-covered copper wire.

MESSRS. ARCHIBALD J. WRIGHT, LTD., 395, City Road, E.C. 1.—Two illustrated price-lists of electrical goods, including small instruments, accumulators, pocket lamps, magnetos, &c.

THE GENERAL ELECTRIC Co., LTD., Magnet House, Kingaway, W.C. 2.—Pamphlet S 2,352. An illustrated and priced publication dealing with "Fairlyland" strip, which consists of lighting cable in which lampholders are fitted at equal distances. It is intended for decorative illumination.

MESSRS. RAYNER & HEALD, LTD., Duke Street, Derby.—A stock-list giving details of squirrel-cage and slip-ring motors of various powers.

"ATTRACTA" ELECTRICAL Co., 11, Hanway Place, Oxford Street, W. 1.—An illustrated leaflet giving prices of "Auto" electric flashers for signs, &c.

MESSRS. SCHOLEY & Co., LTD., 56, Victoria Street, Westminster, S.W. 1.—A priced pamphlet illustrating and describing the "Croydon" electric suction and blowing cleaner. Also Pamphlet M 2, giving an illustrated description of fractional h.p. motors ranging from $\frac{1}{8}$ to $\frac{1}{2}$ h.p. Priced.

Dissolutions of Partnership.—CAYLESS & POTTER, electrical and general engineers, Gladstone Mews, Wood Green, Middlesex.—Messrs. H. G. Cayless & P. F. G. Potter have dissolved partnership. Mr. Cayless attends to debts, &c., and continues the business under the old title.

MESSRS. JOHN PALMER CASTLE and CYRIL JOHN ARNOLD, trading under the style of "The Electrical Equipment and Installation Co.," at 64, Finsbury Pavement, E.C., have dissolved partnership. All debts will be attended to by their solicitors, Messrs. Castle & Co., 31, Gracechurch Street, E.C. 3.

Trade Announcements.—MESSRS. LONDON FACTORS AND AGENTS, LTD., inform us that Mr. F. L. Strawson has left the board of directors, and has severed his connection with the company.

THE ALTON BATTERY Co., LTD., of Alton, Hants, has opened a branch office at 90-91, Queen Street, Cheapside, London, E.C. (Telephone No. "Central 8112"), under the management of Mr. D. Mackay Robertson, who will deal with the sales of A.B.C. accumulators in London and the Home Counties.

THE BRITISH ELECTRIC PLANT Co., LTD., of 66, Carrick Street, Glasgow, has removed its London office to 11, Upper Woburn Place, W.C. 1.

The new telephone number of MESSRS. A. VEEVY & Co. is "Victoria 3189," not 3180, as stated in our issue of July last.

The Cardiff branch office of the EDISON SWAN ELECTRIC Co., LTD., has been removed to larger premises at 25-27, Charles Street. The branch is now in direct touch with the company's works, instead of being a subsidiary branch working from Bristol. Mr. W. Elliott, B.Sc., A.M.I.E.E., has been appointed superintendent of the new district.

MR. W. DUNDAS FOX has opened offices and stores at 80A to 86A, Manningham Lane, Bradford, as an electrical and mechanical engineer and textile electric drive specialist.

MESSRS. FORBES & FOX, LTD., conduit fittings manufacturers, of Beehive Wharf, Brentford, have obtained the permission of the Board of Trade to change their name to that of "Pelican Electric, Ltd." Messrs. A. Fox and Mr. F. F. Whiteing are the directors. The works staff is the same, and the business is carried on at the same works.

German Iron Wire.—The Waterfalls Board has requested authorisation of the Government for the purchase in Germany of galvanised iron wire for high-power lines. The Board points out that, although the Swedish Government has emphasised the desirability of placing orders with Swedish firms, in the case in question there is financial disadvantage in purchasing the wire in Sweden, the Swedish quotation being 63 per cent. higher than the German.—*Reuter's Trade Service* (Stockholm).

Foreign Interest in Swedish Works.—A foreign firm is reported to have sought to acquire an interest in the Swedish electrical company of Luth and Rosén, but the negotiations have not led to any practical results. It is denied that Herr Hugo Stinnes was associated with the discussions.

Private Meeting.—FREDERICK VIGERS and CHARLES H. VIGERS, trading as Vigers Bros. Balfour House, Finsbury Pavement, London, E.C.—The adjourned meeting of the creditors was held on July 8th, at the Institute of Chartered Accountants, Moorgate Place, E.C., when Mr. Agar, who represented the Associated Importers, Ltd., was elected to the chair.

The statement of affairs, which had been prepared by Messrs. Tribes, Clarke, Painter, Darton & Co., chartered accountants, of Balfour House, Finsbury Pavement, E.C., disclosed ranking liabilities of £143,490, against net assets of £52,869, or a deficiency of £90,621.

The chairman said it would be recalled that the meeting was originally adjourned in order that a printed statement of affairs might be prepared and circulated while a committee was also appointed to consider the position. That committee had met and gone fully into the matter, and would make a report to the creditors.

Mr. Gordon Clarke (Messrs. Churchill & Sims) said he was one of the committee appointed at the last meeting. In the first place, the committee satisfied themselves that the partners had given all the information that it was possible for them to give, and the committee also satisfied themselves as to the assets of the partnership and the private estate. A close examination of the figures would show that the estate would not produce the 7s. 6d. in the £ which was suggested as the composition to be paid at the last meeting of the creditors. It appeared to the committee that the utmost which could be paid was 6s. in the £. His own opinion was that a dividend of that amount should be accepted. He read the full recommendation of the committee.

Mr. A. G. Westacott (Messrs. A. G. Westacott & Co.) said that he understood the scheme to be that there would be a deed of inspeachment, and the creditors would accept a composition of 6s. in the £. The creditors would accept that 6s. in full discharge if nothing unforeseen happened. The statement showed about 7s. in the £, but the creditors would accept 6s., and they were also given an opportunity of getting a further 9s. in the £. If liquidation took place after the 6s. in the £ had been accepted, the creditors would take 25 per cent. of the assets. He proposed a resolution in favour of the acceptance of the scheme outlined by the committee.

Mr. W. Crow seconded the motion.

The resolution was carried by a large majority, only the representative of one firm voting against it.

Three of the principal creditors were appointed to act as inspectors.

E.D.A. Activities.—The latest publication of the British Electrical Development Association (E.D.A. 175) is an endeavour to explain to the uninitiated consumer of electricity the necessity of a fixed minimum charge. It shows that even if the quantity covered by the charge is not used, the station plant and staff must always be ready to answer the call of the consumer. Moreover, it points out that the cost to the consumer of this tireless service is really small when spread over the year; indeed, in the average example quoted, it amounts to no more than 1½d a day even if no energy is used at all. It further explains that if the minimum is exceeded there is virtually no direct charge at all for the station's "readiness to serve."

Stoker Contracts.—Recent sales effected by the UNDERFERD STOKER CO., LTD., include the following for electrical stations:—

Wolverhampton, eight travelling grates; St. Helens, four travelling grates; Sheffield, two travelling grates; Newcastle Electric Supply, one travelling grate and air heater; Rotterdam, four travelling grates; Cosipore, India, four travelling grates; Poplar, Bury, and Bradford, ash conveyors.

Oil Fuel.—MESSRS. MELDRUMS, LTD., of Timperley, have recently received orders for oil fuel burners for the Bangor and Altrincham electricity departments.

The Electric Lamp Manufacturers' Association.—

Mr. J. E. Edgcombe, the director, notifies us that the address of the Electric Lamp Manufacturers' Association of Great Britain, Ltd., is now Elma House, 26, Bedford Square, London, W.C.1. Telephone numbers: "Museum 7828 and 7829"; telegraphic address: "Britelma, Westcent, London."

Trade Conditions in Australasia.—On June 30th ended one of the most trying periods for many years. The policy of deflation has resulted in a good deal of writing-down lately, much of which has been substantial. Owing to the prosperity inland and in town and country, buying stocks in the warehouses have been largely reduced, which, combined with the skilful handling of the situation by the banks, has resulted in only a low percentage of compositions. The favorable seasonal outlook is imbuing business men with a more hopeful feeling. In the opinion of an authority at Sydney, the outlook is uncertain, with a tendency towards an immediate mild revival of trade, attended by a partial rise in prices. Prices in New Zealand are generally firmer, warranting the opinion that a steady revival has set in, but the curtailment of imports, following unprecedented imports, has resulted in an almost acute shortage in some lines of necessities.—*Reuter's Trade Service* (Melbourne).

Withdrawal from Industrial Council.—By a large majority the Aberdeen Town Council, on July 4th, decided to withdraw from the Scottish District Industrial Council. The decision was made principally on account of the Corporation's disagreement with a re-arrangement of working hours and conditions of service made by the Industrial Council.

British Goods in Italy.—The Advisory Commission for Importation, representing the Ministry of Finance, has received a telegram from the Federation of British Industries' Commissioner in Italy, asking for a commercial amnesty for British goods stopped by the Italian Customs owing to the absence of import permits. The Commissioner observes that the goods are being ruined, while the Customs might secure considerable sums in the shape of import duties, and at the same time help the good relations between the two countries.—*Reuter's Trade Service* (Milan).

Australian Anti-Dumping Measures.—Mr. Massey Greene, Minister of State for Trade and Customs, introduced a Bill in the House of Representatives, on July 7th, to constitute a Tariff Board, composed of three members, to which the Minister could refer matters relating to the classification and value of dutiable goods, the necessity of Tariff and Excise increases and reductions and the granting of bounties. The Minister added that Parliament would retain the right of final decision in all matters. Mr. Massey Greene also explained a resolution to prevent dumping by countries whose currency had depreciated. The resolution included the imposition of special anti-dumping duties in addition to the ordinary Customs duties.—*Reuter's Trade Service* (Melbourne).

Electric Iron and Steel Furnaces in Brazil.—The Commercial Secretary to His Majesty's Embassy at Rio de Janeiro (Mr. Ernest Hambloch), has forwarded to the Department of Overseas Trade some notes on the Brazilian President's message to Congress at the opening of the first session of the new legislature. The President dealt at some length with the subject of the utilisation of Brazil's immense resources of coal and iron, and said that with a view to establishing not only the possibility of the manufacture of metallurgical coke from Brazilian coal, but also the cost of production of pig iron and steel in electric furnaces either with national coke or with charcoal, the Government sent to Belgium several tons of coal from the mines in Santa Catharina and Rio Grande do Sul, and appointed a professor of the Ouro Preto School of Mines to accompany and control the tests in first-class establishments. In the Coppée works of Belgium, metallurgical coke has been manufactured from Brazilian coal, with highly satisfactory results.

The experimental manufacture of pig iron and steel from Brazilian ore and Brazilian metallurgical coke or charcoal is to be carried out in electric furnaces in Sweden, to which country the necessary coal has also been sent. Simultaneously the Government is taking stock of the hydro-electric resources of Brazil.

The Esperanca (Usina Esperanca), in Minas Geraes is the only source of supply for national foundries and mechanical works. Its production of pig iron is approximately 15,000 metric tons per annum. The company hopes to erect within a short time small works for the manufacture of steel in an electric furnace.

One electric furnace is at present in existence in Sao Paulo with a capacity of 1,000 kg. for the manufacture of steel from pig iron, and besides this there is another small electric furnace for the melting of pig iron.

It is stated that the Companhia Electro-Metallurgica Brasileira will, by the end of the year, have in operation at Ribeirao Preto a factory for rolled steel, and be able to produce everything from pig iron in electric furnaces with charcoal to the most complex siderurgical operations.

The Anglo-Brazilian Iron and Steel Syndicate also intends to erect not far from the city of Rio de Janeiro iron and steel works which will employ electro-metallurgical methods.

Trade Conditions in Australia.—In its report for the year ended April, 1921, the Electrical Traders' and Contractors' Association of Victoria, says that while the conditions under which business has been conducted during the year have materially changed from those which existed at the time of the last report, it cannot be said that the hope then expressed, that affairs would soon have straightened themselves, has yet been realised. The transition period is not yet at an end, and industrial affairs still figure prominently in all commercial arrangements. "In addition, a world-wide trade depression, being the unavoidable reaction following upon the abnormal conditions of the war period, has taken place within the last few months, and all business men are faced with the problems arising out of the contraction of trade and falling markets."

Industrial affairs have occupied a good deal of attention. Last year the Association announced that licensing of wiremen was an accomplished fact. The Association was exceedingly sorry that it had been unable to secure the much needed licensing of employers, but it was hoped that before long this would be accomplished.

With regard to co-operation for improvement in the electrical industry, early in the year the question of the reorganisation of the Association, in order that this question might be completely dealt with in all its aspects, was referred to the members of the Inter-Trade Relationships Committee, who have spent a large amount of time and trouble in connection therewith, and a good deal of information regarding similar Associations in Great Britain and America has been obtained. As, however, the time which the members of this Committee had to spare to give to this important work was limited, it was decided to call in the assistance of an experienced trade organiser, and it was hoped that something in the nature of a definite recommendation would be available at the annual meeting of the Association to be held in June.

Argentina and Trusts.—The Chamber has passed a Bill for the repression of trusts.—*Reuter's Trade Service* (Buenos Aires).

Heating and Cooking Apparatus: Prices Reduced.—THE GENERAL ELECTRIC CO., LTD., has issued an announcement of a reduction of 15 per cent. in prices of "Magnet" electric heating and cooking appliances.

Commercial Monopolies in Italy.—The *Gazzetta Ufficiale* publishes a decree replacing the electric lamp monopoly by a tax on manufacture. Certain other articles are similarly dealt with.

Swiss Foreign Trade.—It is announced that the members of the Swiss Society for the Development of Foreign Trade have decided to dissolve the society. This decision has been arrived at inasmuch as the negotiations entered into between States and the various countries in Eastern Europe have shown that by a mere exchange of goods it was impossible to develop foreign commerce, owing to the existing international economic crisis and the complete transformation of the general economic situation which has taken place since the establishment of the society. The assembly which adopted the above decision, expressed a desire that the States' authorities should assume in future the task undertaken by the society, which included, besides the exchange of goods, services of information, commercial aid, organisation and transit of goods trains, and the utilisation of Swiss capital in foreign countries.—*Reuter's Trade Service* (Berne).

Outings.—A very successful picnic, arranged by the Liverpool Social Committee of the local factors and members of the N.F.E.A., took place on Saturday, July 2nd. A party of nearly 100 persons went for a charabanc drive to Llangollen. Luncheon and tea were partaken of at the "Woodlands," a large private residence taken over by the garage proprietors for catering purposes. In the interval between luncheon and tea impromptu sports were held on the recreation field attached to the house, and after tea Mrs. Crawford, wife of Mr. F. Crawford, of the General Electric Co., distributed the prizes. Mr. Crawford moved a vote of thanks to the Social Committee. Mr. Percy Davies (Messrs. Downes & Davies) seconded, and Mr. Tom Woods replied for the Committee. The hope was expressed that the outing would be an annual affair, as it was the means of bringing factors and contractors into closer contact with each other. The party drove back from Llangollen to Birkenhead in the evening.

An outing of the London staff of Messrs. Falk, Stadelmann and Co., Ltd., took place on Monday, July 4th. The party, numbering 630, travelled by motor-charabancs to Southend-on-Sea, where luncheon was served at the Palace Hotel. Following the loyal toast, Mr. Stockwell, the senior representative of the firm, proposed the toast of "The Firm," which was replied to by the chairman, Mr. Max Falk.

On Saturday last the employés of Messrs. S. Charlesworth and Co., electrical engineers, Oldham, held their second annual picnic, journeying by charabanc to Neston via Liverpool and Birkenhead. At Liverpool the party made a halt, and were shown over the show-rooms of Messrs. Downes & Davies. Mr. Batty, their Manchester representative, introduced the party, and conducted them over the premises. At Neston, dinner was partaken of, followed by a game of bowls. During the afternoon the party went for a run to Hoylake, and after tea returned, travelling via Chester.

British Trade-Mark Applications.—Appended is a summary of the recent applications for British trade-marks in respect of goods and productions connected with the electrical trades and industries:—

I.D. (lettering combined with design) No. 409,235, Class 5, Electric wire. No. 419,236, Class 6, Electrical machinery and parts. No. 409,237, Class 7, Electrical instruments. No. 409,238, Class 13, Electrical fittings of metal. No. 419,239, Class 16, Electrical fittings of porcelain or earthenware. No. 409,240, Class 18, Electrical installations. Ernestine J. G. Pacault, 18, Rue Van den Corput, Forest, Brussels, Belgium, October 29th, 1920.

Mercury, No. 407,984, Class 13, Sparking plugs. Wm. H. God and Walter God, trading in co-partnership, 309, Summer Lane, Birmingham, September 18th, 1920.

Gripac motor lock for cars and cycles. "A Policeman on your Motor" (lettering combined with design). No. 408,153, Class 13, Electric switch for use in connection with the starting gear of motor vehicles, so as to prevent theft. Motor Inventions, Ltd., 30-32, Ludgate Hill, London, E.C. September 24th, 1920.

Insulacra, No. 414,424, Class 50, Electrical insulating preparations and materials. Robt. Ingham Clark & Co., Ltd., 24, Grosvenor Gardens, London, S.W. April 19th, 1921.

Celestron, No. 414,855, Class 50, Electric insulators and electric insulating materials. Siluminite Insulator Co., Ltd., The Green, Southall, Middlesex, May 3rd, 1921.

N.E. (lettering and design). No. 414,331, Class 6, Electric motors and generators. North-East Electric Co., 348, Whitney Street, Rochester, N.Y., U.S.A. April 14th, 1921.

Wizza, No. 413,194, Class 13, An electric spark inductor for use in the ignition circuit of internal combustion engines. Kardoo and Elliott, 27, Russell Street, Brixton, S.W. March 8th, 1921.

For Sale.—Among the plant to be sold by auction at Bekebourne Aerodrome near Canterbury, on July 29th, by order of the Disposal Board, are:—Two 20 h.p. "Aster" petrol engines, two 1-kW E.C.C. dynamos, an electrically-driven centrifugal pump, cable insulators, &c.

Among the material to be sold by auction at Eastleigh Aerodrome, on July 28th and 29th, by order of the Disposal Board, are a 3-ton electric winch, electric motors from 1 to 20 h.p., portable electric tools, and a quantity of other electrical material, including motor starters, blowers, &c. For further particulars see our advertisement pages.

British Manufacturers and New Zealand.—The *Auckland Weekly News* says that Mr. A. Wyllie, the Auckland electrical engineer, referring to the arrangements made with regard to the purchase of the necessary equipment and machinery for the extension of the city electrical plant, said that when he left for Britain he was afraid he would not be able to carry out the scheme within the estimates that had been made. On his arrival he found that manufacturers were beginning to look for orders after a period of exceptional activity, and prices were beginning to fall. He therefore, left the date for the return of tenders as late as possible, with the result that excellent competition was obtained and good contracts were made. In view of this the scheme should be completed within the cost originally estimated. Mr. Wyllie added that the fact that he was able to notify tenderers that the Council would provide cash against documents was a strong factor in attracting competition among the manufacturers.

Foreign Trade.—JUNE FIGURES.—The following are the values of imports and exports of electrical goods and machinery in June:—

	June, 1921.	Inc. or dec. £	6 months, 1921. Inc. or dec. £
IMPORTS.			
Electrical goods, &c.	191,459	+ 67,087	+ 644,302
Machinery	783,364	- 934,533	- 2,217,577
Electrical machinery (included above)	51,463	- 43,605	- 215,102
EXPORTS.			
Electrical goods, &c.	877,190	- 335,170	+ 2,425,165
Machinery	5,285,130	+ 258,847	+ 17,297,462
Electrical machinery (included above)	330,787	+ 157,173	+ 1,508,814
RE-EXPORTS.			
Electrical goods, &c.	14,085	+ 3,816	+ 79,321
Machinery	102,092	- 57,828	- 157,349
Electrical machinery (included above)	712	- 1,531	+ 5,027

Ecuador.—A DWINDLING MARKET.—Machinery and apparatus was imported into Ecuador to the value of £220,000 in 1919 (the latest year for which statistics are available), as compared with £108,000 in 1918, and only £97,000 in 1917. It is not recorded exactly what share the United Kingdom took in this trade, but it is known that her share in Ecuador's total trade dwindled from 25 per cent. in 1917 to nearly as low as 12½ per cent. in 1919. The Consul-General at Quito says in his recent report that although the bulk of the trade of Ecuador has been carried on with the United States of America, local importers are now inclining towards the establishment of commercial relations with British firms to the exclusion of their American competitors. The following are some of the reasons to which this change of attitude may be ascribed:—

1. The high rate of New York exchange comparing unfavourably with that ruling for the £ sterling.

2. The long recognised superiority of British goods.

3. Increasing tendency on the part of Ecuadorians to avoid dependence in any form—commercial, financial, or political—on the United States.

If British manufacturers are prepared to offer facilities, and at least meet Ecuadorian merchants half way, there is every probability of a substantial increase of British imports.

At present, however, depression prevails owing to excess importation of manufactures and the poor demand for cocoa, which is Ecuador's staple export.

Waterways and Power Stations.—A joint conference of the Central Association for German Inland Navigation, the Main-Danube River Union, and the German-Austrian-Hungarian-Swiss Union for Inland Navigation has just been held at Munich in connection with the Waterways Exhibition in that city. The Prime Minister of Bavaria stated that the question before them was to endeavour to realise the long-discussed object of establishing a permanent connection between the Rhine and the Danube, the North Sea and the Black Sea by means of an adequate navigable network for ships up to 1,500 tons. The scheme included the erection of 45 power stations, having an annual production of 2,000,000,000 kWh, which were to be incorporated in the great ring of the Bavarian electricity works, and be of advantage also to Baden, Hesse, Wurtemberg, and the districts in Central Germany. It was expected that the revenue from the sale of power would suffice for the financing of the entire great navigable route. The General Minister of Communications said that Bavaria entertained the idea that the scheme should be carried out on a joint economic basis, and he suggested that a limited company should be formed for the realisation of the project.

High-Pressure Transmission in France.—The French Compagnie Electro-Mécanique is reported to have received an order for transformers and accessory apparatus in connection with the electrification of a part of the system of the Southern Railway Co. The transmission is to be at 150,000 volts, which is said to be the first at this pressure in Europe. The Compagnie Electro-Mécanique is a licensee of the Swiss Brown Boveri Co., and from the fact of its recent absorption of the French Westinghouse Co. is assured of the support of the American Westinghouse Co., as well as, it is stated, of the Metropolitan-Vickers Electrical Co.

Abolition of Polish Commercial Restrictions.—The *Journée Industrielle* learns from Warsaw that the Council of Ministers has decided to render trade in products free, as from September 1st next.—*Reuter's Trade Service* (Paris).

Book Notices.—"The Engineering Index, 1920" (586 pp.). New York: The American Society of Mechanical Engineers. Price 5s. This is the 14th appearance of an index which is compiled from the leading technical journals and the "proceedings" of technical societies in all parts of the world. It is impossible to indicate properly its very wide scope, but the method of arrangement enables the reader to find information on practically every branch of science and engineering. The brief *résumés* are adequate guides to the suitability of the articles included.

"Kelly's Directory of Merchants, Manufacturers, and Shippers of the World." Thirty-fifth annual edition. Two volumes. 64s. net. London: Kelly's Directories, Ltd., 186, Strand, W.C.2.—While it is true that these volumes appear, as the preface says, during a period of international unsettlement, it is equally true that they appear at a time when a host of British trade-seekers are eagerly intent on foreign trade expansion. This means that they are on the look-out for helps to information which will enable them to approach, with a certain measure of confidence that their time and money will not be wasted, possible buyers in the various overseas markets. New markets have to be found, and old connections remade, if we are to find an outlet for the very large production of which the industrial millions of these islands are capable. Whether we have representatives abroad or not, we all need volumes which contain directory information which can only be gathered together efficiently as the result of an experienced and well-organised central effort such as has been put forth by the compilers of the two bulky volumes that are now before us. When it is stated that this edition involved over 600,000 alterations in trade references alone, some idea may be gathered of the magnitude of the work. The books are largely used in other countries of the world, and, in view of the importance of foreign-trade activity on our part at this vital stage in our history, a strong effort is this year being made to extend their use at home. We hope it will succeed. It certainly should, for, to many traders, the volumes are well worth the cost.

Miscellaneous Publication No. 46 of the U.S. Bureau of Standards, "War Work of the Bureau of Standards" (229 pp.). Washington: Government Printing Office. Price 70 cents.—In this volume is briefly outlined the work carried out by the Bureau in a number of directions—chiefly for the military departments. Aeronautics occupies a large part of the publication, but practically every other science has its place. Tests were carried out on a wide range of subjects, from ink to ordnance.

Technology Paper No. 186 of the U.S. Bureau of Standards, "Oscillograph Measurements of the Instantaneous Values of the Current and Voltage in the Battery Circuit of Automobiles." (23 pp.). Washington: Government Printing Office. Price 10 cents.—This is an account of investigations into the demands upon starting and lighting batteries in various types of automobiles.

The Metropolitan-Vickers Gazette, Vol. VI, No. 39, June, 1921, contains illustrated articles on the visit of the Crown Prince of Japan to the Trafford Park Works, "Breaking Capacity of Oil Switches and Circuit Breakers," by W. A. Coates, M.I.E.E., "Salford Electricity Works Extensions," &c.

"Engineering Steels." By L. Aitchison. Pp. xxxii + 396; 119 figs. London: MacDonald & Evans. Price 25s. net. "Proceedings of the Physical Society of London." Vol. XXXIII, Part 4. June 15th, 1921. London: Elettway Press, Ltd. Price 6s. net.

"Power-House Design." By Sir John F. C. Snell. Second Edition. Pp. viii + 536, 20 plates, 201 figs. London: Longmans, Green & Co. Price 42s. net.

Australia.—The Australian Customs authorities have recently made some amendments in the Customs tariff, among which may be mentioned the following:—No. 180 (D), filament lamps for lighting and heating, British goods, 1s. per lb.; foreign 3s. per lb.; No. 181 (A) are lamps, n.e.i.; covered cable and wire, n.e.i., British goods free; foreign, 15 per cent.; No. 181 (B), cables and wires, cotton covered, British, 25 per cent., foreign, 40 per cent.

The Continental Lamp Trade.—Negotiations are reported to have been resumed by the Osram Co., of Berlin, with the Philips Lamp Co., of Holland, with a view to reaching an understanding.

Change of Address.—On July 9th the offices of our contemporary *The Electric Review and Tramway Journal* were moved to 37 and 38, Strand, W.C.2.

Short Time in Switzerland.—Swiss newspapers announce that Brown, Boveri & Cie., of Baden, are reducing the number of their clerical staff by 10 per cent. and the technical staff by 15 per cent. At the same time reductions in wages are taking place in accordance with an agreement between the engineering manufacturers and the Metal-Workers' Union.

A Profit-Sharing Scheme at Work.—The daily Press reports that under the profit-sharing scheme of Sir WILLIAM GRAY & Co., shipbuilders, West Hartlepool, the profit divisible for last year is £31,784, in which over 4,000 workmen participate. This is an average of nearly £8 per man.

Electric Steel Furnace for Spain.—La Sociedad Espanola de Construcciones Navales, of Bilbao, has lately placed a contract with the Electric Furnace Construction Co., of Philadelphia, U.S.A., for the supply of an electric steel re-heating furnace capable of dealing with 60 tons per 24 hours.

Lead.—MESSRS. JAMES FORSTER & Co., reporting under date July 9th, state:—"A considerable quantity of lead is arriving in the next few days, including several hundred tons of Broken Hill lead, 'Sulphide' brand, from Australia, 500 tons 'Perth Amboy' from America, and a large quantity from Spain, all of which is earmarked for consumption. The Australian lead is the first of any consequence since the strike, and it is singular that this shipment must have crossed lead on the way from London to Australia, as at least 1,000 tons were shipped in the spring."

"There has been quite a steady demand from consumers for delivery this month and during August. There is, however, very little surplus lead about, and a premium of 10s. per ton has been freely paid to obtain prompt delivery, but it is expected that the arrivals in the near future will ease the position."

"With labour conditions looking more settled than for a long time past, and a steady demand from the trade in prospect, the outlook points to less fluctuating markets at roundabout present prices."

Application for Patent Restoration.—An application has been made for the restoration of Patent No. 11,116, of 1914, "Improvements in or relating to electrical reactance coils," and Patent of Addition 8,433, of 1915, both of which lapsed on May 5th, 1918, owing to the non-payment of the prescribed renewal fee.

The Half-Year's New Companies.—In their list of company registrations at Somerset House, between January 1st and June 30th, 1921, MESSRS. JORDAN & SONS, LTD., include the following figures:—

Classes.	Totals.	
	Number registered.	Capital.
Electric and gas...	59	£481,600
Engineers...	191	1,310,990
Food...	233	4,765,095
Glass and china...	18	246,200
Iron, brass, &c...	190	2,771,500
Motors...	141	1,016,384
Oil...	19	5,513,500
Railways...	3	621,000
Rubber...	14	574,760
Telephones...	2	7,000
Totals (first half of 1921)...	3,125	£52,247,158

Corresponding figures in 1920 ... 6,415 £448,738,315

It will be observed that there is a great decrease in the number of companies registered compared with the corresponding period of 1920, a comparison of the huge totals attained during the then boom period with the meagre totals attained during the present trade slump being indeed remarkable.

A German-English-American Patent Agreement.—The following apparently inspired notice appears in the German newspapers:—"Already before the war the Siemens & Halske Co. had concluded an agreement with the European companies associated with the Western Electric Co. regarding the exchange of patents, the object of which was to spare both parties costly legal proceedings, and to render possible to each the undisturbed extension of its special system. The war rendered this agreement of no effect. Now, however, the agreement—a gratifying indication of the coming together of the interested industrial circles—has been renewed for a number of years. A similar agreement also existed between Siemens & Halske and the Automatic Electric Co., of Chicago; it has now expired, and its place has been taken by an agreement with the International Automatic Telephone Co., which is connected with the Automatic Electric Co. It refers to the extension and the exchange of patents concerning the Strowger automatic telephone system."

The Engineering Trade Outlook.—Interviewed by the *Financier*, Mr. T. W. How, M.I.Mech.E., chairman of the engineering section of the London Chamber of Commerce, said:—"The general impression is that as the labour troubles adjust themselves there will be a revival in the engineering trade. It will, however, be very gradual at first, but I think it should culminate next year in something approaching a boom. The price of engineering commodities will sympathetically recede with decreased working costs. "The question of surplus stocks, manufactured under conditions of high costs, may, perhaps, present initial difficulties in bringing down prevailing prices, but I think there will be a tendency to reduce profits and dispose of existing stocks expeditiously in order to create room for further production. Once the demand is created it is the wisest policy further to stimulate that demand by, whenever possible, a system of mass production, by which the prices of commodities can alone be lowered and thus preserve or even strengthen the wage status of the workers."

"It should not be forgotten, moreover, that in certain branches of engineering British workmanship excels, and its greater efficiency and durability will always command a higher price than that asked by foreign competitors. Taking this into consideration, I am of opinion that efforts towards lowering the cost of production must tend to place British engineering goods on an economically sound basis as regards foreign competition."

New French Companies.—La Société des Etablissements Labinal (Pièces Detachées de Mécanique et Appareils Electriques) is the name of a new company which has lately been formed in Paris (29, Rue de Londres), with a capital of 4,000,000 fr.

La Société Hydro-Electrique du Val-Vernier is the name of a new company which has lately been formed in Paris (12, Rue Castex), with a capital of 2,000,000 fr.

A German Scheme for Italy.—The management of the Italian Fiat Co., of Turin, has issued a definite denial of the report circulated that the company's works had been practically ceded to the Siemens-Schuckert Co., and that the latter had acquired 100,000 shares in the company with the object of its inclusion in the Siemens-Rhine-Elbe-Schuckert Union. What has really happened, it is explained, is that the German company last year sought to obtain possession of one of the Fiat departments for the construction of electric locomotives, and the negotiations, after interruption, were resumed recently. However, the Italian company found it impossible for the scheme to be realised at present, and on the same day as the report of the alleged cession was published at Rome, the German company caused a letter to be delivered to the Fiat company renouncing any further negotiations in the matter.

New Works in Australia.—The new works built at Waratah by John Lysaght (Australia), Ltd., for the manufacture of galvanised iron have, with their plant, cost over £250,000. They occupy 28 acres, and will produce 600 tons of galvanised iron per month. The employes number 225, and the wage bill is £1,400 per week. The company has built 64 cottages at a cost of £57,600, and the men may become owners of them on a 54 per cent. rent purchase basis. The electrical installation at the works generates at 6,600 volts alternating, and the machinery is all driven by d.c. motors.

LIGHTING AND POWER NOTES.

Aberdeen.—**EXTENSION OF SUPPLY.**—The Corporation electrical engineer has been authorised to enter into an agreement with the village of Dyce for the lighting of streets. The terms are similar to those fixed by the Corporation for the village of Stoneywood, five miles from the Corporation electricity works.

Australia.—**MELBOURNE.**—**YEAR'S WORKING.**—The reports of the City Electric Supply Committee and electrical engineer for the year ended December 31st, 1920, have just come to hand. The accounts show a total revenue from all sources of £303,539, as against £240,081 in the previous year. The total working expenditure was £187,339, as compared with £134,854 in 1919. The gross profit was thus £116,250, as against £105,227. Capital charges and other expenses not chargeable to revenue account absorbed £77,273 (£30,492), leaving a net profit of £38,977, an increase of £8,485. After contributing to town funds, a balance of £12,254 is carried forward. The total number of units sold rose from 33,113,841 to 41,954,531, an increase of 26.7 per cent. The maximum simultaneous load was about 18,300 kW.

ST. GEORGE (N.S.W.).—The St. George County Council has arranged a loan of £100,000 at 5 per cent. per annum for the purpose of carrying out an electricity supply scheme. The scheme provides for the lighting of 400 miles of streets, with over 2,000 street lights. The electricity will be supplied in bulk by the Railway Commissioners from the Illawarra power house, and the County Council will undertake the distribution to private consumers. Tenders are being invited for the work, receivable during July, and it is expected the work will be put in hand early in August.—*Reuter's Trade Service* (Melbourne).

Barrow.—**YEAR'S WORKING.**—The recently published report of the borough electrical engineer for the year ended March 31st last, records a total revenue of £87,068, as compared with £59,147 in the previous year. Working expenses amounted to £68,663 as compared with £46,368 in 1919-20, leaving a gross working balance of £18,405, as against £12,779. Capital charges absorbed £20,944, causing a net deficit of £2,539, which, however, compares favourably with the deficit of £4,488 upon the working for the preceding year. Large increases occurred in the number of units sold, and in the maximum demand; the former rose from 6,648,423, to 9,282,017, and the latter from 3,200 kW to 4,525 kW. The load factor (23.42 per cent.) represented a decline, and was the lowest for the last six years. The average price obtained per unit increased from 2.123d. to 2.218d.

Blackburn.—**PROPOSED TARIFF ALTERATIONS.**—The electrical engineer (Mr. P. P. Wheelwright), in his annual report, says:—"I have given careful consideration to the question whether an alteration in the method of charging would encourage consumption, and have come to the conclusion that this question would repay consideration. At the present time, many householders are considering the installation of electrical appliances for domestic purposes, and are being pushed by enterprising manufacturers and dealers. Owing to the system by which the charge for lighting is kept distinct from that for power, separate connections have to be made, which is a real obstacle to this development. Schemes of charging have been proposed which avoid the difficulty, and I shall be glad if the committee will instruct me to report specially on the subject for their consideration."

Bradford.—**DEMONSTRATIONS FOR CONSUMERS.**—Under the scheme for development of the use of electricity for domestic purposes at Idle and Thackley, the Bradford Electricity Department has opened a temporary showroom at the Old Chapel, Town Gate, Idle. In this connection, and for purposes of general domestic development, demonstrations in the home have been given at the Idle showroom, from July 4th to 8th, and at the city showrooms from July 11th to 15th, by Mrs. Reynolds, of the Western Electric Co., Ltd.

Brentwood.—**ELECTRIC LIGHTING ORDER.**—The Brentwood District Electric Co., Ltd., has applied for the Council's consent to the granting of an order to supply electricity for public and private purposes within the area, including the urban district. The matter has been referred to a Committee.

Chester-le-Street.—**LOAN SANCTIONED.**—The Urban District Council has received sanction to borrow £4,000 in connection with the electric lighting scheme.

Continental.—**FRANCE.**—*The Times* states that the Asnières power station, which supplies the north-western suburbs of Paris, was destroyed by fire on July 8th.

Cookham.—**ELECTRIC LIGHTING ORDER.**—Mr. H. Pinder Brown, who is applying for powers to supply electricity to Cookham, has asked for the support of the Rural District Council. The matter is to be considered at a future meeting of the Council.

Giffnock.—**ELECTRICITY SUPPLY.**—The Clyde Valley Electric Power Co. has acquired a site for a sub-station, and work is to be commenced shortly in connection with the supply of electricity to Giffnock.

Glasgow.—**ELECTRICITY AND GAS FOR HOUSES.**—In a report to the Corporation, the electrical engineer thinks that the best way of dealing with the new housing schemes would be to allot one area to the electricity department, and another to the gas department to save duplication of mains and services. If this were done he estimates that electricity could be supplied at a rate of 2s. per week, plus 4d. per unit consumed. He suggests that each electric house should have one coal fire for the provision of hot water for the whole of the house, and points out that the saving effected in construction would cover the cost of the electrical installations.

SINKING FUND.—It was recently reported that the Electricity Commissioners had intimated that they were prepared to sanction the borrowing of the £1,800,000 desired by the Corporation, on condition that the sum to be set aside for sinking fund be 4 per cent. per annum on the amount borrowed, and without any stipulation as to depreciation. This was agreed to.

Godalming.—**INCREASED MINIMUM FOR PUBLIC LIGHTING.**—At its meeting on June 28th, the Town Council approved an application from the Urban Electric Supply Co. to permit an increased minimum of £1,000 to be charged, in place of the present minimum of £600. This is equivalent to a charge for 16,000 units.

Hoylake.—**LOAN.**—The Hoylake and West Kirby Council has applied for sanction to borrow £1,000 for mains, services, and transformers.

Huddersfield.—**AREA MODIFICATION.**—The Corporation is applying to the Electricity Commissioners for an amendment of the proposed area of supply under the Huddersfield (Extension to Kirkheaton, &c.), Special Order, by the inclusion of the urban district of Marsden.

Kirkcaldy.—**YEAR'S WORKING.**—The annual report for the year 1920-21 of the electricity department records a total income of £40,737, as against £32,221 in the previous year. The total working expenditure was £34,914, as compared with £25,223, leaving a gross profit of £5,813 (£6,998). The net result, after payment of capital charges, was a deficit of £988. In the preceding year there was a net profit of £841. The total number of units sold was 3,785,544, and the average price obtained 2.578d.; the figures for 1919-20 were 3,178,397 and 2.429d.

Leeds.—**EFFECTS OF COAL DISPUTE.**—In a report upon the effects of the miners' strike, the manager of the Corporation electricity department estimates that the total loss during the whole period amounted to about £18,500. This was brought about to the extent of £16,250 by the high price of the "emergency" coal; the price averaged 52s. 6d. per ton, as against the pre-strike rate of 20s.

Leominster.—**SUPPLY FROM HEREFORD.**—With regard to the supply of electricity to the town of Leominster, by the Corporation of Hereford, the Leominster Town Council last week appointed a deputation to discuss the question with the Hereford Council and electrical engineer at a special meeting.

Liverpool.—**BULK SUPPLY.**—The Electricity Committee recommends that an application be made to the Electricity Commissioners for an order to enable a supply of electricity in bulk to be given by the Corporation to the Liverpool District Lighting Co., Ltd., and to authorise the laying of any mains or works in the City of Liverpool, the Borough of Bootle, the Urban District of Litherland, and the Urban District of Waterloo-with-Seaforth, which may be necessary to enable the supply to be given.

London.—**HAMSTEAD.**—The Borough Council has under consideration the cessation of generating its own electricity, and the conversion of the station to deal with a bulk supply.

It is reported that sanction to borrow £38,693, for works in connection with the St. Marylebone bulk supply has been received from the Electricity Commissioners.

COUNTY OF LONDON CO.'S BILL.—On Monday, the Bill was read a second time in the House of Commons, after a division. An attempt was made to block its progress, on the ground that it should wait until the Electricity Commissioners had concluded the inquiry which is now in progress, and made an order. Mr. Neal,

Parliamentary Secretary to the Ministry of Transport, stated that the Commissioners had an open mind on the question.

WOOLWICH.—The Borough Council has approved a recommendation of the Electricity Committee to apply for sanction to borrow £28,500 for the following purposes:—Mains, £9,500; services, £8,000; meters, £8,000; hire rentals, £1,600; and hire purchase, £1,500.

Manchester.—**BULK SUPPLY.**—The Electricity Committee recommends the sealing of an agreement with the Sale Urban District Council for the supply of electricity in bulk to that district.

Newcastle-under-Lyme.—**YEAR'S WORKING.**—The following are the results of working for the year ended March 31st last of the Corporation electricity undertaking (last year's figures are given in parentheses):—Total revenue, £7,816 (£6,285); working expenses, £5,295 (£4,078); gross profit, £2,521 (£2,207); net profit, £24 (£414). The total number of units sold rose from 264,039 to 303,145. Oil and gas fuel are used in this station, and part of the supply is bought in bulk.

New Zealand.—**AUCKLAND.**—The Minister for Public Works, Hon. J. G. Coates, said recently that the decision as to which hydro-electric power scheme should be first developed in the Auckland Province now depended upon the investigations as to which proposal would be the best economically.—Arapuni, with the new dam proposal, Araratia, or two other smaller schemes. The experts would work out the cost of transmission lines and construction work, and the way would then be prepared for a decision. One advantage possessed by Araratia, which was mentioned in the report, but was not generally appreciated, was that it could be developed gradually and yet economically. Arapuni, on the other hand, would not be really payable until they had a large development—say, about 40,000 h.p.—*Auckland Weekly News.*

Peterborough.—**LOAN.**—The Electricity Committee recommends application for permission to borrow £8,776 for the provision of low-pressure mains and feeders.

Richmond.—**PRICE INCREASE REFUSED.**—The Town Council has refused to allow the Richmond Electric Light Co. to increase its charges. It was stated that the average dividend of the company was 4½ per cent.

Rochdale.—**YEAR'S WORKING.**—The 1920-21 accounts of the Corporation electricity department show that the total income was £151,959 and the working expenses £105,212, leaving a gross profit of £46,747. After payment of interest and sinking fund charges £28,744, war bonus £1,895, a total of £30,639, less other receipts of £79, there remained a net profit of £16,187, as against £14,321 in the previous year. Of this amount, £7,000 was transferred in aid of the rates, and the balance to the reserve fund. The prices charged for electricity supplied for purposes other than lighting were further increased during the year, and became operative in the March quarter. The amount standing to the credit of the sinking fund is £83,250, an increase of £12,783.

LOAN SANCTIONED.—The Corporation has received the sanction of the Electricity Commissioners to the borrowing of £77,132 for work in connection with the electricity undertaking.

Sheffield.—**GERMAN PLANT.**—The Corporation's proposal to buy German electrical plant will receive widespread criticism, but it has no opinion. It requires a new 10,000-kW generating plant. The Amsterdam Corporation can supply this plant, of German manufacture, for £49,900. The lowest British quotation was between £90,000 and £100,000. There was a quotation from Switzerland of £80,000. The contract is subject to approval by the City Council on July 13th. The Electricity Supply Committee suggests that its general manager shall go to Berlin with the chief engineer of the Amsterdam Corporation to inspect the plant.—*Daily Mail.*

Shoreham (Sussex).—**APPLICATION FOR ORDER.**—Mr. Frank Gibbs, of Beach Shipyard, Shoreham-by-Sea, announces his intention to apply for a Special Order to enable him to supply electricity for public and private purposes within the urban district and the parish of Lancing. It is stated that this will necessitate the revocation of a part of the Brighton Corporation Act, 1903, which gave the Corporation powers of supply in this area and adjacent districts.

Southport.—**SALE OF OLD PLANT.**—As the whole of the new electricity plant is now in operation, the Electricity Committee recommends that the replaced plant be advertised for sale. As a result of the installation of the new plant, it has been found possible to dispense with the services of two fitters, two fitters' labourers, two stokers, one driver, and one switchboard improver.

NEW MAINS.—The Corporation electricity department intends to commence laying an underground cable to Ardsle. The purpose is that when the Corporation takes over the Blackale Supply Co., according to the terms of an agreement, it will have a good main cable on which to rely, as the present cable is old and decayed. The work will be completed by September.

Soyland.—**COST OF SUPPLY.**—The Urban District Council has received a communication from the Yorkshire Electric Power Co. stating that the company has prepared a preliminary estimate of the cost of supplying electricity in Soyland amounting to £9,000. The company has decided to consider the possibility of reducing the cost.

Swansea.—**YEAR'S WORKING.**—At a recent meeting of the town Council, the deputy treasurer gave the financial details of the past year's working of the electricity undertaking. The revenue amounted to £106,413, as against £77,391 in the preceding year. Working expenses totalled £80,550, as compared with £56,252, leaving a gross profit of £25,863 (£21,139). Capital charges were much heavier, on account of the capital raised during the year, amounting to £22,036. The net profit was £3,877, as compared with £4,406 in the previous year. It is claimed that the Swansea undertaking is the only one in which charges have not been increased by more than 50 per cent. above the pre-war level, and the results of working have justified the Electricity Committee's policy of keeping prices as low as possible.

United States.—**HARNESSING THE COLORADO RIVER.**—The plans of the Southern California Edison Co. provide for the impounding of the waters of the Colorado river and developing hydro-electric power on a huge scale for distribution over a wide area of the south-west. It is estimated that the project ultimately will involve \$800,000,000, or twice as much as was spent on the Panama Canal. It is contended that among the results of the project, when completed, would be:—Absolute flood control; provision for irrigation of 2,500,000 acres, of which 1,000,000 acres would be above the canyons; 300 miles of the river would be made navigable; the area which could be served with power includes the entire States of Arizona, Nevada, and Utah, more than one-half of Colorado and New Mexico, one-fifth of Idaho and Wyoming, and three-quarters of California, with possible large areas in Northern Mexico; power would be used for the electrification of steam railroads, as well as for commercial, agricultural, mining, and municipal purposes.—*Reuter's Trade Service* (Los Angeles).

Walmer.—**TIME EXTENSION APPROVED.**—The Urban District Council has agreed to six months' extension being granted to the gas company for carrying out the Electric Lighting Order of 1914.

Warrington.—**TEMPORARY PRICE INCREASE.**—Owing to the price of "emergency" coal, the Warrington Manufacturers' Association agreed to pay a temporary increase of 1½d. per unit for electricity. It is now stated that the temporary increase will not exceed 4d. per unit, and it is hoped that the increase will be less than 4d. per unit.

WATER POWER.—The electrical engineer has been instructed to report on the possibility of utilising water power at Woolston Weir for the generation of electricity.

West Bromwich.—**YEAR'S WORKING.**—The annual accounts of the Electricity Committee show that the total income of the electricity department for the year ended March 31st last amounted to £86,751, compared with £66,231, an increase of £20,520. The expenditure on revenue account was £67,382, an increase of £185 6. The gross profit amounted to £19,371, as compared with £17,354 last year, being an increase of £2,017. After providing for interest and instalments towards redemption of loans, there is a net profit of £7,893 to carry forward. The Electricity Committee has recommended that the balance standing to the credit of the new revenue appropriation account, viz., £3,926, be transferred to the depreciation fund account.

Willisden.—**STOLEN ELECTRICITY.**—The electrical engineer has reported to the Electricity Committee that his department has discovered an installation which has been connected to the Council's mains since February last—and not connected through a meter. Legal proceedings are to be taken against the person concerned.

Worcester.—**EXTENSION OF SUPPLY AREA.**—The Electricity Committee has deposited with the Electricity Commissioners a scheme for extending the area of supply to surrounding districts in South Worcestershire.

TRAMWAY AND RAILWAY NOTES.

Australia.—**MELBOURNE.**—The agreement between the Melbourne City Council and the Melbourne, Brunswick and Coburg Tramways Trust for the supply of electrical energy expired on February 28th. The Council has authorised the renewal of the agreement with the Tramways Board for a further period of three years at an increased charge of £100 per year. The agreement between the Council and the Melbourne Electric Supply Co., relating to the supply of electricity for the Hawthorn and the Prahran and Malvern tramway systems was also authorised to be renewed for three years on the same terms and conditions as before.—*The Age* (Melbourne).

Burnley.—**YEAR'S WORKING.**—The report of the general manager of the Corporation tramways for the year ended March 31st last emphasises the necessity of re-laying the remainder of the track as soon as possible. To illustrate the war that has taken place on lines that were laid in the years 1901-04, a series of diagrams of the track of various routes has been prepared and published in the report. The financial results were as follows, the previous year's figures being given in parentheses:—Total income, £180,792 (£168,601); working expenses, £68,140

(£137,952); gross profit, £12,652 (£20,649); net deficit, £9,752 (£2,096). The total number of car-miles run (1,774,198) represents a slight decrease upon the total for 1919-20; the number of passengers carried was also smaller by about a million.

Continental.—**ITALY.**—The electrification of the Sampierdarena-Ovada-Alessandria and the Milan-Bologna lines has been authorised. The former enterprise will be carried out by the maintenance department of the State Railways, while the supply of material and the work in connection with the latter will be entrusted to private enterprise. The route of the primary main intended to feed the sub-stations from which the Benevento-Foggia line is being supplied was also approved in principle, the system to be employed being that of direct current at high pressure. This main, which in its turn will be fed by plants belonging to private industry as well as from the plant now under construction by the State Railways, is so planned that it will also serve the Sulmona-Castellamare-Adriatico line and the coast line as far as Foggia when these lines come to be electrified.—*Reuter's Trade Service* (Milan).

Dartford.—**LOAN.**—In connection with the agreement entered into by the Urban District Council with the Bexley Council for the joint operation of the tramways, the Urban District Council has applied to the Light Railway Commissioners for sanction to borrow £2,000 for capital purposes, and £10,000 for repairs and reconstruction of the Dartford track.

India.—**CALCUTTA.**—The inquiry held at Calcutta as to the possibility of constructing tube railways in that town has now been completed, and it is understood that, from an engineering point of view, the idea is considered quite feasible.—*Reuter's Trade Service* (Bombay).

Kirkcaldy.—**YEAR'S WORKING.**—The total revenue of the tramways department, for the year ended May 15th last, was £40,525, as compared with £35,535 in the previous year. Working expenses amounted to £33,794, as against £25,949, leaving a gross balance of £6,731 (£9,586). The net profit was £621, a considerable decline from last year's profit of £3,720. The number of car-miles run (425,917) was slightly lower.

L.B. & S.C. Railway.—**ELECTRIFICATION.**—Sir E. Geddes said, in the House of Commons on July 11th, that the electrification scheme of the London, Brighton, and South Coast Railway had not been submitted to him for approval, but the proposals had been before him on request from that company for State assistance in providing the capital, for which, however, no public funds were available. The scheme had been considered by the Electrification of Railways Advisory Committee, and he was in agreement with its conclusions. The company was fully alive to the importance of proceeding with the electrification of the remaining portion of its suburban system, and at the present time was installing electrical equipment up to Croydon, which was a work of considerable size, and when completed would greatly relieve existing pressure. Future extensions, including the electrification of the main line to Brighton and other places, depended upon financial considerations, and far from the pupping of railways unnecessarily delaying such development, he was of opinion that the formation of a southern group under the terms of the Railways Bill would assist towards that end.—*Daily Telegraph*.

London.—**ACCIDENT.**—On July 8th a collision occurred at Wapping between a Metropolitan Railway electric train and a guard's van and some trucks which had broken away from a Great Eastern goods train climbing a gradient. The driver of the Metropolitan train and the guard of the Great Eastern train were killed; 13 passengers were injured.

"UNDERGROUND" SLUMP.—The Underground Railways of London have experienced a serious falling-off in the number of passengers carried during the first six months of the present year. The decrease amounts to about 20,000,000. The after-midnight services, which were suspended during the coal dispute, are not to be restored, and about 300 men are to be discharged in consequence.

Seaforth.—**TRACK REPAIRS.**—The Seaforth, Waterloo, and Great Crosby tramway track is to be repaired, and agreements have been made for borrowing the sums of \$1,416 and \$3,158 for this purpose.

Stockton.—**TAKING OVER OF TRAMWAYS.**—Regarding the taking over of that portion of the Imperial Tramways Co.'s system within their areas, Stockton and Thornaby have agreed that each Corporation shall own that portion of the permanent way and overhead equipment which lies within its own borough; the whole of the permanent way and electrical equipment at the Bridge Road and Norton depots belongs to Stockton, as do also the land and buildings at these depots; Stockton owns three-quarters, and Thornaby one-quarter of the miscellaneous stock, loose plant, tools, etc., and Stockton takes over 20 cars, and Thornaby nine. The amount due to the company for consumable stores was £24,924, of which Middlesbrough contributed £13,895, Stockton £7,384, and Thornaby £3,645.

Walsall.—**YEAR'S WORKING.**—The accounts of the Corporation tramways for the year ended March 31st last show a total income from all sources of £98,056, as compared with £82,534 in the preceding period. Working expenses amounted to £83,802, as against £70,400 in 1919-20, leaving a gross trading balance of £14,254 (£12,134). Capital charges absorbed £11,147, making the net result a profit of £3,107, a large increase on the previous year's figure—£979. The motor omnibus undertaking incurred a net loss of £9,941.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—**WIRELESS TELEGRAPHY.**—At the request of the Portuguese Government, arrangements are in progress for opening up wireless communication with Timor, Portuguese East India.

Since the occupation of New Guinea by the Commonwealth, the development of radio communication between the mainland and the islands has been rapid. Coastal stations in the north of Australia maintain a reliable service with Rabaul which, in turn, distributes for six or eight smaller wireless stations, originally erected for military purposes, but which are now utilised for public service. Communication is maintained between Cooktown, Samarai, and Misima (British New Guinea), and Port Moresby. Extensive alterations have recently been made to the Townsville station, but further increases are imminent. With the development of the service, certain stations became unnecessary, and the plant at Mt. Gambier (S.A.) and Roeburne (W.A.) was dismantled. It has become possible to meet all present-day requirements by direct working between Brisbane and Perth.

China.—**AMERICAN WIRELESS STATIONS.**—Replying to an inquiry by the Chinese Minister at Washington, the State Department declares that the United States will support the rights of the Federal Telegraph Co. under its contract with the Chinese Government for the erection of wireless stations at Shanghai and elsewhere, notwithstanding the protests of the British, Japanese and Danish Governments. The Department adds that communications on the subject received from the three protesting Governments tend to confirm the belief that their desire to exclude the American company is "founded upon assertions of monopolistic or preferential rights in the field of Chinese Governmental enterprises which cannot be reconciled with the treaty rights of American citizens in China or the principle of the open door."—*Reuter's Trade Service* (Washington).

AMERICAN PLANT.—It is stated that as regards telegraph and telephone requisites, Danish and Japanese manufacturers control the situation in China. According to the *T. and T. Age*, all the telegraph work is done on tape, and the telegraph sounder is unknown at the present time in China. Chinese characters are transformed into four-numeral combinations, and re-translated at the other end from the Continental numeral dots and dashes on the tape to the written numerals, and translated into the Chinese characters which they represent. The first American telegraph equipment is soon to be installed in the central office at Hankow. It consists of motor-generators, a storage battery plant, and a Western Union type pin-jack switchboard. The same kind of equipment will later be installed at Peking, to take the place of practically nothing in the way of inside switching devices. "When the two installations at Hankow and Peking are completed, no doubt the Chinese authorities will look to America for additional telegraph and telephone apparatus."

Czecho-Slovakia.—**TELEPHONE SERVICE.**—A revolt of telephone users has occurred owing, says the *Financial Times*, to a new law having been passed under which all who have a Government telephone must buy at least 6,000 kronen (£80) worth of Government bonds, the proceeds to be utilised for the improvement of telephones and telephone lines. Anyone who refuses to buy the bonds will have his telephone cut off.

France.—**WIRELESS DEVELOPMENTS.**—The report presented at the recent meeting of the Compagnie Générale de Télégraphie sans Fil stated that the company had obtained authority from the Argentine Government to establish and work a large station to ensure communication between Argentina and all countries in the world outside of South America and the investigations of the technical mission sent out would determine the form and conditions under which this undertaking would be carried out. Similar negotiations were entered into with other South American Governments, and certain of them were concluded early in 1921. The States directly or indirectly interested in the negotiations were those of Ecuador, Colombia, Peru and Venezuela. During the year the company participated in the constitution of the Roumanian company, Radioelectrics, with a share capital of 6,000,000 lei, and the company's licensee in Poland was developing satisfactorily. The Compagnie d'Exploitation Radio-Électrique, which was formed in 1919 specially for the working of ship installations, was yielding favourable results; its scope of action was directed in the first place to the French merchant fleet, and it was now beginning to extend beyond France. The report proceeded to refer to the contract concluded with the French Government last October for the construction and working of two transmitting stations, one for the European continent and the other for transmarine communication, and of one receiving station. The concession was for 30 years from January 1st following the date fixed for the inauguration of the stations, and at the expiration the stations would become the property of the State. As the agreement provided that the company must form a separate company to undertake the work, the Compagnie Radio-France was constituted for this purpose at the end of June, 1921, with a share capital of 60,000,000 fr. All the stations were already in course of construction; the two transmitting stations were rising in the district of Sainte-Aesée, near Melun, while the receiving station was being erected at Villecroques, 16½ miles distant from Paris.

New Zealand.—**WIRELESS TELEPHONY.**—The Minister for Public Works, the Hon. J. G. Coates, is considering the use of wireless telephones for lighthouses and other isolated places.

South Africa.—**WIRELESS TELEPHONY.**—The Railways and Harbours Administration is about to install wireless telephone sets at Port Elizabeth and Bird Island. Communication between these two places has hitherto been carried out by means of a pigeon post. (*Electrician, Private Messenger (Cape Town).*)

The Telegraph Service.—**DEFERRED PRESS SERVICE.**—The Colonial Office announces that in order to improve Empire communication the Pacific Cable Board is to reinstate the Deferred Press service between Britain and Canada on the one hand, and Australasia on the other.

Wireless Telegraphy.—The Portsmouth correspondent of *The Times* states that the Admiralty is considering the advisability of closing the wireless telegraph stations at Bathurst (Gambia), Demerara, Mauritius, Port Nolloth, and the Seychelles.

Wireless Telephony.—**LICENCES.**—In reply to a question in the House of Commons the Postmaster-General stated that the use of wireless telephony for ordinary purposes within the United Kingdom was impracticable, because of the unavoidable mutual interference between the various stations. Their objection, however, would not apply to the same extent in the case of communication between this country and abroad, and the issue of licences for the latter purpose was under consideration.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the **ELECTRICAL REVIEW** in which the "Official Notice" appeared.)

OPEN.

Australia.—**TASMANIA.**—August 15th. P.M.G.'s Department. Switchboard material. (July 8th.)

Battle (Sussex).—July 29th. Union. New accumulator plates for 28 cells. Sizes 16½ in. × 10½ × 8½ in. (See this issue.)

Belgium.—July 27th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. 45,940 metres of paper-insulated and alloy-tube-covered cable and 8,638 metres of paper-insulated cable, with armoured-lead covering. Particulars may be obtained from the above address for 3½ francs (Cahier de Charges Special, No. 610).

July 31st. Municipal authorities of Arville (Luxemburg). Establishment of an electric lighting system in the town and district. The plans and specifications can be examined at the office of the Secretariat Commune, at Arville, to which address tenders are to be sent. The scheme includes the establishment of a hydro-electric station on the River Homme, and high and low-pressure mains from the power-station to the distribution plant in the town, a distance of about 4½ miles.

Municipal authorities of Montignies-sur-Roe (Hainaut). A system of primary and secondary electricity mains in the town. The Department of Overseas Trade reports that a contract for the construction of a 60-km. high-pressure transmission line, in the province of Limburg, has been awarded to a Belgian firm of contractors. United Kingdom firms desirous of supplying material to the successful contractor should communicate with H.M. Consul, British Consulate, Liège, forwarding copies, in duplicate, of catalogues, lists, &c.

Bristol.—August 15th. Corporation Electricity Department. The supply of one 3,000-kW, single-phase, 93-cycle, 2,200-V. turbo-alternator and condensing plant and auxiliaries; and one 6,000-kW, three-phase, 50-cycle, 6,600-V ditto. (See this issue.)

Bulgaria.—July 23rd. The Bulgarian Ministry of Finance, in Sofia, is inviting tenders for a quantity of miscellaneous electric material, including motors, transformers, voltmeters, amperemeters and fittings for electric lighting and bell installations.

Glasgow.—The District Committee of the Tower Ward of the County of Lanark. Electric lighting for 50 houses to be erected at Gartcosh. Mr. Jas. A. McCallum, District Clerk, 15, West George Street, Glasgow.

The Corporation invites tenders for the passenger lifts required in connection with the extensions to municipal buildings. Plans at Messrs. Watson, Salmond & Gray, architects, 242, West George Street, Glasgow. Tenders to Town Clerk on or before 22nd inst.

London.—Metropolitan Asylums Board. July 20th. Alterations and repairs to the electric lighting, fire alarms and domestic bell installations at St. George's Home, Chelsea. (July 8th.)

Manchester.—July 29th. Electricity Committee. Five 2,500-kW rotary converters and other plant and switchgear. (July 8th.)

August 3rd. Electricity Committee. Low-pressure steam and water pipes and valves for Barton station. (See this issue.)

Mexborough.—July 23rd. Urban District Council. Electricity Department. E.h.p. switchgear; l.p., d.c. switchboard. (July 1st.)

Newport (Mon.).—July 25th. Electricity Department. 750-kW rotary converter, transformer and switchgear. (July 8th.)

New Zealand.—**WELLINGTON.**—November 1st. Public Works Tender Board. One 200/250 b.h.p. oil engine and one 3-phase, 50-cycle, 190-kW at 3 power factor, alternator, with exciter and switchgear.*

Warrington.—August 9th. Corporation Electricity Department. Circulating pumps. (See this issue.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—**SYDNEY (N.S.W.).**—The Municipal Council proposes to accept the tender of the English Electric Co., of Australia, for low-pressure oil switches (£5,540), and to invite tenders for non-automatic oil switches.

Birkenhead.—Electricity Committee. Accepted:—

Supply and laying of high-pressure mains from Marshall Street sub-station to Wallacey generating station, 23,242. W. T. Henley's Telegraph Works Co., Ltd.

Bradford.—Electricity Committee:—

Steelwork for No. 2 engine-room floor, Valley Road works.—H. Barrett and Sons, Ltd.

Transformer chamber building for Scholemoor housing site and district.—F. G. Burgess.

Air outlets for Nos. 5 and 6 turbines at Valley Road works.—F. Fox.

Tramways Committee:—

48 tons of steel tramway rails, at £20 per ton for high silicon rails, and £21 per ton for rails treated by the sorbitch process.—W. Scott, Ltd.

Doncaster.—Town Council:—

Excavating and laying of tramway rails, &c., Balby, £3,712.—G. Percy Trentham, Ltd.

Low-pressure cables, £1,384.—Enfield Ediswan Cable Works, Ltd.

Extra-high-pressure cable, £1,146.—Callender's Cable & Construction Co., Ltd.

Edinburgh.—A contract for cables for the Portobello electric power station (Corporation) has been given to a Belgian firm, whose estimate of £1,287 was £216 lower than any British tender. Councillor Bruce Lindsay stated that the most important part of the machinery for the new Portobello Station came from Switzerland, at a saving of £60,000.

London.—**HACKNEY.**—Borough Council:—

Electricity works building extensions.—J. Jarvis & Sons, Ltd. (accepted).

Manchester.—Electricity Committee. Approved:—

Three-phase, 6,600-volt sub-station switchgear.—Park Royal Engineering Works, Ltd.

Weldless steel lamp columns.—The British Mannesmann Tube Co., Ltd.

33,000-volt and 6,600-volt sub-station switchgear.—A. Reyrolle & Co., Ltd., and the British Thomson-Houston Co., Ltd.

Three voltage induction regulators.—Maschinenfabrik Oerlikon, Zurich.

Newcastle-on-Tyne.—City Council. Contracts sealed on July 6th:—

Tramway turn-outs and cross-overs.—Hadfields, Ltd., £4,290.

Tramway junctions.—United States Steel Products Co., £18,213.

Electrical installations, Walker Housing Estate.—Fletcher Bros., £5171.10.

Robson & Coleman, £515; Jesmond Electric and General Engineering Co., Ltd., £230; Pinkney & Forster, £505; Wilson & Ridley, £767;

R. W. Cairns, £372 10s.; Reid, Ferens & Co., £485; S. Gillett & Co., £765; Falconer, Cross & Co., £542; T. G. Usner & Co., £620; Devereux,

Mondie & Co., £507 10s.; E. G. Atkinson, £250; Gray Bros., £230;

A. E. Heath & Co., £257 10s.; and G. S. Douthwaite & Co., £252 10s.

Sheffield.—Electric Supply Committee. Recommended:—

10,000-kW plant, £49,900.—B. White-Taylor Marine Corporation.

The plant offered is of German manufacture, and the price includes supervision of the erection of the plant. The tender was considerably lower than any other.

As we go to press we learn from the *Financial Times* that it is unlikely that the Corporation will accept this recommendation, the Committee having asked leave to reconsider the matter.

Spennborough.—Electricity Committee:—

Sub-station switchgear.—To be supplied by Yorkshire Electric Power Co.

Engine-room steelwork.—Leonard Cooper, Ltd.

Cable and house services.—Western Electric Co., Ltd.

Stafford.—Town Council:—

500 yd. high-pressure cable, 19s. 7d. per yd.—Pirelli-General Cable Works, Ltd.

Turton (co. Durham).—Lighting of parish. The following tenders have been received:—

Reid, Ferens & Co., £545; Co-operative Wholesale Society, £695; and the South Hieton Coal Co., Ltd., £4 10s. per lamp.

The last-named company is being approached with a view to securing a reduction in price.

FORTHCOMING EVENTS.

Incorporated Municipal Electrical Association.—Wednesday, July 20th. and following days. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 2.30 p.m. Annual meeting. For details, see "Institution Notes."

Thursday, July 21st. At 7 p.m. At the Hotel Cecil. Annual dinner.

Electro-Harmonic Society.—Wednesday, July 20th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 4.30 p.m. Annual general meeting.

NOTES.

The Circulation of the "Electrical Review."—The directors of the ELECTRICAL REVIEW, LTD., desire to draw the attention of their supporters to the certificate of Messrs. W. B. Keen & Co., chartered accountants, appearing on advertisement page Sup. 17 to-day, showing the net sales and total circulation of the ELECTRICAL REVIEW for the six months ended June 30th, 1921. It may be of interest to point out that notwithstanding the disturbed and depressed industrial conditions which have prevailed during the past half-year, the net sales have increased from 12,564 (average copies per week for the last three months of 1920) to 12,682 average per week for the first six months of 1921. Taking into account 777 free copies issued to Foreign Consuls and advertisers, against 717 the previous average, the total circulation now figures at 13,459, as compared with 13,281, indicating steady and gratifying progress in a period of exceptional difficulty.

Service Notes.—Captain R. W. Strugnell, late of the Royal Engineers, has been granted a pilot's commission in the Royal Air Force whilst employed in the Electrical Services Works Co. under the Directorate of Works and Buildings. Captain Strugnell saw service in the late war. Under the age rule, Captain W. E. Hammerton, T.D., London Electrical Engineers (Territorial Force) has retired from that corps with which he was long and honourably associated. Captain Hammerton was a lieutenant of six years' service in the corps when he got his captaincy in July, 1914, the month before the war broke out. Warrant electrician A. C. Cornhill joined the battle cruiser *Glorious* on the 1st inst. for a turn of duty. Warrant telegraphist G. H. Carkeet has been appointed to the battle cruiser *Queen Elizabeth* as assistant to the fleet wireless officer from 1st inst.

Fatality.—To reach a bird's nest in the roof of an outhouse at Castleloan, Linlithgowshire, Alex. Banks, aged 13, climbed an overhead transmission pole and grasped a conductor carrying electricity at a pressure of 3,000 volts. His hand was burned, and he fell to the ground, and soon afterwards died.—*Daily Mail*.

Educational.—UNIVERSITY COLLEGE, LONDON.—The following awards have been made in the Faculty of Engineering:—Andrews Scholarship (First year).—B. W. Huntsman. Goldsmid Entrance Scholarship (Second year).—L. W. Ball. Archibald P. Head Medal and Prize.—F. W. Neville. L. F. Vernon-Harcourt Prize (Civil Engineering).—A. I. W. Jones and J. P. Porter (equal).

Chadwick Medal and Prize.—J. P. Porter.

Diplomas in Electrical Engineering have been obtained by the following:—E. F. Anderson, H. E. M. Barlow (with distinction), J. R. Harding, R. A. E. Parsons, V. W. Roskilly.

CAPE TECHNICAL INSTITUTE, CAPE TOWN, S.A.—A Department of Electrotechnics has been formed at the Cape Technical Institute, and over 50 students are in attendance. Laboratory classes have been started with an outlay of £83 on equipment, which is being supplemented with apparatus constructed by the students; it is believed that before long larger funds will be available for this purpose, but in the meantime the department is badly in need of a few sensitive galvanometers. An electric supply of 25 h.p. d.c. and 25 h.p. three-phase has been proposed for the electric laboratory in the new buildings, which are being constructed. At present the classes are being conducted in temporary buildings. If any British electrical firms have small plant or apparatus to spare, which they could present to the Institute, the gift would be greatly appreciated, and would, moreover, constitute a valuable advertisement. Apparatus which has become obsolete for the general market, but is otherwise in good order, is often of great value to a technical college, and it could not be disposed of to better advantage; the young student carries through life the impressions received during his college days, and amongst these should be the names of British makers of electrical apparatus.

The foundation stone of the new Institute was laid on May 26th, by Prince Arthur of Connaught, Governor-General, and a public appeal was made for equipment. The electrical students have raised £50, and their instructor, Mr. N. C. Woodfin, invites manufacturers of electrical apparatus and plant to send him catalogues and price lists.

Joint Electricity Authorities' Finance.—At the annual conference of the Institute of Municipal Treasurers and Accountants, recently held in Buxton, Mr. Alfred B. Dawson, A.S.A.A., the accountant to the St. Ann's-on-the-Sea Urban District Council, submitted a well-reasoned paper on the financial aspect of the proposed electricity supply areas, in the course of which he put forward proposals for dealing with existing generating stations, the method of payment for existing stations, the financing of the capital requirements of the Joint Electricity Authority, the advantages and disadvantages of the super station, and the linking up of existing undertakings.

As a result of the examination of the question, he had formed the impression that for the first few years the "super" stations would not be able to supply so cheaply as many of the existing stations, principally because during the early period of their existence they would be heavily capitalised. On the other hand, he believed that when the district boards or joint electricity authorities were relieved of the debt of the existing stations, and when the load approached within reasonable distance of the capacity of the super stations they would prove to be more economic and eventually result in a cheap supply of electricity.—*Municipal Journal*.

Appointments Vacant.—The Liverpool Tramways and Electricity Committee has decided to advertise for a rolling stock and works superintendent, at an inclusive salary of £750 per annum.

The following vacancies are advertised in this issue:—Distribution engineer (salary according to E.P.E.A. schedule commencing at Grade 3, Class E), for Croydon Corporation; three shift engineers (£231), for Dover Corporation; chief assistant engineer (£450), for Coventry Corporation.

The Electricity (Supply) Bill.—It is reported in the lay Press that the Government, anxious to avoid the necessity of an autumn session, has decided to defer the consideration of a great deal of new legislation, including the Electricity (Supply) Bill.

Engineering Wages.—The result of the ballot upon the new terms, arranged between the two parties in the engineering industry, was announced on July 13th. The figures were:—For acceptance, 175,145; against, 108,969; a majority of 66,176. The proportion of votes to the number of ballot papers issued was again small, only about a quarter of the men voting. It is stated that the voting of every constituent trade union of the industry showed a majority in favour of the terms.

Electrical Trades Benevolent Institution.—The E.T.B.I. has received from the Cardiff Local Advisory Committee a cheque for £76, the proceeds of a whist drive and dance organised by the Local Branch of the Electrical Contractors' Association, and held on March 4th.

Institution Notes.—Incorporated Municipal Electrical Association.—The Council has decided to allow time at the annual meeting to be held in London next week for the papers, prepared for the Dundee Convention, to be read in extract and discussed. The programme is as follows:—

Wednesday, July 20th. 2.30 p.m.—Presidential Address, by Major H. Richardson, F.R.S.E., general manager and engineer of the Dundee Electricity Supply Department.

2.45 p.m. Paper on 'Questions Arising in the Consideration of the Financial and Business Aspects of Municipal Electricity Supply,' by Mr. C. W. Charlesworth, Electricity Supply Department, Wolverhampton.

A meeting of the Chairmen Members (only) of the I.M.E.A. will be held immediately following the above paper.

Thursday, July 21st. 10 a.m.—Papers on (a) "Steam Raising—Yesterday, To-day and To-morrow," by Mr. D. Wilson (Messrs. Babcock & Wilcox).

(b) "Modern Boiler House Practice," by Mr. W. M. Miles, Electricity Supply Department, Sheffield.

2.30 p.m.—Paper on "Present Day and Commercial Problems in Electricity Supply," by Mr. E. Cross, Rotherham.

Friday, July 22nd. 10.15 a.m.—Annual general meeting.

The meetings will be held at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C., unless the inquiry which the Electricity Commissioners are holding is still in progress, in which event the meetings will be held at the Institution of Mechanical Engineers, Storey's Gate, S.W.

The annual dinner of the Association, at which ladies will be present, will take place at the Hotel Cecil, Strand, W.C., on Thursday, July 21st, at 7.30 p.m. (reception 7 p.m.).

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

ACCORDING to *The Times*, MR. A. L. TACKLEY has been appointed an electrical inspector of factories.

The marriage took place last week at Stourbridge, of MR. DENNIS G. F. HOLMES, M.M., electrical engineer, of Amblecote, and Miss Adelaide Walton.

In confirming the appointment of MR. HAWKINS, of St. Helens, as the new borough electrical engineer of Wallasey, there was a discussion as to whether he should be paid a salary of £200, and be allowed to take two articled pupils, or whether he be given a salary of £1,000, and not be allowed to take articled pupils. The view was expressed that it was in the interests of the undertaking that the Corporation should have pupils, who would be a good class of young men from the universities. The former proposition was adopted.

MR. F. E. FRAMPTON, who has been engineer and manager at the works of the Paignton Electric Light and Power Co., Ltd., for over 11 years, has resigned, and MR. A. E. BAKER, who has been assistant engineer for nearly 10 years, has been appointed in his place.

On Wednesday last week the permanent staff of the London Chamber of Commerce presented Mr. C. E. TOWN, the recently retired assistant secretary of the Chamber, with a very handsome and large antique mahogany bookcase.

The Bradford Education Committee has appointed MR. P. G. SPARY, of Southampton, as lecturer in electrical engineering at the Technical College, at an inclusive salary of £450, rising to £520 per annum, the salary to be re-considered when salaries are considered after the appearance of the Report of the Burnham Committee, and to be amended accordingly if the Burnham scale operates in Mr. Spary's favour. In the event of Mr. Spary not

taking up the appointment, the chairman and the Principal of the College were authorised to make a fresh appointment.

Mr. WILFRID PLANT, electrical engineer, late of the Dockyard, Invergordon, has secured the appointment as borough electrical engineer at Tain in connection with the new electric lighting scheme.

The Manchester Corporation Electricity Committee recommends that the salary of **Mr. W. G. McCracken**, resident engineer at the new Barton station, be advanced from £450 to £600 per annum.

Mr. G. E. L. ROWARTH, lately with the Dowling Radiant Heat Co., Ltd., has been appointed manager of the electrical department of the Edinburgh branch of the Medical Supply Association, Ltd., 12, Teviot Place, Edinburgh.

Obituary.—**LORD BALFOUR OF BURLEIGH**.—We regret to record the death of Lord Balfour of Burleigh, which occurred in his sleep on July 6th, at the age of 72 years. The deceased peer had a political and financial career of great distinction. He had helped in the settlement of many industrial disputes, and was a member of numerous Commissions and Committees. It will be remembered that he was chairman of the Committee which reported upon "Trade Policy After the War." He was also a director of various companies, including the Western Telegraph Co., and he was a trustee of the Submarine Cables Trust.

Mr. C. E. TAYLOR.—The death occurred recently, at Darlington, of Mr. Cyril Ernest Taylor, of the North-Eastern Railway Co.'s electrical department. Mr. Taylor joined the service in 1898, being in charge of the electrical machinery at York and Sheldon. Subsequently he removed to Newcastle-upon-Tyne to superintend the electrification of the branches to the coast. He was an Assoc.M.I.E.E.

Mr. A. W. SLATER.—We regret to record that Mr. A. W. Slater, electrical engineer, 6, Cork Street, London, W. 1, died suddenly at Saxby, Lincolnshire, on June 26th, aged 55. His main business was installing generating machinery for lighting and power on country estates. Since he started 30 years ago he had put down a large number of plant, many of them being in the historic mansions of this country; among them was Chequers, lately presented by Lord Lee to the nation for the use of the Prime Minister. Mr. Slater was consulting engineer to the Honourable Society of Lincoln's Inn, and to the Warden and Fellows of Winchester College. The business is being carried on under the same title by his son, Mr. Frank Slater, with whom he had been associated for some years.

Mr. E. C. MILLS.—The death occurred on July 3rd, at the age of 61 years, of Mr. Ernest Charles Mills, chief electrician to Apperly, Curtis & Co., Ltd., Duddridge Mills, Stroud (Glos.).

Mr. JOSEPH WILKINSON.—We regret to record that Mr. Joseph Wilkinson, late tramway electrical engineer to the Hull Corporation, passed away suddenly on July 7th at his residence, 4, Morpeth Street, Hull. He had suffered from heart trouble, and for some years had been living at Withernsea, and it was on his return therefrom that he had a seizure which proved fatal. Mr. Wilkinson was 53 years of age. He retired from his office under the Hull Corporation two years ago, and has since practised as a consulting electrical engineer. Latterly he had been introducing electric battery vehicles into Hull. Mr. Wilkinson served his apprenticeship with Messrs. Cox-Walker & Co., at Darlington, and after being for a time with Messrs. J. H. Holmes & Co., he continued his studies at the Durham College of Science. He had a good deal of practical experience in the lighting of ships at Home, and supervised the electrical equipment of a torpedo boat for the Chilean Navy. He was for some time in the early nineties of last century assistant engineer to Messrs. Siemens Bros. & Co., Ltd. He also went to Hobart, Tasmania, to equip the electric tramway system, and on his return, after two years, he became resident engineer for Messrs. Siemens Bros. in connection with the equipment of the Blackburn tramways. In 1899 he was chief assistant for the contractors on the equipment of the Hull tramways, and in 1903 he was appointed tramway electrical engineer. Mr. Wilkinson was a M.I.Mech.E., M.I.E.E., and a member of the I.M.E.A.

Will.—The late **Mr. H. GREEN**, ironmonger and electrical engineer, of Okehampton, left £27,679.

NEW COMPANIES REGISTERED.

Gaunt & Wilkinson, Ltd. (175,555).—Private company. Registered July 6th. Capital, £500 in £1 shares. To adopt an agreement with T. Gaunt and J. A. Wilkinson, and to carry on the business of mechanical and electrical engineers, steel manufacturers and workers, foundries, smiths, &c. The first directors are: T. Gaunt, 56, Chantry Road, Sheffield, engineer; J. A. Wilkinson, 29, Selborne Road, Sheffield, engineer; S. Berrisford, 100, Sharrow Road, Sheffield, engineer. Qualification, £1. Remuneration as fixed by the company. Registered office: Pilot Works, Corporation Street, Sheffield.

S. Rowland & Co., Ltd. (175,599).—Private company. Registered July 7th. Capital, £3,000 in £1 shares, 1,150 "A," 650 "B," and 1,200 "C" shares). To carry on the business of covers of wire with all materials, manufacturers of and dealers in metals, alloys and substances, and coverings therefor, brand and woven goods in all textures, warehousemen, &c., and to adopt an agreement with S. Rowland. The permanent directors are: L. Maister, 60, Osbaldeston Road, Stoke Newington, N.16; M. Cooper, 68, Osbaldeston Road, Stoke Newington, N.16 (both directors of Barmico, Ltd.); A. Simon, 39, Coborn Street, Bow, E.; S. Rowland, 259, Burdett Road, E.14. Registered office: 8, Sturpe Street, Middlesex Street, E.1.

Olsen Engine Syndicate, Ltd. (175,524).—Private company. Registered July 3rd. Capital, £24 in 14 shares. To acquire from S. D. Olsen the benefit of certain existing inventions relating to the production, treatment and application of electric, steam, petrol, oil, gas, compressed air or other power, &c. The subscribers (each with one share) are: E. I. V. Earle, 2, Staple Inn, W.C.1, merchant; T. W. Gouding, 2, Staple Inn, W.C.1, merchant. The first directors are not named. Qualification, 50 shares. Registered office: 8, Staple Inn, W.C.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Aladdin Renew Electric Lamp Corporation, Ltd.—Issue on June 24th, 1921, of £1,200 debentures, part of a series already registered.

Electrical Appliances (Blackpool), Ltd.—Two mortgages dated June 24th, 1921, to secure £700 and £300 respectively, charged on certain lands and premises in Blackpool. Holder: E. Jones, 3, Saville Road, South Shore, Blackpool.

High Temperature Generators (1918), Ltd.—Debenture dated June 16th, 1921, to secure £500, charged on 11 superheater machines and proceeds of sale thereof and company's undertaking and other assets. Holder: W. A. Tompkins, 10, Westleigh Road, Leicester.

Pirelli-General Cable Works, Ltd.—Mortgage dated June 10th, 1921, to secure £15,835, charged on Eastleigh Stores Distributing Park, Eastleigh, Hants., ranking in priority to prior trust deed securing £200,000. Holders: Secretary of State for War, Whitehall, S.W.

Bath Electric Tramways, Ltd. (74,278).—Return dated May 19th, 1921. Capital, £230,000 in 21 shares (75,000 preference, 125,000 preferred ordinary, and 30,000 deferred). 75,000 preference, 75,000 preferred ordinary and 30,000 deferred shares taken up. £150,606 paid. £30,000 considered as paid. Mortgages and charges, £147,517.

Sterling Telephone & Electric Co., Ltd. (101,415).—Capital, £65,000 in 49,650 preference and 15,350 ordinary shares of £1 each. Return dated April 5th, 1921. 39,560 preference and 15,350 ordinary shares taken up. £34,500 paid. £30,350 considered as paid. Mortgages and charges, nil.

CITY NOTES.

Calcutta Tramways Co., Ltd. At the annual meeting held on Monday in London, Mr. John G. B. Stone, who presided, said that the traffic receipts showed an increase of 6½ per cent., with practically the same number of miles run, the passengers carried (nearly 554 millions) showing an increase of 6 per cent. The Indian expenditure showed an increase under all heads. Apart from the advances in wages and salaries, the principal items of increase were power expenses, due to enhanced prices paid for coal, and maintenance and repairs, due to exceptionally heavy repairs on the rolling stock and to abnormal expenditure in making good damage to the electrical equipments of no fewer than 67 motor-cars caused by the floods in August last. The speaker referred to the experience of the company with regard to strikes and wages. The result was that the wages had increased about 33 per cent. for 1920 over the normal total for 1919, while the current year, which would represent a complete year, would show an increase of over 60 per cent. compared with the same period. With this heavy increase in the cost of working it was no longer practicable to carry the public at existing fares, and a new scheme of fares was now under the consideration of the board, and would be brought into operation as quickly as possible. The loss of revenue due to the strikes, coupled with the drop in the takings for the current year from other causes, had drained the company's available cash resources, already depleted by the overspent capital account, and further capital would require to be issued. In the meantime arrangements had been made with the bankers. As regarded their prospects for the current year, although the aggregate receipts to date showed a considerable decrease, it was due to the heavy trade depression and to a variety of causes, all of which were of a temporary nature. There were not wanting signs of improved trade conditions, which a good monsoon would help to develop, and to which their traffic would quickly respond.

Melbourne Electric Supply Co., Ltd. At an extraordinary general meeting held on Monday at Winchester House, E.C., resolutions were passed transferring the control and management of the company from London to Melbourne. Mr. J. B. Braithwaite presided, and said that the meeting was the result of the action of the Chancellor of the Exchequer and the Government in insisting on making companies which were engaged in developing the resources of the Colonies, and the whole of whose profits were made in the Colonies, subject to British income tax. The only effect would be to discourage the investment of British capital in the Colonies, and although at the moment the Colonies were fairly well supplied with capital from their own resources, the time would come when they would be glad of more British capital. They would then find that the action which the British Government had taken would be greatly to their disadvantage. The board had done all it possibly could, but the only result had been to obtain a certain modification, which did not touch the main question—namely, that a company like theirs, which earned the whole of its profits in Melbourne, was made liable for British as well as Australian income tax. He had suggested to the Government that the sensible solution of the problem was that the shareholders resident in Great Britain should be subject to British income tax, that those resident in Australia should be subject to Australian income tax, and that certainly the company's profits themselves should not be subject to British income tax. This meeting had been called on the initiative of the Australian shareholders. If the resolution were passed the result would be that from July 31st the company would cease to be liable for British income tax, but, as a British registered company, it would still be liable to the new corporation tax. The Australian debenture holders would be free from liability for British

income tax. The directors made a point, in the prospectus of the recent issue of preference shares, of the provisions in the Finance Act which gave the holders special benefit in connection with income tax allowances, but since that prospectus was issued an action had been decided to the effect that preference shareholders subject to double tax were not entitled to participate in the relief granted by Section 27 of the Finance Act of 1920. The result of the transfer would be to improve the position of all classes of the company's securities.

The directors report that the net profits for the year ended March 31st, 1921, are £796,149, to which is added the balance brought forward from last account, less E.P.D. to March 31st, 1920, £175,668, giving a total of £971,817. After deducting debenture stock interest £8,000; depreciation £157,915; contribution to pension fund £17,266; dividend 6½ per cent. per annum on "A" preference shares for the year £107,626; dividend 7½ per cent. per annum on "B" preference shares for the year £121,718, there remains an available balance of £559,291. A dividend at the rate of 10 per cent. per annum, free of income tax, on the ordinary shares for the year is recommended, requiring £211,197, and there is to be carried forward, subject to E.P.D. (if any), and corporation profits tax, £348,094. The satisfactory results of the year's trading show that the additional capital obtained at the close of the last financial year is being employed usefully. The general decline of trade throughout the country during the latter half of the financial year did not immediately affect the electrical industry. Contracts in hand assisted in keeping the majority of the company's works fully employed up to March 31st. The results of the company's overseas branches have in nearly all cases been satisfactory, though they have suffered from exchange difficulties. The allied and subsidiary companies have shown good progress and continue to make a considerable contribution to the company's profits. The number of employees increased during the year, and on March 31st totalled over 16,000. Owing to the present state of industry, the directors consider the usual allocation to reserve out of profits inadvisable, and recommend that the amount which they would have allocated under normal conditions, should remain in the "carry forward" to next account, which thus stands at the total of £348,000. They feel all the more justified in making this recommendation as the reserve account has benefited during the year by the sum of £257,016, through the transfer of net premiums received on the share issue of March, 1920, thus making the total of this account over £700,000. The assets of the company as shown in the balance sheet amount to over £11,000,000, an increase of approximately £4,000,000 upon last year's figures. The considerable increase in the fixed assets is mainly accounted for by the absorption of the Peel Conner Co. with its works at Manchester and Coventry, the further large extensions to the engineering works at Witton, and the Osram works at Hammersmith, and the completion of the building in Kingsway. These additions were all approaching completion on March 31st, and have been carried out by considerable financial assistance from the company's bankers, which liability has been met since the close of the financial year by a debenture issue. The item "sundry debtors" also shows a substantial increase, which is partly due to the expansion of the company's trading operations and partly to the refilling of the depleted stores of the overseas companies, owned or controlled by this company. "Stock-in-trade and work in progress" valued in the usual manner show a large increase, which is accounted for to a considerable extent by work in progress for actual orders. Mr. M. Solomon has been appointed managing director of the Pirelli-General Cable Works, Ltd., one of the company's allied organisations, and has resigned from the board of the company in order to devote his whole time to the work involved. Mr. M. S. Conner, formerly managing director of the Peel Conner Telephone Works, Ltd., which is now the property of the company, has joined the board, and his appointment will be submitted to the shareholders for their confirmation.

Annual meeting: July 21st, at Magnet House, at 12 o'clock.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 143a:—

North Metropolitan Electric Power Supply Co.—£228 460 7½ per cent. debenture stock, redeemable, issued at 95 per cent., of which £35 is paid and fully paid, after issue of allotment letters.

Southern Brazil Electric Co.—£80,000 6 per cent. mortgage debentures of £100 each (redeemable), Nos. B 1,021 to B 1,820.

The undermentioned securities have been ordered to be quoted in the Official List:—

English Electric Co.—£1,250,000 8 per cent. six-year secured notes of £100 each, Nos. 1 to 12,500 (registered).

Southern Brazil Electric Co.—£180,000 6 per cent. mortgage debentures, Nos. A851 to 1,004, A1,049 to 1,086, A1,091 and 1,092 of £500, B1,001 to 1,820 of £100, C501 to 518 of £50, and D1,001 to 1,005 of £20.

St. James's & Pall Mall Electric Light Co., Ltd.—The directors have declared an interim dividend at the rate of 7 per cent. per annum on the preference shares and 7 per cent. per annum on the ordinary shares for the half year ended June 30th.

Trowbridge Electric Supply Co., Ltd.—At the annual meeting a dividend of 7½ per cent. on the ordinary shares was agreed to. The chairman said that the result of the year's working was very satisfactory.

New Issues.—In connection with the issue of 7½ per cent. debenture stock of the North Metropolitan Electric Power Supply Co., the amount of stock offered for subscription was £228,460. There were 3,254 applicants for £2,534,485 stock. These applications included 2,245 each for £500 or less.

Electric Supply Corporation, Ltd.—After transferring £7,196 to repairs and renewals fund, and including £621 brought forward, accounts for 1920 show available balance of £3,403. The directors propose to place £3,000 to reserve fund and to carry forward £403.—*Financial Times.*

Telegraph Construction & Maintenance Co., Ltd.—An interim dividend of 6s. per share, free of tax, is announced.

STOCKS AND SHARES.

TUESDAY EVENING.

SHOULD it turn out that the Bank Rate is not reduced this week, but is left at 6 per cent., there will be disappointment in the various City circles that are looking, this Tuesday evening, for a possible 5 per cent. minimum to be announced on Thursday. From the point of view of the Money Market only, there is little to hinder a reduction, and the Treasury will welcome a step that will fillip the new 5½ bonds now on offer at 97. Nevertheless, the prospect of cheaper money is exerting no great influence over Stock Exchange prices or business, the former continuing rather dull, while the latter has been as languid as the weather.

The North Metropolitan Electric Power Company's issue of £223,000 7½ per cent. debenture stock was subscribed nearly ten times over. The applications for amounts below £500 were in themselves sufficient to have absorbed the issue, without taking into account the larger sums. Dealings started in the market at a premium of 3 points above the issue price of 95, and the price stiffened to 3½ premium later.

General Electric new debenture stock has hardened to 5s. discount, which compares with 4 discount to which the price fell as the stags, and some of the underwriters, hastened to get out after the allotment. The company's report shows a net profit of £613,000, or £120,000 more than that of the preceding year. The dividends on ordinary and preference shares require an additional £200,000 this time, owing to the increase in the capital, the ordinary dividend being maintained, as already announced, at 10 per cent. free of tax. The report led to a rise to 21s. 10½d. in the ordinary shares.

Central London Railway stocks maintain their substantial rises secured this month, but Districts have gone back to 17, Metropolitan to 25, while Underground Electric Railways £10 shares, after being 54s., reacted to 2½. The Income Bonds hold steadily to 83½. Home Railway stocks, as a whole, make an irregular showing. While the higher-priced descriptions attract a few buyers, the other stocks are depressed. What may be the outcome of the Railways Bill, none even of the market authorities seem eager to prophesy, so that it is not surprising for the investor in the street to show more reluctance than ever in the matter of touching Home Railway stocks.

Prices in the cable market slacked off a little towards the end of last week, continuing the process which started at the beginning of the month. At the slightly lower levels, however, investment again took the market in hand, with the result that Eastern ordinary is better at 165½, and Eastern Extensions, together with Westerns and Globe ordinary, have all risen to 16½. Great Northern at 25½ are 10s. higher. United River Plate Telephones at 5 11/16 are 1/16 up, and the only retrograde movement in this list is ½ fall in Chile Telephones to 4½. Marconi's remain about 2 3/16. The report of the Marconi Marine Co. is due at any moment, and there is considerable curiosity as to what results the profit and loss account will show. The accounts of the Marconi Co. itself are expected about the end of this month. Marines are 25s. 6d., Canadian Marconis 7s. 9d., and the two Radio shares stand at 10s. 6d. and 9s. 8d. for preferred and common respectively.

Cable manufacturing shares are all very steady. There is not a change in the list. Two or three of the companies are still said to be contemplating new issues when the times become more propitious; in other words, when a fall in the Bank Rate enables them to make an appeal for money on terms less onerous than would have to be paid during the first six months of the current year. The Crompton report announces a profit for the year ended March 31st last of £66,000, which is about £13,000 better than that for the previous twelve months. The company pays 10 per cent. on the ordinary and preference shares. Cromptons have been practically absorbed by Armstrongs, but the ordinary shares are still quoted in the Stock Exchange at 16s. 3d., and the preference at the same level, while the 6 per cent. first mortgage debentures stand at 80 ex the interest due July 1st.

The Montevix Light & Power Co. issues details of the proposed plan for reorganisation of the company, whereby arrears of interest due to holders of the first mortgage debenture stock will be funded. The first debenture stockholders are asked to

give up one-sixth of their nominal capital, receiving in exchange new securities payable, at their option, in Canada in dollars or in pounds sterling. The scheme is somewhat intricate. The debenture holders are offered in exchange for their securities, and the company, in return, pays a cash payment in sterling of the equivalent of 5 dollars. The meeting at which the scheme will be submitted is to be held on July 25th. The price of the stock has risen 3 points this week to 23, comparing with 50½ at which it stood on the eve of the outbreak of war. Other Mexican issues are quiet, awaiting further news from Mexico. Brazilian Tractions have receded to 31. British Columbia Electric stocks are a little irregular. Victoria Falls ½ per cent. second mortgage debentures have hardened to 97½ ex interest, the preference shares remaining at 16s. 3d., around which price there is a fair amount of business being done in them. Canadian General Electric Common are 5 points higher at 130, and the preferred 4 up at 118. Dollar stocks are a little better, owing to the way in which the value of the pound sterling has dwindled, in relation to the dollar.

Electric Lighting shares are a firmer market. Rises have occurred in City of London, Westminster, South London and Metropolitan. The 7½ per cent. Extension debenture stock of the Metropolitan Company has risen to 5½ premium. The scrip is £40 paid. City of London new ordinary at 23s. and the second preference at 22s. 3d. are both rather better. Siemens new 10 per cent. preferred have hardened to 22s. 3d. Central Electric 8 per cent. Notes keep firm at 102, which is 5 premium over the issue price. Melbourne Electric ordinary at 112½ is 7½ higher on the week. The end of the coal-strike is quoted as one reason for the strength shown by the market for home electricity shares. Engineering and kindred issues exhibit no particular movement. Rubber shares are the turn better upon a slender rally in the price of the product, on buying reported to emanate from America.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price	Yield.
	1918. 1920.	July 12.	
Brompton Ordinary	12 12	8	—
Charing Cross Ordinary ..	7 8	8	—
do. do. do. 4½ Pref. ..	4 10	8	—
Chelsea	4 6	8½	—
City of London	13 14	11	+ ½
do. do. 6 per cent. Pref. ..	6 6	14	—
County of London	8 8	8½	—
do. do. 6 per cent. Pref. ..	6 6	8½	—
Kensington Ordinary	7 9	9	—
London Electric	12 12	10	—
do. do. 6 per cent. Pref. ..	6 6	12	—
Metropolitan	6 6	7	—
do. 4½ per cent. Pref. ..	4½ 4½	2½	—
St. James' and Pall Mall ..	13 13	6	—
South London	6 7	10½	—
South Metropolitan Pref. ..	7 7	10½	—
Westminster Ordinary	10 10	8	—

TELEGRAPHS AND TELEPHONS.

	Dividend	Price	Yield.
	1918. 1920.	July 12.	
Anglo-Am. Tel. Pref.	6 6	84½	+1
do. do. Def.	15 15	84	—
Chile Telephone	6 6	8	—
Cuba Sub. Ord.	7 7	7½	—
Eastern Extension	10 10	10	—
Eastern Tel. Ord.	10 10	10½	—
Globe Tel. and T. Ord. ..	10 10	10½	—
do. do. Pref.	6 6	98½	—
Great Northern Tel.	22 24	22	—
Indo-European	10 10	8	—
Marseilles	25	2	—
United Telephone Ord. ..	12 12	9½	—
Oriental & Plate Tel.	8 8	5	—
West India and Panama ..	Nil Nil	6½	—
Western Telegraph	10 10	16½	—

HOME RAILS.

	Dividend	Price	Yield.
	1918. 1920.	July 12.	
Central London Ord. Assented ..	4 4	49½	—
Metropolitan	13 14	25	—
do. District	Nil Nil	17	—
Underground Electric Ordinary ..	Nil Nil	23	—
do. do. "A"	Nil Nil	7½	—
do. do. Income	4 2	104	—

FOREIGN TRAMS, &c.

	Dividend	Price	Yield.
	1918. 1920.	July 12.	
Anglo-Arg. Trams, First Pref. ..	5½ 12½	93½	—
do. do. 2nd Pref.	Nil Nil	26	—
do. do. 5½ Deb.	6 5	66½	—
Brazil Tractions	Nil Nil	57½	—
British Columbia Elec. Ry. Pref. ..	5 6	65	—
do. do. Preferred	5 6	65	—
do. do. Declared	3 0	55½	—
do. do. Deb.	43 44	126	—
Mexico Trams 6 per cent. Bonds ..	Nil Nil	63½	—
do. 6 per cent. Bonds	Nil Nil	23½	—
Mexican Light Company	Nil Nil	11½	—
do. do. Pref.	Nil Nil	11½	—
do. do. 1st Bonds	Nil Nil	72½	—

MANUFACTURING COMPANIES.

	Dividend	Price	Yield.
	1918. 1920.	July 12.	
Baloch & Co. Ltd.	15 16	92	—
British Insulated Ord.	10 10	159½	—
British Insulated Ord.	15	14½	—
Callender	15 15	145	—
do. do. Pref.	6 6	83	—
Crompton Ord.	10 10	10½	—
Edison Swan	10	105	—
do. do. 6 per cent. Deb. ..	5 5	105	—
Electric Construction	10 10	126	—
English Electric	8 8	126	—
do. do. Pref.	6 6	11½	—
Gen. Elec. Pref.	14 14	107 3/4	+6½
do. Ord.	10 10	13½	—
Henley	15 15	13	—
do. 4½ Pref.	14 14	82	—
Indo-Rubber	10 8	8	—
Max. Victoria Pref.	10 8	1½	—
Siemens Ord.	30 30	14	—
Telegraph Con.	20 20	30½	—

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, July 12th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
Acid, Oxalic	per lb.	98d.
Ammoniac Sal.	per ton	475
Antimony, Murate (large crystal) ..	"	265
Bismuthide of Carbon	"	—
Borax	"	534
Copper Sulphate	"	431
Potash, Chlorate	per lb.	7d.
Perchlorate	"	84
Shellac	per cwt.	217
Sulphur, Sublimed Flowers	"	216
do. Lump	"	216
Soda, Chlorate	per lb.	4d.
do. Crystal	per ton	27
Sodium Bichromate, cakes	per lb.	7d.
METALS, &c.		
Babbitt's Metal Ingots	per ton	£96 to £900
Brass (rolled metal 2" to 12" basis) ..	per lb.	11d.
do. Tubes (solid drawn)	"	1/13 to 1/2
do. Wire, basis	"	11d.
Copper Tubes (solid drawn)	"	1/13
do. Bars (best selected)	per ton	£112
do. Sheet	"	£112
do. Rod	"	£112
do. (Electrolytic) Bars	"	£77 10s.
do. Sheets	"	£116
do. Wire Rods	"	£93 10s.
do. H.C. Wire	per lb.	11d.
Ebonite Rod	"	3/6
do. Sheet	"	8s.
German Silver Wire	"	2/9
Gutta-percha, fine	"	13/6
India-rubber, Para fine	"	10½d.
Iron Pig (Cleveland Warrants)	per ton	Nom.
do. Wire, galv. No. 8, P.O. qual. ..	"	£35
Lead, English Pig	"	£24 10s.
do. Mica (in original cases) small ..	per box.	£10 15 to £11
do. " " " medium	"	4s. to 4½
do. " " " large	"	5/ to 10/
Phosphor Bronze, Plain castings ..	"	12½ to 25/ & up
do. " " " rolled bars and rods ..	"	1/4 to 1/8
do. " " " rolled strip & sheet ..	"	2/2 to 2/7
Silicium Bronze Wire	per lb.	1/4
Steel Magnet, in bars	"	1/8
Tin, Block (English)	per ton	£165 10s. to £166
do. Wire, Nos. 1 to 16	per lb.	4½ (16s.)
White Anti-friction Metals	per ton	£78 to £300

Quotations supplied by—

G. Boor & Co.	J. James & Shakespear.
Chas. Bolton & Sons, Ltd.	H. Edward Tull & Co.
Frederick Smith & Co.	J. Boling & Lowe.
F. Wiggins & Sons.	I. Richard Johnson & Nephew, Ltd.
India-Rubber, Gutta-Percha and	P. Ormiston & Sons.
Telegraph Works Co., Ltd.	P. —

r. W. F. Dennis & Co.

Rangoon Electric Tramway & Supply Co., Ltd.—The annual general meeting was held in Rangoon on May 18th. Mr. E. S. Giles (chairman), who presided, said that the capital of the company remained the same. During the year £8,039 had been set aside for the redemption of debentures, in addition to a previous amount of £71,919. The total debentures outstanding had a value of £240,754. By transferring the company's offices from London to Rangoon taxes to the amount of £10,000 had been avoided, equivalent to a dividend of 6½ per cent. on the present ordinary capital. The passenger traffic on the tramways showed an increase of two million; this necessitated the purchase of 20 new cars and probably further additions would have to be made. The electricity supply business had also improved, and to effect the necessary improvements an increase of capital was under consideration.

Major & Co., Ltd.—Mr. J. L. Major, presiding at the annual meeting held on June 30th, said that there had been considerable expenditure upon improvement and enlargement, but, owing to the depressed state of trade, these had not shown the benefit expected from them. They had not escaped the general break in prices which took place, in their case, at the beginning of the present year. During the coal stoppage considerable quantities of fuel oil had been sold and also used by themselves. The most successful of the subsidiary companies had been Tarslag, Ltd., which was doing a very much increased business. The statement made last year that the earnings of the subsidiary companies would be sufficient to pay the interest on the preference shares would be more than justified.

Cape Asbestos Co., Ltd.—A dividend of 10 per cent. per annum, less tax, on the ordinary shares (including 3½ per cent. already paid) is recommended; carry forward £9,136.

Dublin United Tramways Co., Ltd.—Interim dividends of 6 per cent. per annum, less tax, on the preference, and 3 per cent. per annum, less tax, on the ordinary for the past half-year.

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(Continued from page 44.)

The Economic Limits of Distribution from Coal-fired Stations.

By W. B. WOODHOUSE. (Abstract.)

The solutions of the problem of supplying an area which extends beyond the economical limits of the distribution pressure in use are to supply it from: (1) One generating station by increasing the output to meet the demands and adding to the original distribution mains a higher pressure system or systems feeding into the general distribution system at a number of points; (the general distribution system may or may not be subdivided into independent sections), or from two or more generating stations; (2) each feeding a part of the area independently of the others; (3) interconnected by a system of h.p. mains with or without intermediate feeding points.

Within certain limits the first solution is the most economical.

1. *Economy of Capital.*—The total cost of a generating station increases less rapidly than the rated output of the plant installed, particularly so in the case of buildings, auxiliary machinery, and steam turbo-alternators. The reduction of the capital cost of a turbo-alternator is a function of the speed and output, and puts at present an approximate limit of 25,000 kW to a single-cylinder machine, and 50,000 kW to a two-cylinder machine.

A large number of machines for the same total output will cost more; a smaller number, to give the same security, must be of a greater total rated output. If each turbo-alternator has an overload capacity of 25 per cent., and two sets are regarded as essential spares, then the economical subdivision is into ten sets. This particular consideration is modified by the relatively high steam consumption of smaller turbines which, in a station of, say, 50,000 kW, would reduce the economical number to seven. Interconnection of stations also affects the question. A further advantage of a large station is due to the diversity of demand arising from supply over a wide area which may have the effect, as between a station of 100,000 kW and one of 500,000 kW, of reducing the station demand by some 10 per cent., and the capital expenditure accordingly.

2. *Economy of Coal.*—The increase of efficiency as between turbines of 1,000 and 25,000 kW under similar steam conditions represents a saving of some 25 per cent. of the coal consumption. The diversity of demand improves the load factor and still further reduces the coal consumption. The economies made possible in a large station represent a further saving, but as between a 150,000 and a 500,000-kW station the amount is not great.

3. *Economy of Wages and Other Expenses.*—These represent a saving on only a small part of the total costs, and are relatively less important.

Total Saving.—It is with hesitation that one submits a general figure of the savings to be made on these accounts; however, the relative cost per kW-year varies somewhat as follows: 500,000 kW 100 per cent., 250,000 kW 114 per cent., 150,000 kW 122 per cent., and 50,000 kW 173 per cent.

Cost of Distribution.—Against these economies the extra costs of distribution over the wider area must be set. The requirements of a constant-pressure supply limit the radius of distribution at any particular pressure. If (as is usually the case) the pressure of utilisation and of distribution is fixed, then, to supply a wider area, a second system of higher-pressure mains becomes necessary, from which the secondary system is supplied at a number of points. This involves capital expenditure on which the annual charges must be met. The new system of mains and transformers also involves energy losses in iron, copper, and dielectric, and the annual cost of these must be added to the capital charges on distribution. However, the addition of the higher pressure system, by permitting the subdivision of the general distribution system, will allow a greater load to be carried on this latter system without further capital expenditure, or alternatively will effect a reduction of energy losses with the same load. In either case this saving must be taken into account. The economical area of distribution is a function of the load factor of the system, and other conditions which make a comparison between different areas a matter of great difficulty. If it be assumed that such an area has a density of load of from 500 to 2,000 kW per sq. mile, a pressure of 10,000 volts has been fully demonstrated by practical experience as suitable for general distribution. The economical area for such a pressure of distribution is approximately 150 sq. miles from which a station demand of, say, 137,500 kW may be expected to arise. As an indication of the magnitude of the various charges a comparison may be made for the hypothetical case of an area 15 miles square with a uniformly distributed load, and the comparison is made for a total area four times as great.

Case 1.—Extension of supply to the larger area from one central station involves the introduction of a higher pressure; if underground cables are used a comparison may be made between pressures of 33,000 and 66,000 volts. The use of overhead lines would lead unquestionably to the use of the higher of these pressures. The costs of these systems are in-

dicated in Tables I, II, and III, and the annual cost of a kilowatt-year (60 per cent. load factor) at the busbars of a 500,000-kW station may be taken as £5 with coal at 30s. a ton.

TABLE I.—UNDERGROUND CABLES AT MAXIMUM RATINGS.

Cost per kVA Mile.		Rating. Cost per kVA mile.	
Pressure.	Cost per mile.	Rating.	Cost per kVA mile.
11 kV.	£14,000	18,300 kVA	£0.765
33 kV	£18,100	48,600 kVA	£0.373
66 kV	£23,000	78,800 kVA	£0.292

TABLE II.—UNDERGROUND CABLES.

Annual Cost of Capital Charges and Energy Losses per kVA Mile.

Pressure.	Rating.	Capital charges.	Energy losses.	Total.
11 kV	18,300	£0.095	£0.085	£0.18
33 kV	88,600	£0.047	£0.028	£0.075
66 kV	78,800	£0.036	£0.017	£0.053

Capital charges, 12½ per cent.

Energy losses, at 60 per cent. load factor, 0.5d. per unit.

TABLE III.—TRANSFORMERS AND SWITCHGEAR.

Annual Cost per kVA Double Transformation.

Pressure.	Rating.	Capital.	Energy.	Total.
33 kV	48,600	£0.264	£0.183	£0.447
66 kV	78,800	£0.299	£0.195	£0.494

Capital charges, 12½ per cent.

Energy losses, at 60 per cent. load factor, 0.5d. per unit.

Case 2.—The subdivision results in the loss of the benefit of diversity, in the increase of the cost of the stations, and in a poorer load factor. On the other hand, the expenditure on higher-pressure mains and transformers is altogether avoided.

Case 3.—The comparison here made is between equal stations of equal efficiency, one at each of the four corners of the area. Where an existing system is added to, the older stations are likely to be the less efficient, and it will prove economical to deal with the basis load (high load factor) from the new stations and the peak load from the old. Considerable economies of station operation may be gained by interconnection and for the development of a large area, whether the stations be of the same class or of different classes (peak and base load stations), practical conditions will compel the establishment of more than one station, and that the stations will be interconnected. The comparative costs are tabulated below.

COMPARISON OF ANNUAL COSTS OF ALTERNATIVE SCHEMES OF SUPPLY.

Case	1	2	3
Generating stations:—			
Number of stations	1	4	4
Total demand	500,000 kW	550,000	525,000
Mains and transformers:			
Pressure	volts	33,000	—
Route miles	—	42.4	—
Kilowatt miles	—	5,250,000	1,560,000
Annual costs per kW year:			
At stations	4	8.00	11
Distribution	—	1.23	0.24
Totals	—	9.23	10.14

For the area considered one large station shows an advantage over four. If for the same total load the area is increased and with it the distance between stations, an increase of transmission pressure will become necessary; this will introduce also intermediate feeding points whose effect on the cost of the 10,000-volt distribution complicates the comparison.

Broadly speaking, however, the comparison shows equality of cost between Cases 1 and 3 when the distance between stations is approximately 30 miles.

Low-voltage Overhead Distribution.

By B. WEILBOURN. (Abstract.)

The distribution of electrical energy by bare overhead conductors has made slow progress in this country, two of the oldest and most important schemes being those of Ebbw Vale and Ystradgynlais in South Wales.

The B.E.S.A. has recently issued a specification for creosoted wood poles, and has in hand the preparation of specifications for telegraph and telephone line materials. The specifications which deal with insulators and pole fittings will be particularly useful for light power work, while the elaborate specification for different types of tubular light steel poles may be helpful in some directions. The B.E.S.A. also has in preparation specifications for copper and aluminium conductors and steel strand, but their completion is dependent on the results of extensive tests which are being made at the N.P.L. for the B.E.A.I.R.A.

Overhead lines are required to comply with "Regulations prescribed by the Board of Trade under Section IV of the Electric Lighting Act, 1883," (now administered by the Electricity Commissioners and under revision with the assistance of an ad hoc committee appointed by the I.E.E.) The exist-

ing regulations prescribe factors of safety which are highly controversial, and seldom observed.

For lines which give a supply to consumers at pressures above 250 volts, the regulations require that a continuous earth wire should be provided, that all metal work on each pole should be connected to it, and that it should be definitely "earthed" at every fifth pole. Nothing is said about earthing at pressures below 250 volts, and the author is decidedly of opinion that the fittings on each pole should not be "earthed" by a single wire coiled into a flat spiral beneath the lower end of the pole. There are various objections to it, the chief one being that the surrounding ground may not in all cases provide an efficient "earth."

The question of distribution by overhead wires *versus* underground cables is a controversial one, and cases may sometimes be settled by first-cost considerations, but, fortunately, aesthetic and maintenance conditions are sometimes given their full value—especially in garden city schemes. In one such scheme the total first cost of the overhead distribution, including 108 public lighting fittings, was £6,800, whereas the estimate for a high-class scheme using cables throughout was only some 20 per cent. higher. Allowing for the longer life and lower maintenance charges on cables, it is very doubtful whether there was any real saving by using overhead wires in this case.

Overhead distribution has a special field of its own in the development stage of the electricity supply industry in the United Kingdom—particularly in rural areas and in works and colliery distribution. The standard of work and appearance, as well as of continuity of supply, are much higher in this than in many other countries, and the author believes that ultimately the distribution in all our towns, garden cities, and large villages will be done by underground cables. The basis for this belief partly lies in the growing practice of the General Post Office in replacing overhead wires by cables even in country villages.

DISCUSSION.

The papers by Messrs. Woodhouse and Welbourn were discussed together on the second day of the Conference, when Mr. Roger T. Smith presided over Section VII.

The CHAIRMAN, in opening the discussion, expressed the opinion that the last paragraph of Mr. Woodhouse's paper which stated: the "comparison shows equality of cost between cases 1 and 2, when the distance between stations is approximately 30 miles," was of great importance to railway men. It might be more economical for a railway company to erect a generating station of its own (even if it had only a capacity of 6,000 kW) if by so doing it could save 30 miles of transmission. The Electricity (Supply) Act, 1919, seemed to indicate that the railway companies should purchase electricity in the cheapest market, and they had the power to build their own generating stations. Regarding Mr. Welbourn's paper and the transmission of electricity by overhead *versus* underground lines, that was not purely a problem of economics from the railway point of view, because considerations of greater convenience and added safety might outweigh those of an economical nature.

Mr. A. PAINOTON thought that the new proposals now under consideration, if carried into effect, should make overhead transmission popular in this country. A seven-strand aluminium conductor, the centre strand being of steel, had advantages over copper for small conductors. In connection with the calculation of safety factors, the proposed ice load which it was suggested should be applied was good, but it should be remembered that the same factors of safety could not be applied to lines in exposed and sheltered positions.

Mr. B. WELBOURN explained that the Electricity Commissioners had not yet accepted new factors of safety which had been suggested for h.p. lines. It was his opinion that l.p. distribution by overhead lines had a definite place to fill in the future, and many designers were only waiting for new rules and regulations to be issued before they proceeded to work on up-to-date lines. There was much to be said for the method of connecting the house service to the overhead pole line by means of a length of underground cable, and in that connection the subject of disturbance by lightning was an important one. Lightning surges had been known to reach a house circuit even through an underground cable system.

Mr. G. V. TWISS said that if Mr. Welbourn thought that overhead lines in sheltered positions should be erected in the same way that Post Office lines were, it should be realised that if a P.O. line came down, there was no danger to the public. Moreover, it would be useless to attempt to use telegraph insulators for l.p. power distribution. The reduction of the ice and wind loads on lines in sheltered positions would reduce the sag of large conductors, but would increase that of smaller ones.

Mr. S. G. LEECH pointed out that larger wire than No. 3 or 4 could not be used if appearances were considered, because it was liable to kink if it was not stranded. "Weather proofing" the wire was of little use, and would not add one year to the life of the conductor. No one knew how the figure of 22 ft. for the allowable distance above ground of overhead conductors had been arrived at, and probably 17 or 18 ft. would be all that was necessary. He had found the G.P.O. most reasonable, and it had in some cases consented to insulate its wires with P.B.J. compound, which was the best way of

overcoming the difficulty. There was probably a saving of between 40 and 50 per cent. to be made by the use of overhead distribution for public lighting and similar work, and he, therefore, differed from the author's conclusions. The only way to supply rural districts economically was by the use of overhead distribution, but he pointed out that P.O. experience showed that certain belts of the country were devastated once every ten years, and provision for rebuilding certain lines periodically would have to be made.

Mr. B. BARTHOLOMEW denied the statement that had been made to the effect that the P.O. carried out its work without regard to its cost. Nowhere was closer consideration given to the financial aspect of a job than in the Post Office. He pointed out that authorised and unauthorised suppliers of electricity did not have to comply with the same clauses of the Electric Lighting Acts, and also that towns and such like places could not be regarded as sheltered positions. The greatest risk of danger to the public from falling lines was in or near towns, &c.; the regulations were framed solely for the safety of the public—they were not in any way intended to be a specification for a good way of doing the job, and therefore the subject of sheltered positions should not be laboured too much. Some of the worst breakdowns had occurred at sheltered positions. The P.O. rules allowed several alternative methods of protecting its lines, for instance, the use of an earthed neutral as a guard wire. With regard to lightning, the author was perhaps an alarmist. If a conductor was struck directly it disappeared entirely and secondary effects due to discharges elsewhere could be satisfactorily dealt with by a gap between two carbon plates, one of which was earthed. He knew of no record of a building being damaged by P.O. lines being struck, and explained that the P.O. use of underground cable was not determined by any particular storm.

Mr. A. H. PREECE was of the opinion that it was all a matter of economics, and that it was impossible to do overhead work now because of the cost of poles. Regarding Mr. Woodhouse's suggested 600,000-kW station, it would be extremely difficult to secure a suitable site for a station of such a capacity in this country. It would require 10,000 cu. ft. of water per minute which quantity could only be obtained at the coast. Moreover, it would use something like 5,000 tons of coal per day, and it would be necessary to hold two or three months' stock in hand so that the arrangements for handling such quantities of fuel would be very difficult, and it would be hard to justify the enormous expenditure that would be involved. A load factor of 60 per cent. could not be attained, and therefore the author's assumed figures were false ones. The diversity factor would only be slightly improved if the stations were to be combined—it all looked very nice on paper, but would not work in practice.

Mr. L. B. ARKINSON agreed in part with the previous speaker's remarks regarding Mr. Woodhouse's paper; the only way to discuss it was to challenge the author's assumptions. Regarding Mr. Welbourn's paper, the speaker mentioned that the early distribution system on the Trafford Park estate was all overhead; it had now, however, all gone underground. Rural areas were the places for overhead distribution, if made at all, and when they put transformers on the consumers' premises they would at last begin to use higher voltages. In Holland, where a considerable amount of overhead line was in use, they experienced no more difficulty with 10,000 than with 500 volts. Concerning factors of safety, ice and wind allowances were really beside the point, the figures met with in practice were very much greater than anything allowed for in calculations. They must make up their minds that overhead lines would come down occasionally, the real trouble was that they were much more particularly about continuity of supply in this than in other countries. It was a fact that lightning could get into a house circuit, and with reference to cost of poles, the speaker mentioned that cables now cost double their pre-war price, and road work, excavation, &c., from five to six times as much. He saw very little use for "weather-proof" wire.

Mr. W. A. TURNBULL favoured h.p. a.c. underground distribution with transformers provided that the cables were made large enough initially for meeting future needs. In housing schemes the cables should be laid early while the ground was soft and before it was necessary to reinstate the surface.

Mr. MACLEWAN drew attention to the importance of the possibility of an insulated wire spreading fire in a rural area. It was a fact that a man could not run as fast as a flame would travel along the wire.

Mr. A. S. BARNARD thought that the possibility of malicious damage being done to transmission lines should be realised and allowed for.

Mr. A. H. PEARCE, speaking a second time, explained that a good many laymen liked to see something round the wire, and in some cases they had to comply with the wish (*i.e.*, in South America). In New Zealand a good deal of such wire was used, and he was told that the American cotton-covered and compounded wire lasted for ten years, whereas the English make only lasted half as long; it deteriorated because of the alternate wetting and drying.

Mr. G. V. TWISS also spoke a second time, pointing out that the failure of the American lines was due to the deterioration of the porcelain insulators. British porcelain did not deteriorate. The ice coating allowance was a logical method of calculating the stresses.

Mr. MATHEWS spoke in favour of American insulators. Mr. F. WELBURN, in reply to the discussion, said that "weather proofing" of wire was an abomination; it was no protection, and added nothing to the safety of men working on the line.

(To be continued.)

THE THERMAL EFFICIENCY OF HEAT POWER PLANT.

(Continued from page 45.)

ON Friday, July 1st, Dr. W. R. Ormandy, F.I.C., opened a discussion on "Liquid, Colloidal, and Powdered Fuels." He put the average calorific value of oil at 18,000 B.t.u. per lb., and that of coal at 12,000 (pre-war) and 10,000 B.t.u. (nowadays), but pointed out that the saving due to the use of oil was not confined to the difference in calorific values; the oil could be burnt with greater efficiency owing to the ease with which the best ratio of air to oil could be attained. Burning oil, an efficiency of 80 per cent. could be reached with a Lancashire boiler, while with bad coal the limit would be 60 or 65 per cent. Hence oil was the more economical up to the point where its price was from 1.5 to 2 times the price of coal. Purchasers should have their coal analysed to avoid paying for ash; in a particular case a customer who bought his coal by analysis received only 10 or 11 per cent. of ash, whilst others who did not follow this course received coal containing 22 per cent. of ash. With oil fuel, the cost of getting rid of clinkers was saved, a heavy item in London. Generally in industry the boiler house was the place where the greatest economies could be made—far greater than in the engine room.

For marine use, oil had no rival. It should not, however, be burnt under boilers if it could be used in internal-combustion engines, the efficiency of the latter being far in advance of that of steam plant. The tendency in internal-combustion engine practice was to use oil with solid injection. Research should be directed towards using a wider range of oils; the Diesel engine was confined within narrow limits. The newer supplies of oil were of an asphaltic nature, and caused trouble in the engines; endeavours should be directed to making the engines suitable for fuels of this character, which carried the least proportion of valuable by-products, and were, therefore, the most suitable for combustion.

Powdered fuel was coming into extended use abroad; it had long been used here for cement kilns, as the best fuel for the purpose. Powdered coal was used a good deal in the United States, but Dr. Ormandy was loath to recommend its extended adoption here. It was doubtful whether it would pay to dry and grind the coal, in view of the high efficiency attained in burning fine coal on modern mechanical stokers. Powdered coal could certainly be burnt to better advantage than coal on a stoker, and its use might pay in special cases, but he doubted whether it would pay in ordinary cases. The cost of drying and grinding had been brought down by the use of ingenious machinery to 3s. or 3s. 6d. a ton, which was not much with coal at its present price, but they must consider the position that would be reached if coal was reduced to half the price ruling at present.

With regard to powdered lignite and peat, much time and money had been spent on the peat problem, and extended researches had been carried out in Germany, Norway, and Sweden. There was no way of drying it so good and cheap as by the use of mechanical diggers, macerating and drying in air to a moisture content of 27 per cent. Under cover it could be dried to 17 per cent., and powdered. Lignite was not so much used in the powdered form, but in Germany it had to be used, and had been found cheaper than coal.

Dr. Ormandy next dealt with powdered fuel mixed with oil. Coal was denser than oil, and tended to sink in it, the oil having a density of 0.93 to 0.98. The coal was ground fine to pass through a screen of 100 meshes to the inch—much of it passing through 180 mesh—at a cost of 2s. or 3s. per ton. Mixed with oil and used as a fluid, it did not appreciably increase the viscosity, and made the oil go further. With oil at 4s a ton and coal at 30s. to 35s., the mixture was cheaper than oil alone. While powdered coal by itself was not recommended, the use of the mixture with oil was worthy of serious consideration; the mixture behaved like oil, and it was said that the coal dust suspended in the oil tended to hold the more volatile constituents and reduce the flash point. Mexican fuel oil had a density of 0.95. When powdered coal was mixed with it in the proportion of 75 per cent., the coal tended to settle in a paste, cream, not like sand; the mixture could be agitated and the coal dust kept in suspension with very little expenditure of power. The distribution of oil was an important matter; it was in the hands of a small number of people. The apparatus used for the conveyance of fluids in wartime was available for use for this purpose. The coal could be ground and mixed with the oil after the latter was delivered. The author deprecated attempts to form a so-called "colloidal" mixture. A portion of the flue gases could be used to warm and agitate the mixture. One method of maintaining the dust in suspension was by giving the particles an electrical charge, so that they repelled one another; but the better plan was to depend on simple mechanical agitation.

In the discussion which followed, Sir HENRY FOWLER said he was surprised to hear that one could get from oil 1.75 to 2 times the value of coal; his own records suggested 1.5 to 1.75. The whole question was purely a financial one. The best burner was what was called the "Mexican trough" type, which was operated with steam at a pressure of 30 lb. per sq. in. He preferred to use oil with an efflux time of 400 at 60 deg. F. Much of the oil that was sold required preheating. He was not optimistic with regard to the use of oil on locomotives when the price of coal came down; a stoker must always be carried on a locomotive, so that no saving in labour could be made there by the use of oil. The difficulty attending the use of powdered coal was formerly the effect of the intense heat on the firebrick; had this been overcome? In the United States it was said that no such difficulty was met with, but he found that this was due to the use of a complicated system of replaceable brickwork. On the Rumanian railways lignite was used in conjunction with oil, but not mixed with it.

Mr. P. D. VERNON drew attention to a new system of powdering coal invented by Mr. Charles Blyth; the machine dried and pulverised the coal at one operation. It was of a rotary type, with two stages; in the first stage coal and hot air expanded outwards, drying and partially pulverising the coal; in the second stage the coal was drawn inwards, and pulverised, with the aid of a fan. Coal containing 25 per cent. ash and 20 per cent. moisture was put through the machine and came out in the form of a dry impalpable powder. A great saving was effected in the space occupied and power consumed; from 147 h.p. the power was reduced to 60 h.p., and two men did the work of five. The air discharged was free from dust, which was not the case with the old type of plant, of which the upkeep, moreover, was enormous. A further invention of Mr. Blyth's was described. During the shortage of coal it was desired to use a quantity of coal refuse, hardly black in colour, wet, and having a calorific value of only 7,000 B.t.u. per lb. This was put through the machine and blown into the cement kiln, but the flame was not hot enough. Mr. Blyth tried the effect of feeding in a small quantity of paraffin—only 0.07 per cent. of the weight of coal, with the result that the flame was completely changed. The powdered coal was here a vehicle for the oil, which was so small in quantity that the heat units which it represented and the cost of it were negligible. Apparently the oil enabled the "coal" dust to flash or burn in the kiln at an earlier stage. This device would enable them to burn rubbish that would otherwise be useless.

Mr. LAWRENCE asked whether the ash from finely powdered coal gave rise to trouble. At a works in Birmingham the fine ash went out of the chimney and settled on the neighbourhood, with the result that eventually they were compelled to shut down the plant.

The CHAIRMAN, Mr. Loughnan Pendred, gave some particulars of the work done in the United States, where powdered coal was used extensively. Grinding cost 1s. 0½d. a ton in 1918, and had to be done on the spot, as the dust was not transportable. The dust was also an extremely dangerous explosive, and could not be stored in large quantities. Powdered anthracite was useless owing to its lack of volatiles and had to be mixed with 40 per cent. of bituminous coal. The temperature attained in the combustion of coal dust was from 2,500 to 2,900 deg. F. An American correspondent informed him that the use of powdered fuel was going ahead very rapidly, and claimed that an efficiency of 85.6 per cent. had been attained with a large boiler by the Milwaukee Electrical Co., or 90.2 per cent. with the economiser, the CO₂ in the flue gases being 16 per cent.

Mr. GRIFFIN said that no liquid slag was formed when powdered coal was burnt in a properly designed combustion chamber. He thought the explosion scare was rather a bogey. It was quite easy to grind coal so that 85 per cent. of it would pass a 200-mesh screen, and it was no good going beyond that; the cost was 5s. to 5s. 6d. a ton, including interest and depreciation, and repairs. The ash gave trouble when much iron or lime was present, if the combustion chamber was unsuitable. Quite a large number of powdered coal installations were at work in England; an efficiency of 80 per cent. was attained during a 72-hour test, with coal which was useless for other purposes. The temperature conditions in the combustion chamber governed the formation of slag. Under proper conditions there was no smoke at all. The great advantage of powdered coal was the large surface of contact with air; the air supply could be reduced to the minimum. In a puddling furnace, the consumption of coal had been reduced from 25 to 12 cwt. per ton of iron. Powdered fuel could not be used in Lancashire boilers. Pit-mounds consisting of rubbish were now being burnt as powdered fuel.

Mr. R. W. BRUCE referred to the great future for powdered fuel, and asked what size the combustion chamber should be—an essential piece of information. The cost of grinding must be kept down.

Mr. ERITH, of the Underfeed Stoker Co., doubted whether powdered fuel would ever become of commercial value in England; the great cost of the plant killed it in competition with ordinary methods. The capital cost was 4 to 5 times as great, and a large space was required for the grinding and drying machines, while the running cost was also high. The total costs of capital, labour, and power for grinding and drying were nearer 5s. than 1s. or 2s. per ton. In a modern generating station they could obtain an average efficiency of 78 per

cent. if the plant were well cared for, and no great increase was likely with powdered fuel. There ought to be no difficulty in burning powdered anthracite if the furnace was suitably designed. This was a matter of enormous importance to South Wales, where vast quantities of fine anthracite, as well as of fine steam coal, were available.

Mr. FOSTER dealt with the size of the combustion chamber, and quoted records from the White-Foster boiler, which burned 114 lb. of coal per sq. ft. of grate per hour. He said there was no disadvantage in allowing the flame to impinge on the tubes.

Replying on the discussion, Dr. ORMANDY suggested that Sir Henry Fowler's figures for the relative value of coal and oil were lower because Sir Henry had included the cost of labour. In the case quoted by Mr. Vernon, the effect of the paraffin was probably due to its lower ignition point. The fine ash from powdered fuel was a real difficulty. He could not accept a boiler efficiency of 90 per cent.; 80.3 per cent. was very rarely attained. A mixture of coal dust and air was fearfully explosive. Powdered coal was useful in metallurgical industries, but he did not recommend it for boiler firing. There was no harm in letting the flame strike the tubes if the water was really pure. Anthracite dust was now in great demand.

(To be continued.)

THE LONDON FAIR AND MARKET.

On July 4th, the London Fair and Market at the Agricultural Hall, Islington, was opened by Sir William Joynson-Hicks. As in the two preceding Fairs, electricity again does not play a very prominent part, although it may be said that the number of electrical exhibits is slightly larger this year.

Although the Fair is purely a trade show, it has been arranged with much taste, and is well worth a visit. The principle "lines" exhibited are hardware, toys, jewellery, stationery, and fancy goods, and these make an excellent display. The main feature of interest to the buyer of electrical goods is the stand held jointly by MESSRS. SIEMENS BROS. AND CO., LTD., and ENGLISH ELECTRIC & SIEMENS' SUPPLIES, LTD. This is a large display of electrical goods of many descriptions. On the "Siemens" side are numerous dry batteries, fluid cells, and accumulators, as well as many appliances for operation by these agents. Several cycle and motor-cycle lighting sets are shown which are marvels of compactness. In addition to these are samples of fuse units, distribution boards, pocket lamps, torches, and large incandescent lamps, vacuum and gasfilled. In the centre of the stand is a comprehensive display of ebonite and articles made of this substance. A new type of ebonite is shown which is variously coloured in a resemblance of marble, the colours being worked right into the material and not merely applied to the surface. The manufactured parts include telephone receivers and transmitters, as well as pipe stems and other non-electrical articles. On the "English Electric" side of the stand is a comprehensive range of domestic appliances. These were all manufactured in a Canadian works controlled by the company, and because of this the name "Canadian Beauty" has been applied to them. The predominant feature of all these appliances is their very high nickel finish. All the usual small heating and cooking devices are on view. The grill is a strong but neat example of its class. It is fitted with two aluminium pans—deep and shallow—and a nickelled reflector plate which enhances its efficiency. The heating element, as in all the other appliances, is of pure nichrome wire wound on metal-bound mica. The plug contacts are well shielded, effectively guarding against shock to the user. Three "heats" are provided, and these are put into operation by inserting the plug on pairs of terminals in succession, one terminal for one heat being used for the next heat. The "Canadian Beauty" irons are made in various sizes, from the 3 lb. to a large tailor's iron; in this, again, as in all the articles, the contacts are heat-insulated and well guarded. Another useful appliance shown is a four-tier electric steamer, which only consumes 600 watts on full heat; 200 watts is sufficient to keep the water boiling once it has reached boiling point. A 1-kW "Britannia" fire is displayed; this is a very neat and convenient fire which weighs only 4 lb. Other appliances include boiling rings, coffee percolators, toasters, &c. A "Bee" vacuum cleaner is also shown. This is a very light machine with a high vacuum.

MESSRS. BENNETT BROS. have a brilliant display of artistic French glass-ware in the shape of bowls and lamp shades. A "smoke" effect is obtained by burning oil the surface of the glass in various designs by means of acid, the result is very beautiful. Many other small articles are shown, including a coloured glass scent diffuser, in which perfumes are evaporated through a perforated cap, by means of a small electric lamp. A cigar lighter shown is somewhat different to the usual type. It consists of a highly polished wooden case containing a well of porcelain in which are two small contacts. A brass top containing petrol has a small-bore stem, upon the end of which is a wad of asbestos wool in a brass collar. When this is plunged on to the contacts, the resultant spark ignites the petrol on the wool.

THE BRITISH CELLULOSE & CHEMICAL MANUFACTURING CO., LTD., has on view "Celastod" non inflammable celluloid in

many shapes and forms. These include lighting bowls and lanterns, tumbler switches, bell pushes, &c., as well as such articles as table knives, brushes, and combs.

THE EXCELSIOR SHADE MANUFACTURING CO. has an excellent display of silk lamp shades and metal shade rings in many colours and designs.

Among a large number of toys exhibited by MESSRS. STUSSFELD FRERES, is a miniature workshop equipment, including a lathe, emery wheel, grindstone, and drilling machine driven through shafting by a little electric motor.

MESSRS. CHAS. BOYTON & SON, LTD., exhibit a large array of tumbler switches and metal stampings of all kinds. The "B.T.N." tumbler switch is of solid construction, and is finished in a number of styles, including brass, aluminium, bronze, nickel, and other finishes. A feature of these switches is that all its pivots are screwed and not riveted.

ZONDERVAN WORKS, a French firm, exhibit a special type of builders' crane, which can be arranged for hand, petrol engine, or electrical operation. It has two jibs which may be used simultaneously, one lifting and the other lowering, or separately. This is effected by a common pinion between two wire drums, which may be moved to operate only one drum.

The jib gearing is arranged to stop when a certain point is reached, thus preventing accidents due to an operator's inattention. Brick and block-making plant, for plain or decorative work, is also shown and operated, in addition to motor-driven stone and gravel crushers.

Another French firm, MESSRS. ROSSLIER & FOURNIER, show a novel electrical device in the form of a letter- or document-sealing appliance. This is an inverted conical brass container in which sealing wax is melted by a small heating element. The wax is applied through a small hole in the apex of the cone, which is opened and closed by a small metal plug operated by a thumb lever.

THE GEM LABOUR-SAVING DEVICE CO. displays a number of "Gem" vacuum cleaners and accessories. Electric vacuum cleaners also appear on the stands of THE DOMESTIC APPLIANCES CO. ("Simplex") and THE ELECTRIC APPLIANCES CO., LTD. ("Eureka").

MESSRS. O. F. AHLMANN have a display of glass ware, including lighting bowls, lamp shades, &c., and MESSRS. RICHES, GREEN & CO. exhibit a number of highly artistic lamp standards in carved wood and metal.

MESSRS. JARVIS, PERKIN & CO. show a number of their "Fonoto" telephone call recorders.

The London Fair and Market closes to-morrow (Saturday).

JOINT ELECTRICITY AUTHORITIES.

London and Home Counties Inquiry.

(Continued from page 71.)

On Wednesday, July 6th, Mr. BOWDEN, chief engineer to the Poplar electricity department, said that contrary to the views of the engineers of the technical scheme of the L.C.C., the Conference of Local Authorities and the nine companies' proposals, he held the opinion that in the case of East London the expenditure on a new capital station could be justified, and he did not recommend extending the existing stations beyond the plant already ordered for that purpose. He suggested that the whole area delimited by the Commissioners would be best dealt with by dividing it into, say, four districts, each with a separate District Committee with financial autonomy, but under the general control of a Joint Electricity Authority for the whole. His idea was that there should be an Advisory Committee of Engineers consisting of the chief engineers of the various electricity undertakings in the district, which should meet regularly and discuss the engineering policy, reporting its decisions to the District Committee, which, in turn, would make recommendations to the Joint Authority. In the event of differences of opinion, there would be an appeal to the Commissioners. It was not proposed that the District Committee or the Joint Authority should take over the power stations; they would remain in the hands of the existing authorities. His estimates had been based on including the railway and tramway load, which he thought was essential to obtaining the best results.

Sir JOHN SNELL said that having regard to the suggestion of Mr. Donald that the East London area might be worked by an independent committee within the ambit of a larger Joint Electricity Authority, for the reason that a better engineering scheme could be evolved for that district, the Commissioners thought that it would be better for Mr. Donald to confine his evidence to engineering, leaving the administrative side to be dealt with in argument.

Mr. BOWDEN, continuing his evidence, said that on the Dagenham site for the new power station there were already coal jetties, and that would save considerable capital expenditure. Moreover, it was obvious that the industrial development would take place in the Dagenham area. Dealing with working costs, he said there would be a considerable saving with regard to ash disposal, this saving being put at 5s. to 5s. 6d. a ton. He calculated that the ashes could be got rid

of for 6d. per ton on the Dagenham site, and taking 84,400 tons of ash when dealing with 600,000,000 kWh per annum, there would be an actual saving of £23,000 per annum, which represented a saving of from £250,000 to £500,000 capital expenditure on plant to deal with the ashes. That would more than offset the extra cost in transmission due to the extra distance of the site from London, which would be from £8,000 to £10,000. The land available for the site was anything up to 150 acres, and the owners had been approached, the price to be paid being under negotiation. Mentioning that Poplar supplied electricity more cheaply than any other part of London, Mr. Bowden said that last year the average price received was 1.66d. per kWh, and there was a net profit of £9,250. The nearest to that was 1.67d. per kWh at Stepney.

Passing on to what is being done now with regard to linking-up in the East London area, Mr. Bowden said that there was a saving of 800 tons per annum in each of the undertakings concerned, viz., Hackney, Poplar, Shoreditch and Stepney, and a saving of £1,500 per annum through one undertaking dealing with the light load for a certain period alternately. So far, however, full advantage had not been taken of the possibilities. A further trial extending the interconnection between these undertakings was to have been undertaken, but the coal strike intervened. By this extended trial it was hoped to save a further £500 per annum. In answer to Sir John Snell, Mr. Bowden said he did not think the full advantage could be obtained from interlinking until there was a central authority which should be able to direct operations and say what should be done. If the Committee of Engineers reported that a certain station should be shut down for a short period, or even altogether, he felt it would have more weight with the engineer of that station than would the opinion of one individual with autocratic powers to say what should be done. He did not think it would be necessary for the District Committee to have an engineer, at any rate, at the beginning.

Sir JOHN SNELL asked if engineers would be able to find time to attend to the work of such a committee, having regard to the increasing importance of the commercial side of the business, and the increasing call on the engineer's time in that respect.

Mr. BOWDEN agreed that the work of such a committee would at times be very heavy, but the engineers were now working on similar lines. If the proposition was put before the various undertakings from the business point of view, he believed they would all come in.

Sir JOHN SNELL said that it had taken eleven years to interconnect four stations, this interlinking having started in 1910. At this rate it would take until the third generation to get in the whole of the undertakings on the present basis.

Mr. BOWDEN said that was hardly a fair way to put it. Between 1910 and 1914 Poplar and Stepney were connected, and an agreement was entered into between them that neither would extend without consultation. As a result, Stepney put in new plant and Poplar refrained at first. Then Poplar put in two sets when it only wanted one, in order that Stepney should not be put to the expense of extending. Now Stepney was extending again. At first he did not propose that there should be an engineer to the District Committee, but later, when the East London scheme erected a generating station, then he would have a chief engineer to the District Committee.

Mr. HENDERSON, cross-examining for the L.C.C., put it that Mr. Bowden now abandoned the idea of being a separate area, and asked to be a sub-committee under the main authority. Mr. BOWDEN agreed.

Mr. HENDERSON then put it that East London, having certain advantages, did not want to sacrifice anything for the benefit of the non-industrial area outside, and thus the supply in that non-industrial area could not be cheapened.

Mr. BOWDEN said that was largely the case, but the development of the non-industrial area would depend largely upon railway electrification, and there were other factors which might come in to cheapen the supply in the non-industrial areas. Witness added that the East London scheme had been devised as a municipal scheme as far as possible.

Mr. HENDERSON suggested that possibly the promoters would prefer to confine the scheme solely to the area north of the Thames, and that the addition of the other portion south of the Thames was really only camouflage.

Mr. BOWDEN said the area north of the Thames was the area selected by the Conference of Local Authorities when London was divided into areas before that idea was abandoned by the Conference, and he believed he could justify a scheme for that area apart from the southern part.

Dealing with the cost of ash disposal, Mr. BOWDEN said that this would be at the low figure of 6d. per ton, because the ashes would be used for spreading out on the site around the works for building up the level of the land. That would go on for a good many years.

In answer to Mr. Turner, who pointed out that the Joint Electricity Authority would have power, under the Conference scheme, to set up such a District Committee as was now suggested, Mr. BOWDEN said that would go a long way to meeting his case, but he wanted something more definite.

The effect of Mr. Turner's cross-examination was that all Poplar was asking to do could be done by the Conference scheme.

Mr. KENNEDY, for the companies, asked whether the station proposed at Dagenham was likely to be more economical than a station at Beckton.

Mr. BOWDEN said he had inspected that site, and did not consider it so good as Dagenham, and he believed electricity could be supplied more cheaply from Dagenham because of the physical disabilities of the footpath between the river and the site, which would necessitate putting the buildings further back, thus involving extra expense in pipes, &c.

Mr. MORSE put some questions, pointing out difficulties through including the City of London Co.'s Southwark area in the district delimited by the scheme, and Mr. BOWDEN, while quite willing to leave out all the companies included in the companies' scheme, said he would not compel any company remaining in the area to take a supply, but would deal with it on a business basis.

Answering Mr. Booth, Mr. BOWDEN said he contemplated supplying the whole of the area eventually from one or more capital stations, shutting down all the existing stations.

Asked if, on the assumption that the other authorities did not come in, he would advise his own authority to come into the larger scheme, Mr. BOWDEN said he would not take a dog-in-the-manger policy, and on the whole he felt he would have to come into the other scheme, but he hoped the Commissioners would give special consideration to the industrial area. So far as the control of the Joint Authority for the larger area was concerned, his intention was that it should only be over operation and not finance.

Discussing the erection of capital stations, Mr. BOWDEN said that the cost of plant was now 20 per cent. lower than last year, and cables were from 20 to 25 per cent. lower. He did not think prices would fall very much more during the next few years, and therefore there was no need for undue delay in erecting capital stations. He felt that the engineers who had drawn up the technical scheme for the L.C.C. companies, and Conference of Local Authorities, had displayed an excess of caution in dealing with this matter.

Sir JOHN SNELL put a number of questions tending to show that there was no substantial difference between the scheme on the engineering side and the engineering proposals for the other schemes, except as regarded the position of the generating station. Mr. BOWDEN agreed.

Sir JOHN SNELL, in his final questions, suggested that by breaking up the large area into a number of smaller ones would be reintroducing the difficulties already experienced by supply authorities through the existing small areas.

Mr. BOWDEN said it was all a question of getting the proper area, and he reminded Sir John that the companies' scheme took in a smaller area than that delimited provisionally by the Commissioners.

Mr. E. M. LACEY said that in 1918 he was instructed to prepare a report dealing with electricity supply in West Ham and Poplar, at the same time bearing in mind the supply in the area now called the East London area. In 1919 there was a conference of electricity authorities with the Commissioners, and at that conference it was understood that if any scheme was put forward dealing with a part of London on the engineering side, it must contain an administrative scheme for the whole area delimited.

Sir JOHN SNELL said his strong advice on that occasion was that all parties should endeavour to come to an agreement.

Mr. LACEY, continuing his evidence, said he was asked to prepare a scheme for the East of London, and in doing so he came to very much the same conclusions as the other engineers, taking London alone. Then he dealt with the East London area, he considered whether he could justify erecting a capital station earlier than would be the case with the larger area, and he came to the conclusion that he could, having regard to the demand and the price at which electricity was being supplied. He gave the figures of load factor, &c., given by Mr. Donald in his opening statement, and put it forward that when a capital station was erected the same advantages would accrue, the present advantage being that electricity was supplied in the East London area at 22 per cent. less than in the rest of London. He strongly advised against putting any new plant, other than that already ordered, in the existing stations, and said the capital station should be proceeded with so that it could be made use of in 1924 or 1925. To do what was proposed in the L.C.C. and other schemes, was to continue the present bad practice of adding to many small stations, and, moreover, it would be necessary eventually to centralise the supply. As to the railway load, he said his experience of adding a tramway load to a general supply was that the combined load factor was higher than either of the two individual load factors, and he anticipated that the same thing would be found to be the case with railways, and thus both parts of the supply would benefit. Railway electrification went on so gradually that the supply for it would be better dealt with as part and parcel of a general supply, and in that way, the railway companies would get electricity more cheaply than by putting up a separate power station.

Mr. LACEY, continuing his evidence on Thursday, July 7th, said that the figures of cost already given were per unit generated, but adding charges for working capital (not provided for in the other schemes) administrative charges, and interest and sinking fund, brought the total cost per unit generated in 1926 to 0.999d. per unit, and in 1931 to 0.912d. per unit. Thus the same disparity between the area chosen and the larger area which already existed, being an advantage of 22 per cent. in favour of the East London area, would continue

to exist if the East London area were developed on the lines laid down in the scheme.

Summing up the advantages of site in his scheme over the others, Mr. LACEY said that there was the constructional advantage of not having to construct loading jetties—a similar advantage being claimed for the location site at a saving of £200,000—and the land was much cheaper, the bulk of it being marshy land. For the 50 acres available for buildings, &c., he had allowed £600 an acre, which, he thought, was reasonable, and for the marsh land on which the ashes would be dumped, he had allowed £200 an acre.

Cross-examined by Mr. Henderson, Mr. LACEY said the Advisory Committee of Engineers would only exist during the interim period of five or six years until the capital station was erected, and when that time arrived, a chief engineer would be appointed for the East London area, and it would be necessary for him to resign the Advisory Committee of Engineers. He might even be appointed before the capital station was built. When the undertaking had developed sufficiently for the capital station to be erected, he was inclined to the view that there should be one person in charge of the whole, with the necessary authority to see that his requirements were carried out.

Mr. HENDERSON wished to know to what extent Mr. LACEY proposed that the District Committee should be under the control of the Joint Authority for the larger area. As first put forward, the East London scheme was to have a separate Joint Authority for that district; now that had been abandoned, and a District Committee was asked for, with financial autonomy. In that way, it would be unfavourable to develop the whole of London on an economical basis, because the non-industrial areas would get no benefit from collaboration with the industrial areas.

Mr. LACEY said that in dealing with a large industrial area a difference of 0.1d. per unit was a very important matter, whereas in non-industrial areas, even 0.25d. per unit difference was not material. Therefore, if the linking-up, financially, of a non-industrial area with an industrial area resulted in an increase in price in the industrial area, it might make all the difference to the success or otherwise of industries in that area. During this cross-examination, a discrepancy was found in the figures of the estimates, but even so it was agreed that the total figure of cost of generation was less than that shown in the L.C.C. scheme. At the same time, other inconsistencies were found, and Sir JOHN SNELL requested that certain tables should be redrawn.

Answering Mr. Turner, for the Conference scheme, Mr. LACEY said he did not agree with preferential tariffs in particular districts under the aegis of a Joint Electricity Authority for the larger area.

Mr. KENNEDY, for the nine companies, put some questions to show that in some parts of London the load factors were even better than in the East London area.

Mr. LACEY, replying to further questions, said he did not agree with the policy of the L.C.C. in proposing to extend the Stepney station to the fullest limit of its capacity. His opinion was that no other plant than that already authorised and in hand should be put in the existing stations.

Sir HARRY HAWARD asked if the engineer of the Joint Electricity Authority for the whole area should have any control over the engineer of the District Committee.

Mr. LACEY thought not. The engineer of the District Committee should have complete control of that district as far as the executive work was concerned, but the District Committee would bring all matters before the engineer of the Joint Authority, which would decide whether it should act on the advice of the engineers of the District Committees.

Sir HARRY HAWARD said this appeared likely to lead to a duplication of officers and duties, and not likely to lead to a reduction of the cost of electricity in the long run.

Mr. LACEY did not take that view. He had included £7,000 per annum as the administrative expenses of the District Committee during the interim period, including a small technical staff.

Sir HARRY HAWARD then contrasted the periods adopted by Mr. LACEY in his estimates for the repayment of loans, as being too high compared with the periods usually allowed.

Mr. BOOTH asked what there would be left for the Joint Authority to do. Mr. LACEY said it would deal with broad questions of policy and finance.

Mr. PAGE drew attention to the fact that in his estimates Mr. LACEY had put down £20 per kW as the cost of the plant in the capital station by 1936 against £24 per kW in 1931.

Mr. LACEY said he had made that difference because by 1931 more buildings would be required, and the cost of these he estimated would more than offset the tendency for prices to fall.

During the afternoon Mr. HENDERSON, for the L.C.C., entered a protest against the lines of administration under the Poplar Borough Council. In his counsel's speech, as suggested in the minutes yesterday. Such a procedure, he said, was hardly likely to be the best, and others, who should have the opportunity of testing the relationship of the District Committee to the Joint Authority for the larger area, for instance, should be asked to do so.

Mr. HARRY HAWARD said the point was a good one, and it would be in Mr. Donald's own interest to put forward a scheme to deal with the question of the case, seeing that the original proposal to constitute a Joint Electricity Authority for the area had given way to a proposal to form a District

Committee. Questions were then put by Sir JOHN SNELL as to the ability or otherwise of engineers to design and carry out a scheme for such a large area as the one delimited by the Commissioners, and he quoted Chicago and the North-East Coast as examples of what he meant.

Mr. LACEY adhered to his view that it would be unwise to put the whole of the control under one man in such a large area.

Other questions put by Sir JOHN SNELL were directed to the point that a Committee of Engineers such as that suggested under this scheme would lead to great delay.

Mr. LACEY said the point was that having got a scheme for a definite area, it would be possible for the engineers to go ahead at once.

Sir JOHN reminded Mr. LACEY that under the terms of the Electricity Supply Act, 1919, authorised distributors must be supplied at a price not exceeding that at which they could supply themselves at the present time. Therefore, he could not see why, if Poplar was merged in the larger scheme, the price it would have to pay for energy would be any higher than it now was.

Mr. P. J. SUTTON, F.I.C.A., handed in an estimated balance sheet of the revenue of the proposed East London District Committee, showing details of the estimated costs of generation in 1925 and 1931, the total figures of which had already been given by Mr. LACEY.

Mr. HENDERSON, for the L.C.C., asked where the revenue for the District Committee was to come from under the scheme during the first period, until the capital station was erected. As it had been put forward the scheme was that the existing owners of the stations would continue in possession until their plants were closed down.

Mr. SUTTON agreed that in these circumstances the District Committee would have no revenue.

Sir HARRY HAWARD said that what he wanted to know with regard to the scheme, and at least one other, was what revenue the Joint Authority or District Committee would have until the capital stations were built. He hoped that that information would be forthcoming before the inquiry was concluded.

Mr. DONALD said that he frankly stated that under his scheme there would be no revenue for the first five years, or until the capital station was in operation.

After a short discussion as to procedure, it was decided to adjourn until Tuesday, July 12th, the reason being that certain financial witnesses for the three previous schemes who have to be recalled would not be ready for the following day, neither would it be convenient for Mr. Donald to call his witness on the administrative side of the scheme, whilst the railway companies, the next on the list, also were not ready.

At the opening of the inquiry on Tuesday, July 12th, Sir JOHN SNELL, speaking to Mr. Morse, said it would be advisable and useful if he could put in some evidence showing the growth of the load in the County of London and West Kent Companies' area, and the effect of the Barking station on the areas of the company inside London. Mr. Morse promised to consult with his clients on the matter.

Mr. DONALD then handed in the resolution passed by the Poplar Borough Council authorising the submission of the East London scheme.

Sir JOHN SNELL then asked Mr. Donald to call his witness to deal with the administrative portion of the East London scheme.

Mr. DONALD said the difficulty was that having been asked by the chairman to deal with that in argument, he had released the witness whom he intended to call, and could not get him back from the country, and he felt he had been prejudiced by the course the proceedings had taken. All he could do was to call a witness for the Poplar Borough Council, and do the best he could in the circumstances.

Mr. TATE, assistant manager of the Poplar Electricity Department, handed in a scheme for the formation of the District Committee on the lines of the proposals made by the Conference of Local Authorities at the time when it was proposed to divide London into four areas for the purpose of electricity supply. This statement differentiated between the executive functions of the Joint Authority and the District Committee. It was suggested that the Joint Authority should make such regulations as were necessary to bring about co-ordination of supply, such as provision of new generating station, laying mains, extending existing stations, shutting down stations, &c., the supervision of working arrangements between one District Committee and another, charges, &c. Each district would have its own capital stations and subsidiary stations, but each district would be connected up electrically, and it was over the arrangements for this that it was proposed the Joint Authority for the whole area should have control. On the other hand, the District Committee should have powers to appoint an Advisory Committee of Engineers consisting of the chief engineers of the undertakings in the district, which committee should carry out the same duties within the District as were to be carried out by the Joint Authority as between the various Districts. As to loans, it was suggested that the Joint Authority should raise them on behalf of the District Committee or Committees on the security of the rates of the whole area of the Joint Authority.

Sir HARRY HAWARD said this would involve the Joint Electricity Authority in lending money to a Committee of itself.

Mr. DONALD said it was done every day under the Education Act, the Education Committees having separate accounts. The Joint Authority could raise loans and place the proceeds at the disposal of the District Committees, as was done in the case of Education Committees. Where, however, the Joint Authority did not approve of certain proposals of a District Committee, and, on appeal to the Commissioners, the scheme was passed, then the loan should be raised by the District Committee on the security of the rates of the particular district. This, however, would be avoided if a Joint Committee was set up under Section 8 of the Electricity Act of 1909.

Mr. CRAY HENDERSON, cross-examining for the L.C.C., was told by the witness that the administrative scheme had not been before the Poplar Borough Council, because there had not been time.

Witness agreed that in some degree this scheme would localise electricity supply, but it would be in areas large enough for economical distribution and for self-control, which was very different from the present state of affairs.

Mr. TURNER put it that the District Committee would, under the scheme, have a power of appeal to the Commissioners against the Joint Electricity Authority of which it was a Committee. Witness agreed.

Mr. DONALD, in re-examination, said all the difficulties suggested in the working of this proposal would also arise in connection with the Companies' scheme.

Sir HARRY HAWARD said it was quite possible that any Joint Electricity Authority might decide to work the area by District Committees as suggested by Poplar, but he understood the East London scheme went further and asked for autonomous powers, at any rate financially.

Mr. TATE said that was so.

Sir HARRY HAWARD: And have the credit of the central authority for raising money?

Mr. TATE said not necessarily, because he believed the East London area would be able to raise its own capital on satisfactory terms.

With the handing in of some revised tables of estimates in regard to the engineering aspects of the scheme, Mr. Donald closed his case.

Mr. CRAY HENDERSON, referring to the Conference between the L.C.C., the Conference, and the Companies regarding the purchase of undertakings, said it had been found impossible to come to an agreement, as the local authorities desired certain terms with regard to acquisition of the Companies' undertakings, which the L.C.C. did not agree with, nor did the Companies.

Mr. TURNER, for the Conference of Local Authorities, said that certain resolutions had been passed by the Executive of the Conference dealing with the question of purchase. The main point of these was that the Executive did not feel justified in considering the question of purchase coupled with an extension of the Companies' distributing powers, without consulting the whole of the members of the Conference.

Sir JOHN SNELL said it seemed that the main point in dispute was the point of the extension of the Companies' life as distributors.

Mr. TURNER said if the difficulty of dealing with the acquisition of the Companies' apart from any extension of distributing rights could be got over, it would go a very long way towards agreement. It was intended to hold a full meeting of the Conference to consider the position, but the Executive Committee did not feel it could go further than it had in the resolutions that had been passed. All the proposals for extending the Companies' distributing rights had been brought up since the inquiry began, and he was not yet sure what attitude some of his local authorities might now wish to take with regard to it.

Sir JOHN SNELL said the Conference must be fully aware that there was no power to compel the Companies to come into any scheme for the re-organisation of electricity supply in the area, and could they expect the Companies, as it were, to give something for nothing?

Mr. TURNER said that was hardly the view which the Conference Executive took. They felt that if the Companies got the cost of their stations less depreciation, and a guarantee of electricity at no higher price than that at present possible, then they had got sufficient consideration without any question of an extension of distributing powers.

Sir JOHN SNELL said that speaking on his own responsibility he sincerely hoped this opportunity for the L.C.C., the Companies, and the local authorities to come to an agreement would not be lost. As things stood, the L.C.C. could in 1928 give notice to acquire all the Companies' undertakings in London. The L.C.C. was willing to agree to an extension of the Companies' distributing powers, with a view to inducing the Companies to come into a scheme at once. If the Companies were purchased under the terms of the Act of 1888, the cost would be more than the terms now proposed by the nine companies, and could Mr. Turner suggest any means for consolidating the supply without the assent of the Companies? He imagined the answer was "No." [Mr. Turner agreed.] Therefore, if the Companies were willing to sell their stations or allow control practically at once and upon terms which were less than under the 1888 Act, could they expect them to do it without some *quid pro quo*?

The matter was left there for the moment.

Mr. TYLOR then opened the case for the L.E. & S.C. Railway and the G.E. Railway.

(To be continued.)

The Sheffield Corporation's Scheme.

WHAT follows is an abstract of the scheme that has been submitted to the Electricity Commissioners on behalf of the Corporation of the City of Sheffield (Mr. S. E. Fedden being the general manager and engineer of the electricity department) for the constitution of a Joint Electricity Authority for the North-East Midlands Electricity District.

The scheme is divided into administrative, technical, and financial sections, and proposes that the Authority shall consist of 18 members, of whom 12 will be appointed by the City Council of Sheffield and the County Borough Council of Rotherham, and one each by the Borough Councils of Chesterfield and Doncaster, and the County Councils of the West Riding of Yorkshire, Derbyshire, Nottinghamshire, and Lindsey.

The Authority may give notice to the Yorkshire Electric Power Co. requiring it to sell to the Authority so much of its undertaking as is within the district upon the terms set out in Section 2 of the Electric Lighting Act, 1888.

Regarding the second or technical part of the scheme, it is proposed in the first instance to interlink the generating stations at Neepsend, Blackburn Meadows, and Rotherham. Later, as required, links will be carried out as follows: (1) Rotherham, Mexborough, Doncaster. (2) From Neepsend to Dronfield, Sheepbridge, Chesterfield, Clay Cross, Staveley, Barlborough, and Eckington. (3) Blackburn Meadows and/or Rotherham to Ecclesfield and Chapeltown. (4) Blackburn Meadows and/or Rotherham to Rotherham Main Colliery, Treeton, Waleswood, Kiveton Park, Shireoaks, and Worksop. (5) Rotherham to Greasborough, Kilnhurst, Rawmarsh, and Wath-on-Dearne. (6) Rotherham to Silverwood, Thurcroft, Dinnington, and Maltby. (7) Mexborough to Yorkshire Main Colliery and Doncaster or vice versa.

The system to be adopted will be three-phase alternating current, 50 periods. The main transmission pressure will be 11,400 volts, or higher if necessary, and will be stepped up to these pressures from the existing generating pressure, which in the majority of the stations is either 11,400 or 6,600 volts. The suggested transmission lines will be 14 in number, of which six will consist of single cables and seven of duplicate cables, while that from the Doncaster new station to Kirksandall will be an overhead line. All the lines will be at a pressure of 11,400 volts, except that from Rotherham to Silverwood and beyond, which will be at 6,600 volts; 3-core cable of 0.25 sq. in. section will be used throughout. Provision will require to be made for one 10,000-kW transformer with switchgear at the Rotherham station, and the following extensions of plant are in course of construction or authorised to be proceeded with: Chesterfield, 3,000 kW at 6,600 volts; Doncaster, 6,000 kW at 3,000 volts; Rotherham, 30,000 kW at 6,600 volts; Sheffield, 53,500 kW at 11,400 volts.

The maximum loads estimated for the first five years for the main generating stations are as follows: Buxton, 400 kW; Chesterfield, 5,344 kW; Doncaster, 6,000 kW; Mexborough, 1,500 kW; Rotherham, 36,000 kW; Sheffield, 100,000 kW; Worksop, 650 kW; total, 149,894, say, 150,000 kW.

The additional demand anticipated from existing installations of private plant is 15,000 kW, and that from the coal owners is 5,000 kW. The allowance for spares is 57,000 kW, and the existing plant installed or authorised amounts to 210,610 kW, which, less the Sheaf Street station that is to be discarded, leaves a balance of further plant required by the end of the first period of, say, 20,000 kW.

The estimated maximum demand for second period of development is: Maximum demand at end of first period, 170,000 kW; 10,000 kW per annum of local loads, 50,000 kW; railways, 40,000 kW; coalowners, 20,000 kW; allowance for spare, 93,000 kW.

The existing plant at end of first period is 227,000 kW, leaving balance of plant required by end of the second period of 146,000 kW.

The maximum loads that can be provided for during the first five years by the undertakings with existing plant and extensions already sanctioned, allowing 25 per cent. for spare, will be 155,000 kW, which shows a difference of 15,000 kW, plus its proportion of spare, making 20,000 kW additional plant required during the first five years, to be installed as determined. During the second period of development it is anticipated that the maximum loads on the generating stations of the authorised undertakers will have increased to 280,000 kW, and with a reasonable allowance for spares, a total maximum plant capacity of 373,000 kW must be provided, to meet which the aggregate plant installed will amount to 227,000 kW, leaving a balance of excess load over plant capacity of 146,000 kW.

The additional plant required will be provided as follows: At Blackburn Meadows, 30,000 kW; at Rotherham, 30,000 kW; and at the new stations at Doncaster and Mexborough, 90,000 kW, increasing later to 120,000 kW.

As the plant at the following stations becomes obsolete it will be discarded, provided an alternative and cheaper supply is available—The Sheaf Street and Kelham Island stations of the Sheffield undertaking and the existing stations at Chesterfield, Doncaster, Worksop, Mexborough, and the Rotherham No. 1 station. The scheme will include provision for supplying the railways in the area with an extra high-pressure supply into sub-stations at convenient centres.

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THE RUBBER INDUSTRY.

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The position of the rubber-producing industry is reaching a climax following successive attempts to bring about stabilisation, none of which has attained any real success. Towards the end of last year the members of the Rubber Growers' Association (which includes most of the large British-owned Eastern estates), agreed voluntarily to reduce their output to 25 per cent., and although this understanding was loyally adhered to, the surplus rubber in existence to-day is greater than it was then. There are now between 70,000 and 80,000 tons stored in New York, and something like 78,000 tons here, while it is estimated in directions which should be well-informed, that the stocks available for shipment in the East are about 100,000 tons. In order to put the trade on a better footing the Rubber Growers' Association has now formed the Rubber Producers' Corporation, with the object of controlling the rubber output of its members, fixing the selling price and regulating the sale of such rubber, controlling the opening up of fresh rubber plantations by its members, and generally of assisting to finance the stocks of its constituents. As the Corporation is concerned only with British-controlled plantations, it is proposed that a similar Corporation be formed simultaneously to include estates owned by Dutch interests and by companies or individuals in the Dutch East Indies, a working agreement being entered into between the two Corporations, to ensure uniformity of action. The Rubber Producers' Corporation will not go to allotment until the owners of at least 2,200,000 acres, inclusive of the Dutch Corporation membership, have agreed to come into the scheme. The capital of the British end of the organisation will be £2,000,000, with borrowing powers either on debentures or otherwise up to £8,000,000, of which at least £3,000,000 is to be raised in the first instance.

There is no doubt that part of the demoralisation recently seen in the rubber market is the aftermath of excessive optimism on the part not only of producers but also of consumers, certain of the latter, indeed, having enormously over-bought themselves, and having been compelled to throw their holdings on the market, in addition to which there has, of course, been inevitable speculation for the rise which has involved very heavy losses. Whatever the result of the proposals now put forward, it must be remembered that the restriction of output can be merely a temporary palliative, but on the other hand, if the restriction were entirely voluntary and left to the judgment of each individual producer, there could be no effective stabilisation, because as the price rose to a profitable level, over-production would again result, with its inevitable consequences. As it is, a considerable area of the rubber estates in Malaya consists of small holdings owned by Chinese and others, who will probably be outside the operation of any restrictive covenant amongst the British-owned concerns, and these might easily become thorns in the flesh, the removal of which would present difficulties.

It is the considered opinion of the trade that any material and early expansion of demand is out of the question. The existing world stock is somewhere about 300,000 tons, the potential output in 1922 is over 400,000 tons, and the potential consumption is this year unlikely to exceed 250,000 tons. It is quite clear, therefore, that if anything is to be done effectively the time is fully ripe for action. The slump in prices has been prodigious and severe, and it is reasonable to believe that with selling prices so far below cost, a reaction must be seen sooner or later, but meantime, producing costs have no

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significance, where holders are compelled to liquidate their stocks or their commitments, and it is only by concerted action of some kind, artificial though this may be, that selling prices can be put on a more satisfactory basis. Under any circumstances the stabilisation of the rubber market must prove a long and painful process, though by the efforts of the new organisation it may be possible somewhat to advance the selling price, and to impart a degree of stability to which the market for some time has been a stranger.

A National Electrical Convention.

ON Wednesday the annual meeting of the I.M.E.A. was opened by Mr. H. Richardson, and having listened with interest to his presidential address, we are in a position to congratulate him

upon the admirable views which are embodied in it. There is not a sentence with which we do not cordially agree, and we trust that it will be widely read and laid to heart by all who are interested in the development of the electricity supply industry. While we know that there are many amongst the ranks of municipal engineers who are wholly free from prejudice against private enterprise, it is refreshing to hear the President of the Incorporated Municipal Electrical Association appeal for closer co-operation between municipal and private enterprise, and deprecate the unjust attacks which are too often made upon the latter.

The subject, however, to which Mr. Richardson devotes the greatest space is one which we, as he says, have dwelt upon, and to which we again drew attention on two occasions recently—namely, the promotion of a great annual Convention of the whole of the electrical Associations in the kingdom, similar to that which has so often excited our envy, in the United States. True, we cannot hope to rival the N.E.L.A. Convention in magnitude; we must be content to work on a smaller scale—but we can rival our American cousins in efficiency, zeal, and enthusiasm, and the success of such a venture need not be held in doubt.

Mr. Richardson quite rightly suggests that the Institution of Electrical Engineers should be the first body to be approached in the matter; since it developed a progressive spirit and proved its readiness to adapt itself to modern conditions, the Institution has gained immensely in efficiency and prestige, and has definitely assumed its rightful position as the leading electrical society in this country. But as the President surmises, the organisation of the National Convention would be a heavy addition to the burdens of a Council and staff that are already overworked, and as we have previously indicated, we think, with the President, that the British Electrical Development Association is admirably adapted to take charge of the movement—a movement which is entirely within its special sphere. In saying this we have in mind one aspect of the Convention to which Mr. Richardson alluded, and on which we have laid stress—the educational side of the function in the public eye. Undoubtedly the value of the Convention as a first-class propaganda would be enormous, and the lay Press would be aroused to a degree of interest and appreciation far beyond anything yet achieved by any electrical gathering in this country. But we do not lose sight of the strong attraction that such a Convention would hold out to the whole of the industry as a unique opportunity for meeting everybody, and discussing everything, in the electrical field. It would be the event of the year in electrical circles, and it would do more than any other means to foster close co-operation between all branches of the industry.

We earnestly hope, therefore, that the seed sown by Mr. Richardson will bear fruit, and that all parties will receive the proposal with cordial approval. The sooner action is taken the better, for it is not a day too soon to commence the work of organisation if the first Convention is to be held next year. We understand that it is the intention of the "Buenos" to hold an electrical exhibition in 1922, if possible, and if the Convention can be held at the same time and place, so much the better.

Currency and Government, the Credits and Currency Credit. Department of the Federation of British

Industries asks for a new commission on currency and credits, in order that the present situation may be examined in the light of recent events. It points out that since the late Lord Cunliffe's Committee reported there have been important changes in our circumstances.

In the first place the exchanges were artificially controlled during the War, with the result that the European exchanges in terms of dollars have depreciated in certain cases to such an extent that it is impossible to expect a recovery to pre-war levels within a decade. Consequently it is pointed out that there is no sign that any of the nations of Europe are really willing to face the enormous sacrifices involved in the general adoption of the currency policy. On the contrary, producers in most European countries are successfully bringing strong pressure to bear upon their Governments to prevent any attempt at an improvement in their respective rates of exchange. Foreign manufacturers, especially Germans, see clearly enough the enormous advantages to them of keeping their own rate of exchange as low as they possibly can. Those people in this country who sometimes rejoice when they see a slight improvement in our rate of exchange, do not seem to realise that every one per cent. that our exchange goes up, makes it one per cent. more difficult to sell anything abroad.

The Federation of British Industries further points out that through the years 1919-1920 an upward movement of prices continued to a lesser or greater extent in all European countries, and in most of them a continued inflation of the currency took place. Consequently, the distance to be travelled before they can return to their pre-war gold currency is very much greater than it was at the time of the Cunliffe Report.

The last point touched upon is the enormous increase in the burden of taxation, and the fact that any attempt to repay in to-day's currency debts incurred at the pre-war level is practically an impossibility.

A more detailed memorandum is to be forwarded to the Government in due course, in the hope that a new Commission will be appointed before the close of the present Session. It seems to us that if a new Commission is to result in anything being done to improve conditions for British traders its composition will be a difficult affair. Any more of the pious aspirations embodied in the report of the Cunliffe Committee would be absolutely useless, and unless men can be selected with new ideas, who are prepared to recommend something practicable to help the manufacturer and the trader, the Committee might just as well not be appointed.

The Buenos Ayres Electricity Works.

THE report of the Compañia Hispano-Americana de Electricidad, of Madrid, which acquired the works of the German Transmission Electricity Co. at Buenos Ayres and the interests held by the latter in other undertakings in South America, contains a statement which reveals the fact that Belgian technical advice has now replaced German in connection with the development of the undertakings. The directors state that their principal preoccupation from the time of the transfer in July, 1920, was not only to continue the management of the business, but also to develop it, and they proceeded to prepare a scheme of renovation and extension which had become necessary during the years of warfare. It was soon possible to proceed with the execution of the scheme, thanks to the co-operation of the Société Financière de Transports et d'Entreprises Industrielles, of Brussels, to which the directors entrusted the realisation of the investigations and works of a technical kind. Among the works in progress or completed are mentioned the provision of two turbo-alternators of 20,000 kW and 50 periods, one of 20,000 kW and 25 periods, and three of 6,000 kW, the modification of the main switchboard at the South Docks station, Buenos Ayres, and other works.

THE CO-OPERATIVE SYSTEM OF ENGINEERING EDUCATION.

By E. KILBURN SCOTT.

SOME professors and teachers of engineering believe that it is possible to give sufficient practical instruction in engineering in what may be called "school workshops." Such workshops usually contain a number of more or less obsolete machine tools, one or more smith's hearths, and the usual benches for fitting, pattern-making, &c. There may also be some attempt at making small brass and iron castings. However up-to-date such a workshop is when first equipped, it soon falls behind the times because of the quick progress of engineering development. Commercial engineering becomes more and more concerned with the manufacture of large quantities of apparatus requiring special automatic tools, and a great deal of the most important work is structural steel, chemical machinery, mining apparatus, &c., which has to be built on a large scale.

For the above and other reasons, many believe that practical engineering training can only be properly acquired in industrial workshops, and that the school workshops are only useful for giving preliminary instruction in the use of hand-tools and to teach young men how not to injure themselves when handling machinery, belting, gearing, &c.

The question is: What is the best method of co-ordinating the theory and principles taught in engineering colleges and technical schools with the practical experience that can only be properly acquired in real engineering workshops?

It is clearly desirable that students should take a course in practical engineering at the same time that they are doing theoretical work, and for this reason it is customary for some university students to voluntarily spend part of their vacations in workshops.

The sandwich system whereby students spend half of the year in college and half in works has been very successful, and it is interesting to note that a somewhat similar method is very successful in the United States. It is known as the *Co-operative System*, and it is the purpose of this article to describe it.

It was first started at the University of Cincinnati in 1906 by Prof. H. Schneider, Dean of the College of Engineering, and consists of two groups of engineering students spending fortnightly periods in industrial works of Cincinnati and intervening fortnights in the class-rooms and laboratories of the College of Engineering. The two groups change and change so as to give continuous training.

Prof. H. Schneider saw that such a system would enable many worthy young men to obtain instruction at the Engineering College who otherwise would be excluded, for the main idea of the course is to enable a student to earn sufficient money to keep himself and pay his class fees, whilst at the same time acquiring workshop experience and theoretical instruction under the very best conditions.

When the plan was first mooted to the University faculty it met with scepticism, as it was said that a group of "boiler makers" would soon destroy the scholastic atmosphere of the University, but opposition was broken down by Prof. H. Schneider proving that many practising engineers and managers of industrial concerns of Cincinnati viewed it favourably. They expressed belief in its feasibility, and were unanimous in saying that their theoretical training had meant little to them upon graduation, because they lacked practical knowledge.

The officials of a large bridge-making corporation gave hearty endorsement to the co-operative plan, both as an educational and a commercial proposition, and when the plan had been explained to the superintendents of departments and foremen of workshops, they also showed interest. Finally, twelve concerns engaged in electrical

and mechanical engineering agreed to try the co-operative system.

The arrangement of the alternating periods proved to be a matter of mere administrative detail, the only change suggested being to make each period a fortnight instead of a week.

The next problem was to find students who would take the co-operative course, for those who came to take the regular four-years' course could not be induced to try, because of the requirement that they should spend the summer in the shops. This requirement discouraged many prospective members of the first group of co-operative students; for ten hours of manual labour in hot weather, and on equal terms with ordinary apprentices, is a pretty severe test.

To fill their place Prof. Schneider hurriedly recruited a class of young men who had failed to obtain the full academic units required for admission to the college, but who had had some practical experience and gave evidence of fitness for engineering work. Notwithstanding their rather poor scholastic records, the members of this first class were promising, and caught the spirit of the new course. One of them is now efficiency engineer for the Bell Telephone Co., in a Middle-West State, and he was admitted against the advice of his father and over the protests of three high-school principals, who had dismissed him as incorrigible.

Once the system was proved a success, progress was very rapid, and many thousands of young engineers in Ohio and neighbouring States owe their start in engineering to this co-operative training, and the College of Engineering at Cincinnati is now one of the largest and most successful in the country.

It has been found that interlinking practical work and theoretical studies closely for five years enables young engineers to acquire a thorough acquaintance with practical engineering conditions, and on graduation they are able to at once undertake positions of responsibility. The co-operative system has an improving influence on character, and develops industry, loyalty, and self-reliance, because the students are earning money all the time they are learning.

The young men obtain such excellent first-hand information of workshop processes, &c., that the College can concentrate on theory and principles, with the result that the theoretical training is very complete. Continuous experience in theory and practice enables students to find their special forte very quickly, and there is less chance of misfits in after life.

The first groups of co-operative students developed great responsibility, because they knew the outcome of an important educational experiment depended upon success, and the realisation of this fact seemed to give a sense of loyalty to the college, and a determination not to disappoint those who had trusted them.

They were self-conscious owing to being the centre of interest in the educational clinic, and the knowledge that they were being analysed and written up gave them a feeling of aloofness from the rest of the students.

At first there was class consciousness, caused by the exclusive attitude of the regular academic students, but the animosity between the two groups soon disappeared, and co-operative students and others have found that they have a great many things in common. The fact that their interests and experiences are in some respects unlike has made their association mutually beneficial.

Co-operative students take a prominent part in every kind of student activity. Three have been elected to the presidency of the senior class, and the captains of both football and basketball teams are "co-ops." In all musical, social, and other organisations there is a large proportion of co-operative students, and in view of recent developments, it would be hard for either group to

understand that the "ostracism of the boiler makers" was once seriously considered.

The co-operative student is alert, rugged, and independent, more serious than the "regular" student, and yet on occasion displays a sense of humour and a buoyancy which shows that the sobering of practical work does not depress him.

The latest development in co-operative instruction at the University of Cincinnati has been the merging of the College of Commerce with the College of Engineering. This has opened up many new opportunities for the further usefulness of the co-operative system, for students of commerce spend alternate bi-weekly periods in the business departments of various firms in the Cincinnati area, and thus gain first-hand information regarding the application of their studies under commercial conditions. A feature of the new course is that during the first two years the same fundamental training and same industrial contact are given to both commercial and to engineering students.

To summarise, the "co-operative system" may be said to be a co-ordination of theoretical and practical training in a progressive educational programme, the agency which furnishes the practical experience being always some branch of actual industry, thus giving the fullest possible utilisation, for educational purposes, of equipment used in commercial production.

From the employer's point of view, the most important elements of the co-operative plan are the proper selection of workers, and the awakening of an enlightened interest in their work through co-ordinated instruction. From the standpoint of the school and the student, the important feature of co-operative education is the realisation of theory through its practical applications. In a very literal sense the studies become "applied sub-

jects," and in the word "co-operative," emphasis is placed not only on the kind of training, but also on the relation between school and industry, and the method of bringing them together.

Co-operative engineering graduates have become a factor in engineering circles of the United States, for not only are they being trained at Cincinnati, but also at the University of Pittsburgh, the Municipal University of Akron, and the Georgia Institute of Technology.

A report recently published, based on an investigation of engineering education in the United States, by the Carnegie Foundation, strongly endorses the co-operative system.

In a number of high schools the co-operative plan has also been adopted, and courses have been operated successfully under widely varying conditions. Thus at Fitchburg, Mass., high school students, after spending one year *wholly* in the school, go to work during alternate weeks as apprentice machinists, pattern makers, saw makers, draughtsmen, moulders, tinsmiths, printers, or textile workers. The instruction which they receive at school is co-ordinated with their practical work.

The co-operative system is similarly applied in a Pennsylvania high school, where students work in machine shops, foundries, automobile and carriage works, and in the cabinet-making department of a piano factory. Recently co-operative courses have been introduced into several high schools in New York City, and co-operation is carried on with machine shops, railroads, automatic factories, printing offices, electric light and power companies, mail order houses, and department stores. The results of the New York experiment have refuted arguments that the co-operative course can only succeed with a few occupations, and in small centres of population.

THE ELECTRIC WASHING MACHINE: FROM THE HOUSEWIFE'S POINT OF VIEW.

By MARY GWYNNE HOWELL.

WITH the present high prices of the commercial laundries, and with the servant shortage, there should be a big demand for electric washing machines. That they are not universally popular in this country is due as much to the fact that their possibilities are not understood by the firms that sell them as to the timidity on the part of the housewife to invest in something so new and untried.

If a woman is attracted by a window display and makes inquiries as to the method of using a washing machine the following directions are given: "Fill the machine to the water line with *very hot water*, add soap, put in the clothes, turn on the switch, and, hey presto! the clothes will be washed clean without any further attention.

This sounds very alluring, but if the prospective purchaser happens to be a practical housewife, she begins to ask detailed questions, which can only be answered by one who understands the processes of laundrywork, at least in theory. No really practical woman can be convinced, for instance, that if she plunges her woollens and flannels into the very hot water directed to be used there is sufficient magic in the washing machine to prevent the possibility of their shrinking! Many such points will arise, and it is because the directions are so misleading that people are sceptical as to the powers of the washing machine.

As a matter of fact, an electric washing machine used in the proper way has far more merits than are usually advertised, and armed with the necessary information, a salesman could easily convince a progressive housewife. The true facts, as tested by domestic science experts, both in the United States and in this country, are these:

1. *The clothes do not need any soaking overnight.* The machine is capable of flushing out the dirt without

this preliminary process, and much better results are gained if the clothes are put into the machine dry.

This point will appeal to the housewife, since it saves her much time and trouble.

2. *The water in the machine should only be warm—not very hot.*

The fallacy of very hot water has arisen from the fact that when a test wash is carried out at the factory, the garments washed are workers' greasy overalls—the grease being mineral oil. It is true that very hot water dissolves and removes mineral oil, hence the directions. The housewife, however, has to deal with garments soiled with animal fats and grease, and the albumen in animal fat *coagulates with heat*, with the result that the dirt is set fast.

This is the reason why wristbands, collars, and cuffs, and very soiled parts are often still grimy after a machine wash.

Not only does warm water give better results than hot, but it is also a matter of economy in hot water, which again will appeal to the housewife.

3. An important factor in machine washing is the use of really efficient soap *in solution*, together with a little water softener (soda or borax).

It is most important that the water should be soft and foamy with soap before the clothes are put into the machine. Proportions will vary according to the hardness of the water, but as a guide a general proportion of half a pint of soap solution (a breakfast cupful) and half a cup of strong soda solution can be given.

4. The clothes should be sorted into "loads," care being taken not to overcrowd the machine. It is far better to divide a big heap of clothes into two smaller loads, washing each for 15 minutes, than to crowd them all in at once and risk injury to the garments and strain to the machine.

5. Fifteen minutes in the machine should cleanse any but very soiled garments (which will require 20 to 30 minutes). After washing, each garment should be put through the wringer and left until all are finished.

The water does not need changing for each load of clothes, but only when it is really dirty, and the soap has disappeared.

6. The method of rinsing is most important. White clothes should be rinsed in *scalding hot water*, in the machine, running for five minutes.

This simple process does away with the necessity for *boiling*, and will be the most appreciated of all the virtues of machine washing.

Coloured materials and silks need warm water for rinsing. Flannels and woollens need warm, slightly soapy water.

An understanding of all these points will greatly enhance the value of a washing machine in the eyes of a would-be purchaser.

As with all machinery, there are important details as to the care which will make all the difference to the working efficiency of the machine.

These points are not understood by the average house-woman, and therefore a wise salesman will impress them upon a purchaser:

1. The moving parts require frequent lubrication. A woman who has had nothing to do with machinery

would not think of oiling the machine unless told to do so.

2. The machine must be thoroughly rinsed and dried after each use, but *not scoured*. If the interior is galvanised a whitish-grey deposit gradually collects as the result of a chemical reaction due to lime and magnesia salts in the water combining with the soap. This coating is not harmful—in fact it protects the metal from further chemical reaction, and should be left alone unless it becomes too thick.

3. Care must be taken that the connecting cord is not permitted to lie on a wet floor. When not in use it should be coiled carefully without knots or twists. The plug should never be jerked from the socket by means of the cord.

A practical woman having been shown in full the advantages of home washing with an electric machine should need no further persuasion; but should the price prove a stumbling block, a telling argument can be introduced in the fact that a reliable make of modern washing machine is constructed of such lasting materials that, given common sense care and treatment, it should last at least 20 years. This being so, the cost can safely be calculated on the basis of a 20-years' investment, and as such, proving the machine to be an inestimable bargain. Few women who have experienced the toil of washing by human power will be proof against such arguments.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

ANNUAL MEETING.

The annual meeting of the Association was opened on Wednesday last at the Institution of Mechanical Engineers, the I.E.E. building being still occupied by the inquiry which the Electricity Commissioners have in hand with regard to the London electricity supply. There was a large attendance of members from all parts of the country, and while the usual civic reception was lacking, there was otherwise no great difference between the proceedings and those which characterise the annual conventions of the Association. The meeting, however, commenced in the afternoon, instead of the morning, and there were no social functions or organised excursions, the only break in the labours of the members being made by the annual dinner on Thursday evening, for which some 200 tickets had been taken.

The meeting was opened by the President, Mr. H. Richardson, F.R.S.E., general manager and engineer, Dundee, who delivered his address; afterwards Mr. C. W. Charlesworth (Wolverhampton) read an exhaustive paper on "Questions arising in the consideration of the financial and business aspects of municipal electricity supply." A meeting of the chairmen members of the Association followed.

Yesterday the programme provided for the reading and discussion of three papers: "Steam raising—yesterday, to-day, and to-morrow," by Mr. D. Wilson (Messrs. Babcock & Wilcox); "Modern boiler-house practice," by Mr. W. M. Miles (Sheffield); and "Present-day commercial problems in electricity supply," by Mr. E. Cross (Rotherham).

The annual general meeting was to be held this morning, and a meeting of the Associated Municipal Electrical Engineers (Great Britain and Ireland) at the same place this afternoon.

Presidential Address.

By Mr. H. RICHARDSON.

General Manager and Engineer, Dundee. (*Abstract*.)

The Association continues to flourish exceedingly; it now represents a capital sum, due to municipal electrical development, of almost £50,000,000 and a total revenue of practically £20,000,000 per annum.

A little over a year ago many were full of hope as to the great strides which were to be made in the direction of a cheap and abundant supply of electricity all over the country, and seemed to hold the opinion that the Electricity

Commissioners would at once cause difficulties and obstructions to vanish, when each and every power supply authority whether municipally or company controlled, would be given freedom to attain its individual ambitions. When the obvious results of any constructive organisation became apparent, however, many of these entities felt that it would have to be a case of self-immolation for the benefit of the multitude, and are now betraying a sudden preference for a conservative maintenance of the *status quo* rather than wholeheartedly to join in a collective effort which cannot fail to be eventually of great benefit to the community.

There appears to be a lack of co-operation between municipally controlled undertakings and those which have been built up under private enterprise, which is not justified. Both are necessary, to obtain the maximum benefit for the public. The old difficulties have vanished, and the interests of municipalities and companies are very much more parallel and allied than many appear to think. Although the opinion that municipal concerns cannot work as cheaply as those run by companies is, to an extent, true, yet the companies should give full credit to many municipal electricity authorities which have been noticeable successes.

The reiterated accusations against private enterprise which insist that industries financed by private bodies make huge profits and generally batten upon a helpless public, are not borne out by the facts of the case as I see them. Indeed, I would go further, and state that it would have been impossible to develop the electrical industry to the extent it has been developed had it not been for the risks taken and losses experienced by companies and their shareholders in the early days of electricity supply.

Even to-day it is an outstanding fact that we have to rely for the necessarily expensive stages of experiment and initiative on those concerns owned by companies; the records for cheap electricity supply in this country are held by supply companies, and there is no evidence to show that, generally speaking, the charges made by them are in excess of those made by municipalities. In the United States of America, where energy is sold comparatively as cheaply as it is sold in this country, the supply is almost entirely in the hands of private enterprise, and the development of the uses of electricity has been much more intense and the benefits to the public have been greater and more rapid than on this side.

Under modern conditions municipalities will have to adopt a more liberal view in the methods of developing their trading departments if they are going to maintain their head on such a vast industry as the power supply of the immediate future must become. I am so anxious to see municipalities maintain a high standard of public service of electricity, with more rapid development, that I cannot refrain from pointing out the dangers of the continued parsimony of view which has recently been apparent.

Great as is the support the Electricity Commission deservedly enjoys, to be useful it must be practical. The Commissioners have set to work to mark out the road of our future progress. It can only do good and strengthen their confidence in them.

sewage and their work if we joyously and continuously let them feel that they have our enthusiastic and active support. I earnestly trust that chairmen and managers of both company-owned and municipally-owned concerns will use their undoubtedly powerful influence with their authorities to smooth away apparent obstacles or obstructions to recommendations the benefits of which may not be immediately forthcoming.

Managers and engineers of electricity supply authorities never had a better opportunity than the present for arriving at a practical basic principle of charging for electricity. Nothing can be clearer than the necessity for a simple charge for all purposes made up of a standard or service charge graduated according to the practical demand of the consumer, and, in addition, a certain rate per unit for all energy consumed. I hope this method, already placed before the Commissioners, will receive their approval at an early date, and having been adopted, let all resist the temptation to handicap the system with irritating and unnecessary complications.

I would take the opportunity of expressing the hope that every possible encouragement will be given by the Commissioners to the development of water power in this country. I have formed the opinion that many of us have greatly underestimated the possibilities of the country in this direction.

Owing to the large capital cost, however, there is a tendency for municipalities to avoid the responsibility; therefore (assuming that they have had the first opportunity and have decided not to use it) it must ultimately fall to private enterprise to develop hydro-electricity. Municipalities, however keen to insist upon control of these matters, must realise that they cannot get such control unless they supply the necessary capital and take a proportionate share of the responsibility.

I now have to make a suggestion which is no new idea, either to myself or others, and has been occasionally more than hinted at in the technical Press, notably in the columns of the *Electrician* and *ELECTRICAL REVIEW*. In my opinion, and I believe many others are with me, the time has now come for an actual recognised co-operation of all branches of our industry, in its first stage to take the form of a National Electrical Convention to be held annually in a place chosen for its suitability, where each sectional association of the Convention will hold its own meetings, yet maintaining a close contact with the main body, and thus commence to reap the innumerable advantages which the consummation of such a scheme cannot fail to produce. I suggest that such a congress be held under the auspices of the Institution of Electrical Engineers as the proper body for the purpose. The Institution has here an excellent opportunity to put into practice many of the lines of organisation mentioned by Mr. Wordingham in his addresses during the time he was president of the Institution, and, what is more, has a great chance to show that it is prepared to amalgamate the Institution with the industry. Each Association in the whole industry should be represented at this convention. Immediately upon the formation of a new Council of the I.M.E.A. a few gentlemen should be appointed to approach the Council of the Institution and as many other Associations as is possible, with a view to bringing this desirable scheme to fruition.

There are many advantages about such a scheme. I may mention the moral effect that such a large and powerful Convention would have upon the public in general by keeping them in closer and more sympathetic touch with what is of much importance to them. Again, we would have the more general support of the lay Press, added to the loyal and well-tried assistance of the technical Press, to say nothing of the benefits which would accrue from the incidental propaganda and advertising value.

Although I believe that it would be preferable for the Institution of Electrical Engineers to take a lead in this formation of a national electrical convention, yet I realise the very heavy and constantly increasing work which falls upon that body, and it is just possible that it may not be practicable for this part of my suggestion to be carried out. In such an event, I suggest that the next institution, within whose scope such work logically comes, is the British Electrical Development Association, which has done sufficient valuable work under different conditions to show the necessary potentialities to initiate an assumed success in such a direction. I think that an effort should be made first of all to get the Institution to move in the matter and show that it considers the commercial development of the industry as important as that of any other section.

In proposing a vote of thanks to the chairman for his address, Mr. A. W. Tarr reminded the meeting that they had also to thank him for the work that had already been carried out by the Institution of the meeting being held at Dundee. The vote of thanks was carried unanimously, and the chairman responded briefly.

(To Be Continued.)

JOINT ELECTRICITY AUTHORITIES.

London and Home Counties Inquiry.

(Continued from page 103.)

On Tuesday last week Mr. Tylor opened the case for the L.B. & S.C. Railway and the G.E. Railway.

Counsel said that under Section 11 of the Electricity (Supply) Act of 1919, the Companies had intended to bring forward schemes for dealing with their own supply, and to make the necessary application to the Commissioners, but they had not been able to get their schemes ready. The position now ready was that the railway companies wished to be able to see in what way they could obtain supply most cheaply. If they erected their own stations with the consent of the Commissioners, then they would be willing to supply any surplus to the Joint Electricity Authority. Generally speaking, the railway companies had no objection to any of the present schemes, and all they asked was to be left in the position of being able to obtain their supply in the cheapest market. It was impossible for the railway companies to say, in the meantime, that they would take their supply from a public source. If it could be shown that the Railway Companies could get their supply most cheaply from a public source, then he felt he could say that the railway companies would take a supply in that way. The companies were not desirous of being involved in any capital expenditure which could be avoided, and it was mainly with a view to hearing what the promoters of these schemes had to say that the railway companies wished to be present at this inquiry. So far, the evidence for the promoters had all gone to show that the railway companies would be more likely to be able to generate a cheaper supply for themselves than by purchasing from a Joint Authority.

After lunch, Sir JOHN SNELL, speaking to the representatives of the railway companies, said the Commissioners felt it would assist them if they could have a railway witness.

Mr. MILLER said that, speaking after consideration, he had nothing to establish through a witness, but at any time he would be pleased to give the Commissioners any information. He was not in a position to assist the Commissioners now.

It had previously been arranged that such of the smaller opponents as cared could hand in statements instead of making speeches. Consequently, such statements were now handed in by representatives of Barnes, Kingston and Croydon.

The opposition of the Metropolitan Electric Supply Co. was then proceeded with.

Mr. A. W. TARR, chairman of the company, was called, and explained the operations of the company as regarded the area inside the County of London, which is purchasable by the L.C.C. in 1931, and the bulk supply powers in Middlesex, which latter area it is desired to exclude from any of the schemes. At the present moment an additional 20,000 kW of plant is being installed at Willesden at a cost of £400,000. A recent bulk supply price quoted to Ealing was £4 10s. per kVA per annum plus 5d. per kWh, plus—in respect of coal—0.15d. for every 100 units when coal is over 20s. per ton. Any interference with the company by a Joint Electricity Authority would seriously hinder the company in raising capital. A large number of tables were handed in showing the financial position of the company.

Mr. J. S. HIGHFIELD, engineer to the Metropolitan Electric Supply Co., handed in further tables showing the position of the company so far as average prices, &c., were concerned. A three-phase, 50 cycle cable would be completed from Willesden to Uxbridge this year, and before long the whole of the supply would be on the three-phase, 50-cycle system, and the change-over from the two-phase, 60-cycle system would then be complete. Willesden still had room for another two 10,000-kW turbine sets in addition to the two similar sets now going in. This would fill up the site on the north side of the canal, but the company had nine acres on the south side of the canal where further extensions would take place. The Willesden stations of the Metropolitan Electric Supply Co. and the North Metropolitan Electric Power Co. were only a mile apart, and could easily be connected. Brinsdown was already linked up with the North Metropolitan Willesden station, and other stations in the area could be linked up very easily. The new plant going into the Metropolitan Co.'s Willesden station cost £20 per kW, and there would also be considerable economy of fuel consumption, the figure being about 24 lb. of coal per unit generated with normal coal.

A large number of questions were put by Sir John Snell as to how Mr. Highfield would proceed assuming the whole of the area under consideration were cleared of any of the 77 stations now in it, but Mr. Highfield did not care to make the assumption, and preferred to deal with the position as it was to-day.

On Wednesday, July 13, the opposition of the North Metropolitan Electric Power Supply Co. was taken.

Sir JAMES DEVONSHIRE, managing director of the Power Co., gave details of the incorporation of the company, the area of supply being about 326 sq. miles. The company now has authority to supply in bulk to authorised distributors and also for power purposes, these powers being held in perpetuity. Reference was made to the purchase of the Willesden power station of the Willesden Urban District Council, which, as a

Water-Power in the United States.—The Federal Power Commission has received 222 applications for permits to utilise water-powers, aggregating 114 million h.p. Twenty-nine permits have been granted respecting a total of about 2 million h.p. in 17 States, two of these are over 400,000 h.p. each, and three others average over 200,000.

matter of fact, is outside the company's limits of supply, but is held by the company in perpetuity. Moreover, the whole of the Borough of Stoke Newington, which is in the County of London, is now in the company's area of supply, whereas the remainder of the area is outside the County of London. An important feature of the company's powers was, said Sir James Devonshire, the authority to give or receive a supply from distributors in contiguous areas, and under those powers a supply had been given to Hackney. Thus there was nothing to prevent linking-up between the company and all authorities contiguous to its area.

An interesting question arose at this point as to whether it would be legal for the North Metropolitan Co. to supply an area contiguous to another area with which the power company was interconnected; for instance, to give a supply to Poplar through Hackney. The result of the discussion was that Sir James said there was no legal limit to the amount of energy which could be supplied to Hackney, and it was no business of his what Hackney did with it.

Continuing his evidence, Sir James enumerated the districts in which the power company was giving a supply for all purposes, Provisional Orders having been acquired. Dealing with other Acts obtained by the power company, reference was made to the fact that Parliamentary sanction had been given to the Metropolitan Railway Co. and the L. & N.W. Railway Co. to give a supply to the Power Co. from the Neasden and Stonebridge power stations respectively.

Sir JAMES DEVONSHIRE then went on to deal with the development of the electric tramway systems of Middlesex and Hertford, in conjunction with the Power Co. In addition to the authorised distributors taking a supply in bulk, the company had about 20,000 private consumers. The company had 168 miles of high-pressure mains and 156 of low-pressure mains. Statements were handed to the Commissioners showing the capital and revenue position of the company, units sold, &c. During the past two years the revenue had taken a leap upwards owing to the introduction of a coal clause in many of the power contracts.

Sir James said he objected to inclusion in the proposed London and Home Counties Electricity area. A Joint Electricity Authority would have a very vast business to deal with in the central area; he did not believe the Authority could help his company very materially, and his view in that connection was strengthened by what he had heard at the inquiry. At the same time, his company would always take or give a supply if it were more economical to do so. For instance, at the present time a supply was being taken from the Amberley Road station of the Metropolitan Electric Supply Co., and the Underground Electric Railway Company was also willing to give the Power Co. a supply. On the other hand, the Power Co. had given supply to outside authorities. The present supply of the Power Co. to authorised distributors was being given at prices lower than those shown in the estimates of the L.C.C. and the other schemes when everything which was contemplated had been accomplished. Indeed, he saw positive disadvantages from the proposals before the Commissioners. Even the promoters had suggested that they could not help the Power Co. for many years, and all they seemed to want was a contribution of about £5,000 or £2,500 a year towards the administrative expenses of the Joint Authority in the early years. He objected to paying anything for what was admittedly or no advantage. The company would have to pay a heavy contribution to the administrative expense because its sales were about 10 per cent. of the total in the area, and the administrative expenses had been put at £50,000 per annum. Another objection was that the Joint Electricity Authority could acquire power stations in the Power Co.'s area and supply them in bulk, thus competing with the Power Co. and depriving it of business, yet the *raison d'être* of the company's existence was to supply in bulk. He much preferred to remain under the Electricity Commissioners. He was a member of the B.O.T. Electric Power Supply Committee, and agreed to the recommendation to appoint Electricity Commissioners. Having got the Commissioners he wished to be left to enjoy what he had got.

Sir JOHN SNELL reminded Sir James that he also, as a member of that Committee, agreed to the appointment of District Boards.

Sir JAMES DEVONSHIRE replied that there was an exception made in the case of undertakings giving supply over a large area like the North Metropolitan Power Co. He believed the intention there was that the Joint Electricity Authorities should come up to the borders of the power companies and not go into them. He hoped that would be the case here. Finally, he agreed with Mr. Tait's view that the existence of the Joint Electricity Authority would interfere with the raising of capital.

Sir JOHN SNELL remarked that it did not seem to have affected the recent issue of the North Metropolitan Co.

Sir JAMES replied, amid laughter, that no mention was made in the prospectus of the black cloud which was hanging over the company.

Mr. CRAIG HENDERSON'S cross-examination was to the effect that the only real objection to inclusion on the part of the company was that it was likely to be called upon to pay a portion of the administrative expenses.

Sir JAMES DEVONSHIRE said he objected to inclusion because of the possibility of the Joint Authority filching away many

and distributions from the Power Co., and, moreover, the Joint Electricity Authority was bound to have a political complexion which he objected to also. Moreover, the Act of 1919 did not compel the Commissioners to set up electricity areas. The Act and they may set up areas and be bound to object to inclusion in any area on principle. The Association of Power Companies had sent in a memorandum to the Government, urging that if Joint Electricity Authorities were to be financed out of public funds, the money raised on the security of the rates, then the operations of the Joint Electricity Authorities should be excluded from the areas of power companies. There might be strong political motives in the operations of such Authorities. Once the Joint Authority got into his area there would be a strong inducement to undertake him in person for other reasons than purely commercial. Parliament incorporated this company to do much that it was proposed the Joint Electricity Authority should do, and he contended that there was no need for the Authority in his area.

Answering Mr. Turner, for the Conference scheme, Sir James Devonshire said he objected to public ownership in any form, and in these days he believed it was highly undesirable even that companies should be purchased by local authorities.

In the afternoon, Sir JAMES DEVONSHIRE continued his evidence. In reply to Mr. Lackie, who said that evidence which had been put before the Commissioners from time to time showed that there was a tendency for local authorities to supply electricity more cheaply than companies, Sir James said that he did not think much importance could be attached to that, because in the London area local authorities were often operating in industrial areas, whereas the companies supplied the West End and other residential districts.

Questioned by the chairman, Sir JAMES expressed the opinion that if the company had separate representation on the Authority it might be able to exercise some restraining influence over the political element. With regard to credit, local authorities were rather under a cloud as regarded finance. Local authorities going into the city for the purpose of raising money at the present time would be frowned upon, whilst a public utility concern in the hands of a company would be welcomed.

The CHAIRMAN then put a number of questions with regard to the coalition of the areas of supply of the North Metropolitan Co. and the Metropolitan Electric Supply Co. On this point Sir James said he did not think it necessary or desirable to amalgamate the two areas, but probably by the interchange of one or two directors on the boards of the companies concerned, all that was necessary could be achieved in connection with the efficient and economical supply of the two areas. He thought arrangements could be made between the two companies to prevent waste by endeavouring to supply consumers, say, on the boundary line of one company, by the organisation of the other, where they could be more efficiently and cheaply reached, and where this could be done they contemplated doing so. Therefore, if that flexibility existed between the two companies, no engineering and no financial improvement could be effected by the establishment of a Joint London Authority beyond that which was within the bounds of possibility to-day.

Mr. E. T. RUTHVEN MURRAY (engineer and general manager to the North Metropolitan Co.) handed in a number of tables dealing with the company's undertaking. With regard to power stations, there were eight within the company's area, of which four were the property of the company—namely, those at Brimsdown, Willesden, Hertford, and St. Albans. Of the remaining four, three were owned by the local authorities at Finchley, Hornsey, and Walthamstow, and one by the Tottenham Light, Heat & Power Co., at Wood Green. The total present capacity of the four stations owned by the company was 32,810 kW, and the capacity of the other four stations 10,220, making a total capacity over the whole area of 43,030 kW. The simultaneous maximum demand on the whole eight stations during 1920 amounted to 33,604 kW. Extensions of the various stations were now in hand, which, when completed, would increase the capacity of the company's four stations to 45,810 kW, and that of the remaining four stations to 16,550 kW, bringing the total capacity over the whole area up to 62,360 kW. In addition to the extensions already mentioned, the company's stations could be still further extended. The Brimsdown station alone was capable of extension to the extent of a further 50,000 kW or more, which would bring the capacity of that station up to 73,000 kW. A further 17,000 kW could still be installed at the company's Willesden station, bringing the total there to 36,650 kW. Extensions were also possible at the Metropolitan Electric Supply Co.'s stations at Willesden and Uxbridge, which would increase their total capacity to 92,100 kW, so that the combined capacity of the two companies' stations could be extended to 201,750 kW on existing sites, exclusive of plant in the stations of other undertakers. There were, therefore, ample facilities in the whole area to meet the demands likely to occur for many years to come, without going outside the system.

Dealing with reasons for the non-inclusion of the North Metropolitan Co.'s undertaking in any scheme for the establishment of a Joint Authority for London, Mr. Murray said that in the first place, such a scheme would involve the provision of long and expensive inter-connecting mains, which must affect the price of energy. The average price to be obtained for energy under the new scheme was 1.326d. per unit at the busbars of authorised undertakers. That was the average price for extra-high pressure supply, but in view of

the factors which had to be taken into consideration, it was obvious that the savings derived from the central source would have to pay above the average, in order to cover transmission costs. If the North Metropolitan had to pay up to 1.25d. per unit, which was just above its present figures, the average for London would be 1.2d., and it could only supply at a loss. It was the policy of the company to purchase in bulk from outside sources, when reasonable terms were obtained, and in 1920 it purchased 1,000,000 kwh. Assuming the future demand over the whole of the company's area, Mr. Murray said that the demand of 33,000 kW in 1920 would be increased to 37,250 kW in 1925, and to 42,000 kW in 1930, these figures leaving out of consideration railway supplies. In 1920 the total units sold by all producers in the area amounted to 75½ millions, which would increase to 96 millions in 1930.

In reply to Mr. PAGE, witness said he did not think the case for capital stations was a very strong one, having regard to the cost at which energy could be produced at a small station having a high load factor.

As to voltage, Mr. MURRAY told Mr. LACKIE that certain of the company's new mains would be worked at a pressure of 10,000 to 11,000 volts to commence with, but later on this would be increased to 22,000 volts.

The CHAIRMAN asked a number of questions as to the desirability of combining the areas of the North Metropolitan Co. and the Metropolitan Electric Supply Co., in reply to which Mr. Murray said he did not think, from an engineering point of view, there would be very much economy in working expenses, though there might be a saving in capital expenditure. As to the inclusion also of the County of London Co.'s area, which was suggested by the chairman, Mr. Murray expressed the opinion that better results would be obtained by keeping the County of London area distinct as one area, and the joint areas of the North Metropolitan and Metropolitan Electric Supply Companies as another, because of the expense which would have to be incurred in linking-up mains.

A lengthy discussion then took place between the chairman and Mr. MORSE, representing the County of London Co., with regard to the Commissioners' request that the County of London Co. should give information as to the proposed Barking station, which was considered by the Commissioners in October last year. Mr. MORSE said that technical details of the scheme had been dealt with at the previous inquiry, and the company, therefore, did not propose to call evidence on this occasion. The chairman pointed out that he wanted, among other things, information as to the anticipated growth of the demand in the County of London Co.'s area and the Romford area. Again, whilst the County Co. were of the opinion that the Barking station should be proceeded with at once, it was the contention of the promoters of the other schemes before the Commissioners that the erection of capital stations should be postponed, owing to the costs, and that the demand in the meantime should be met by utilising to the full the present resources. Seeing that a conflict of opinion existed, it was very material that the matter should be fought out, in order to arrive at the best course to pursue. The County Co. had had the opportunity of cross-examining witnesses giving evidence on behalf of the promoters' schemes, and of pointing out weaknesses in those schemes, and he suggested, therefore, that it would be fair if the County Co. put witnesses into the box to point out the advantages of the adoption of a totally different policy.

Mr. MORSE replied that the company had considered the matter carefully, and did not propose to give evidence at this inquiry.

On Friday, July 14th, Mr. ARTHUR COLLINS was recalled on behalf of the Conference scheme, especially with regard to the question of terms of purchase of the companies' undertakings. He said the resolutions passed by the Executive of the Conference and referred to in Tuesday's report, had been drafted as the result of observations made by himself on the subject. His opinion was that the question of acquisition of the stations of the companies should not be confused, at this stage, with the question of distribution. His main reason for this was that the Joint Electricity Authority would have plenty to do during the first ten years to handle the question of generation. Moreover, it was felt that if the L.C.C. acquired the undertakings of the companies in 1931, it would require the distribution to be carried out by the local authorities. Therefore, if the companies got the terms for their generating stations and mains secured, with a guarantee of a supply of electricity for the next ten years at a price not greater than the present cost, the question of distribution in future could very well be left over for the present.

Mr. COLLINS recommended further that the companies were to be asked to give information on the broad basis of cost of their undertakings.

Mr. COLLINS also mentioned that under the terms of the Act of 1911, in the Stockton and Thornaby, Framingham, and the London and South-Eastern Electric Light and Power Act, 1911, it had been stated that in 10 years the cost of plant would have got back to pre-war figures; in fact, Parliamentary estimates for the companies were that in 10 years' time the cost of plant would be only one-third or one-third or two-thirds. Assuming that in 10 years the cost of electrical plant would be 10 times the cost, and the companies were asked to sell not for pre-war cost less depreciation, he

admitted that the cost to the purchasers would be more than if the sale took place in 1931 under the terms of the 1888 Act, and so increase the cost of energy. At the same time, this was not entirely a question of the bare price of energy, because it was in the minds of many eminent engineers dealing with arbitration for the purchase of various public utility undertakings, to lay greater stress on the factor of obsolescence, and it would be argued that although the war had increased prices, at the same time obsolescence had proceeded at a greater rate and the increased rate of depreciation in consequence would largely offset the increase in price. Quite apart from this, he felt it would be very unwise to enter into a bargain with a vendor company at the present time when prices were falling very rapidly.

Sir JOHN SNELL: And would you leave matters in the present unsatisfactory state for 10 years?

Mr. COLLINS said he would not, and he hoped that the Conference would consult again with the companies and see how much nearer they could get together on the matter, but he did not think it would be wise to accept the companies' terms in return for a further life of 60 years as distributors.

Sir JOHN SNELL said that the local authorities had had a long time in which to consider this question of purchase, and it would be a pity if the inquiry had to close without a definite expression of opinion from the Conference on the point.

Mr. COLLINS said that at present the companies and local authorities were too far apart to agree, but he hoped that by further discussions a bridge might be found, perhaps on a smaller extension of term than 60 years, and a sliding scale of dividends and prices. He was, however, authorised to say that rather than pay the companies' terms the Conference would make an endeavour to co-ordinate the 34 local authorities and leave out the companies altogether.

Sir JOHN SNELL: And close this inquiry with an entirely inconclusive position as between the companies and local authorities?

Mr. COLLINS, further examined, said that another advantage to the companies under the proposed terms of purchase suggested by the Conference was that the companies would by selling now, have the money in hand 10 years earlier than otherwise, and at the same time they would have a guarantee of electricity from the Joint Authority. Moreover, he did not believe the companies in 1931 would have more than a sporting chance of getting more than pre-war cost, in consequence of the element of obsolescence to which he had already referred.

COUNSEL put it that the companies would only be brought to sell their generating stations and mains by agreement, and as the terms proposed by the local authorities were less than those which the companies would get under the 1888 Act, what earthly hope was there of getting them to agree? What had induced the Conference to change its view with regard to extension of tenure (the Chairman of the Conference said the Conference was willing to consider an extension of tenure)?

Mr. COLLINS said that since that statement was made by the Chairman of the Conference, they knew what the terms proposed were. He disagreed with counsel that the local authorities were hoping to get the companies' distributing systems after the L.C.C. had purchased the companies, and that that was the reason why the Conference objected now to an extension of tenure. At the same time, he felt that the local authorities were the right people to carry out the detail distribution in the companies' areas and not the L.C.C. In any case, the proposed terms by the companies were very much more serious than the Conference at one time thought.

Sir JOHN SNELL said it was very embarrassing to the Commissioners that the Conference had changed its mind so soon after a definite expression of opinion by Mr. Duncan Watson.

Mr. TURNER, for the Conference, said that Mr. Duncan Watson was expressing his own opinion.

Mr. CRAIG HENDERSON said that Mr. Duncan Watson said the Conference would agree to the principle of extension of tenure.

Sir JOHN SNELL said that, speaking for himself, it seemed to him that the Conference was changing its mind from day to day, and how could the Commissioners come to a decision in these circumstances? Was it the intention of the Executive to recommend the full Conference to adopt the views put forward by Mr. Collins against the principle of extension of life of the companies as distributors?

Mr. TURNER said the matter was to be put to the full Conference without any recommendations.

Mr. COLLINS, answering Mr. Craig Henderson, said, personally, he would advise the Conference not to accept the principle of extension of tenure.

During Mr. Collins's evidence, there was an interposition by Mr. Albert Gay, chief electrical engineer to the Islington Borough Council. It appears that although Islington is a member of the Conference of Local Authorities, it has sent in certain objections independently.

Sir JOHN SNELL said it did not seem that the Islington Borough Council knew its own mind.

Mr. TURNER, for the Conference, said that in view of the position, he would take it that Islington was no longer a member of the Conference.

Sir JOHN SNELL suggested that Islington should send in a statement, a course with which Mr. Gay agreed.

Later on, a long discussion took place between Mr. Collins

and the Commissioners as to the terms of purchase of the companies; he put it frankly that the terms proposed by the companies were too great a price to pay for a unified electricity supply in London. He hoped, however, that the parties would come together again, although at present neither side would consider the terms put forward by the other.

Sir JOHN SNELL put it that there were 34 local authorities owning electricity undertakings, which were holding out with regard to terms of purchase by the L.C.C. for companies in areas in which the Conference of Local Authorities had no concern. Moreover, the L.C.C. as the purchasing authority was agreeable to the terms proposed by the companies.

Mr. COLLINS said that if the terms of the companies were accepted, it would mean either that the consumers in those areas would have to pay a much higher price for energy in the event of the distribution in the companies' areas being placed in the hands of the local authorities, or, if the L.C.C. retained the distribution in its own hands, which was inconceivable, then the extra cost would fall upon the whole of London through the L.C.C. rate. The point was, he said, that on the local authorities' valuation, the price which would have to be paid was considerably less than that which would be paid on the companies' basis, and the capital charges on that extra sum would have to be borne by some one.

Sir JOHN SNELL could not get Mr. Collins to agree with him that failure to come to terms with the companies would result in a continuation of the present state of affairs, because the 34 local authorities would go ahead by themselves, said Mr. Collins.

Sir JOHN SNELL replied that nothing effective could be done without the consent of the Commissioners, and it was placing the Commissioners in a very great difficulty if the various authorities did not agree.

Sir JOHN SNELL then asked how, in these circumstances, the Commissioners could refuse such applications as those of the County of London Co. and the West Kent Power Co.

Mr. COLLINS said it must be for the Commissioners to decide what was best for the area.

Sir JOHN SNELL concluded his questions by saying that time was passing; they were all looking forward to the revival of trade, and representations had been made to the Commissioners that there was a great need for improving the supply.

Mr. PEARMAN, secretary of the Westminster Electric Supply Co., then handed in further tables explanatory of the proposals of the nine companies with regard to purchase.

When the inquiry was adjourned for the day, Mr. SYDNEY MORSE, for the County of London Co., said his clients had reconsidered the question of giving evidence, and in view of the personal appeal of Sir John Snell, and in order to avoid any suggestion that the County Co. did not wish to assist the Commissioners, they had decided to put forward evidence on the matter of the relative advantages of erecting capital stations at once and extending existing stations.

Sir Harry Haward presided over the inquiry on Friday, July 15th, in the absence of Sir John Snell.

Mr. JOHNSON (Comptroller of the London County Council) was then recalled, and handed in a number of tables giving revised financial particulars with regard to the results of the purchase terms proposed by the companies, applying them to companies and local authorities.

The case for the Hertford County Council was then dealt with.

Sir CHARLES LONGMORE, K.C.B. (clerk of the County Council) handed in tables containing statistics of the area and population of the county, which, he said, was largely agricultural and residential; the richer part of it was in the south, and was included in the delimited area. It would be an unfortunate thing if the richer portions were taken away, which would have a detrimental effect on the remainder. In some of the towns in Hertfordshire there was a good supply. That in Watford for instance was excellent. There were a number of Provisional Orders existing for the supply of electricity in various parts of the county, which had not been put into operation. Witness referred to the excellent relations existing between the county authorities and the North Metropolitan Power Co., which was supplying in parts of the county, and also with the Middlesex County Council in connection with the tramways which ran into Barnet from Middlesex, owned by the Metropolitan Electric Tramways. The Welwyn Garden City and the town of Hertford would be supplied from the Hertford generating station of the company, but it was contemplated that eventually mains would be laid from the Brimsdown station to Welwyn, and this would enable a supply to be given to Hoddesdon, Ware, and Cheshunt. Hatfield also needed a supply of electricity, and witness was of the opinion that it would be much more likely to get it from the company than from a Joint Authority embracing the whole of London. The company would more easily raise money than the local authorities to finance a scheme. On the whole, the opinion in Hertfordshire was that the supply of electricity would be very much better left in the hands of private enterprise. A conference of the County Council and of the local authorities in the county had decided that it was desirable to keep the whole county out of the scheme.

In cross-examination by Mr. Engelbach, for the L.C.C., Sir Charles said that even were the Joint Authority able to supply energy more cheaply in part of Hertfordshire than the North Metropolitan Co., he would still object to inclusion, in view of the administrative difficulties which would arise.

Mr. W. B. KEEN (accountant to the Hertfordshire County Council) also said it would be an advantage to leave the county as a whole out of the joint scheme. Being a residential area largely, a trifling reduction in the price of electricity would not affect the community so much as it would an industrial community, and they might buy such a trifling advantage at too great a cost from other points of view. The schemes before the Commissioners appeared to him to be very speculative, and depended on estimates at a time when it was almost impossible for anyone to make a reliable estimate. The Hertfordshire local authorities were not prepared to give financial support to the scheme, and, therefore, they could not expect any effective degree of control, without which it would be unsatisfactory that they should be subject to all its incidences. Lastly, it was a well-established principle that the local feeling of a community should not be overlooked, unless on the ground of very great public service. As to municipal credit, there had been so many issues recently on the security of the rates that the market was getting tired of them, and he was strongly of the view that Hertfordshire would be wrong to use its credit for the purpose of such an undertaking as that suggested.

Mr. HORACE FENTON (Electrical Power Engineers' Association) handed in a statement to the Commissioners, and stated that if it were desirable he would be able to bring evidence in the following week. The chairman said there was already a statement from the Electrical Trades Union, of which, however, Mr. Fenton disclaimed all knowledge.

A statement was also to be handed in by the town clerk of Watford.

Mr. PADDEN then addressed the Commissioners on behalf of the Port of London Authority, who asked for direct representation upon the administrative body of any scheme upon which the Commissioners might ultimately determine. The gist of the evidence during the inquiry had been that it was essential for the economical working of the capital stations that they should be constructed on the river. The erection of these stations would entail the construction of wharves, the dredging of the river, and many other things in order to adapt the riverside to the purposes of the engineers. A Joint Authority could not do that without the approval, cognisance, or licence of the Port of London Authority. Therefore, it was obviously an advantage that the latter body should have direct representation on the board of the Joint Electricity Authority. The point was whether they would bring enough technical advice and assistance to justify their representation, and he ventured emphatically to say that they would do so. Mr. Fladgate, in his evidence, said that the Port of London Authority might secure direct representation by virtue of their being large consumers of energy—and in this connection Mr. Padden mentioned that they purchased nearly 17 million units per annum—and he would raise no objection to their representation, subject to the consent of the Commissioners. Mr. Padden thought this was the general view.

Mr. WROTTESELY, addressing the Commissioners on behalf of the Middlesex County Council, appealed for the taking-over of the whole of the Middlesex area, or leaving the whole of it out. Middlesex was the most developing area of all those around London to-day, and it was obvious that if justice was to be done to such an area, any scheme should take in, not as little, but as much of the area as possible. The engineering point of view was not the only one to be considered. The companies' scheme with a radius of ten miles round St. Paul's Cathedral, in which area was concentrated practically the whole of the load in the area delimited by the Commissioners, he described as skimming the cream off the milk. If the whole of Middlesex were left out of any scheme, the area would be sufficient to justify them in providing a supply of electricity for themselves, or in conjunction with some other authorities adjoining.

Their position was, in the first place, that they did not want to be split up. Secondly, with regard to the constitution of the Joint Authority, the suggestion of the L.C.C. was such that sufficient consideration was unlikely to be given to the interests of Middlesex. Thirdly, with regard to finance, they did not think the terms upon which the L.C.C. proposed to purchase generating stations and mains were as favourable and fair to the consumers and the local authorities as those of the Conference of Local Authorities. For these reasons, they asked to be left out of any area which was to be governed on the lines of the L.C.C. proposals. As to the scheme of the Conference of Local Authorities, subject to the Commissioners granting them representation—and they thought it not unreasonable to ask for two representatives, they were willing to be incorporated, provided the whole of the County were taken into the scheme.

The inquiry was then adjourned until Tuesday.

Resuming the inquiry on Tuesday, Sir JOHN SNELL referred to a letter sent in by the Electrical Trades Union, and the statement by counsel for the Electrical Power Engineers' Association, and said that the Commissioners proposed to ask each of these bodies to put a witness in the chair.

Mr. C. H. MING was then called on behalf of the County of London Electric Supply Co., and said he appeared in response to the Commissioners' request that a witness should give evidence as to the relative advantages of constructing new power stations and extending existing stations. Mr. Merz's evidence occupied the whole of the day's session.

(To be continued.)

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New Rotary Transformer.

We were recently given an opportunity to inspect a new type of rotary transformer patented by the CRYPTO ELECTRICAL CO., LTD., Acton Lane, Willesden, N.W. 10, and saw a number of load tests carried out upon it.

The saving of space and expenditure effected by this means of transforming d.c. voltages as compared with the employment of the motor-generator method needs no emphasis.

The machines made by the Crypto Co. are designed either with "reverse-compound" or "level-compound" windings, the voltage regulation being carried out by means of interpoles. The reverse compound-wound transformer is eminently suitable for welding and kinematograph work, where the load is thrown on and off suddenly at frequent intervals. The level compound-wound machine is designed to maintain a constant voltage at all loads, and for this reason may be used for lighting supplies or other purposes in which violent voltage variation is undesirable.

The construction of these machines is safe and substantial. The armature is laminated, and the coils are former wound. The insulation between the primary and secondary windings is capable of withstanding more than 1,000 volts. The whole armature is vacuum impregnated, giving a high insulation resistance and dielectric strength. The frame is of cast iron, having steel poles with laminated tips; the field coils are

to say, the rollers between which the metal passes during welding do not rotate continuously, but intermittently, making a series of overlapping spot welds in rapid succession. Each spot weld is made while the roller is stationary and extra pressure is applied to the roller before it moves forward, thus producing a much stronger weld than is obtainable by the normal pressure of the roller. An important advantage of the spot seam is that unpickled metal can be welded without difficulty, and there is far less tendency for any scale to attach to the rollers than when the latter are allowed to rotate over metal at the welding temperature. The rollers, therefore, require less attention and give better work. The welded seam is made at the rate of 3 ft. per minute, and 100 ft. of seam can be welded for an expenditure of 1 kWh of electrical energy.

The machine comprises a 1-p. transformer arranged to suit the voltage and frequency of the available electricity supply, the secondary or welding circuit working at a pressure of only 2 volts; thus, there is no risk of any shock to the operator. The welding rollers or electrodes are connected to the secondary circuit, the upper one being mounted on a pivoted arm and driven by a ratchet mechanism, while the lower one is fitted on a slide and moved from side to side by a hand lever. When in the working position the slide is locked to prevent its displacement during welding; to make a weld the slide is

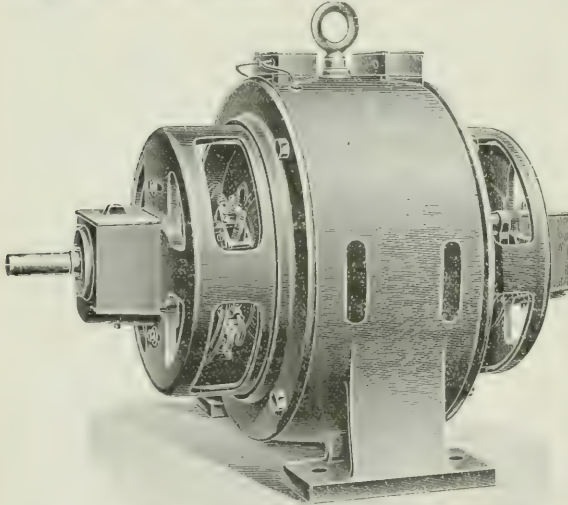


FIG. 1.—"CRYPTO" ROTARY TRANSFORMER.

former wound and impregnated. The bearings may be ball-bearings or of the ring type. In the case of the latter they are self-oiling, and made of the best anti-friction metal.

The machine seen under test was arranged for both level and reverse compound working. The supply to the primary end of the machine was at 460-480 volts; this remained practically constant at about 464 during the tests. In level compound working the secondary voltage at light load stood at 88.8; upon full load being applied it fell to about 88. At about 130 per cent. of full load the pressure fell a trifle more but the fluctuation was negligible for all practical purposes. In previous tests the variation between light load and full load (93 A) was only about 2 V, this was increased by about 2 V on an overload of 33 per cent. The speed varied from 1,480 r.p.m. at light load to 1,580 r.p.m. at full. The results when running as a reverse-compound machine were as follows: The voltage at light load was 86.5. Upon the imposition of a load taking 90 A the pressure fell to about 73.5 V. At 145 per cent. of full load the readings were 65 V, 130 A. The voltage at half-load was 79. During continued overloads there was practically no brush sparking, and the temperature rise was not excessive.

The illustration (fig. 1) shows a machine of the type described.

A New Electric Seam Welding Machine.

The accompanying illustration (fig. 2) shows a new machine for seam welding the bodies of stamped kettles, designed and manufactured by the M.P. ELECTRIC WELDING MACHINE CO., of 28, Hatton Garden, London, E.C.1.

The machine operates on the "spot-seam" principle—that is

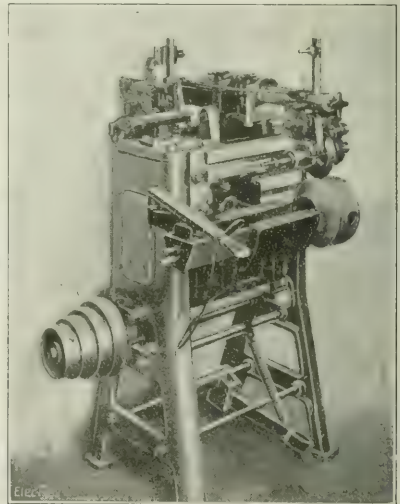


FIG. 2.—A NEW M.P. SEAM WELDER.

released by a trigger on the hand lever and pulled to the right. The kettle, previously assembled, is placed over the lower electrode and the slide pulled back as far as it will go, where it is locked by a catch. The pedal is depressed by the operator, bringing down the upper roller on to the work and starting the weld. Nothing more is required of the operator beyond a slight guiding of the kettle to ensure the rollers passing properly over the seam. When the weld is made, the pedal is released, the slide pulled to the right, the kettle removed, and the operation repeated. The machine is suitable for welding the circumferential seams in various kinds of hollow articles varying in thickness from No. 25 gauge to 3/32 in. thick.

The M.P. Electric Welding Machine Co. makes a complete line of spot, seam, and butt welders, which are suitable for a wide variety of work.

The Quadrant Electrometer.—A new method of using the quadrant electrometer for the measurement of electrical power is described in the *Proceedings of the Physical Society of London* by Mr. H. Parry. It involves the use of a potential divider across the supply circuit, and a standard non-inductive resistance in series with the load. An ammeter and a voltmeter are employed to measure the supply voltage and the load current, and an example of the application of the method to determine the power factor of a condenser is quoted.

BUSINESS NOTES.

Bankruptcy Proceedings.—GEORGE EDWARD LEIGH WYNN, trading as the Amalgamated Trading Co., 44, Surbiton Road, Kingston-on-Thames, dealer in electrical goods, &c.—The adjourned public examination of this debtor was held recently at the Court House, Kingston, Surrey. The statement of affairs showed ranking liabilities £917, against assets £4, but debtor stated that the statement was incomplete, and his liabilities amounted to something like £1,600. Questioned by the assistant Official Receiver, he said that on his demobilisation from the Army in December, 1919, he commenced business as a boot repairer in Manchester, with £50. Subsequently he sold the business for £225, and in August, 1920, started as a manufacturer, importer and factor of electrical and aluminium goods, at 44, Surbiton Road, Kingston, the rental of the premises being £36 a year. At the time his capital was only £10, he was unable to pay cash, and obtained goods on credit. At the date of the receiving order, there were six judgments against him for £420. The examination was closed.

REGINALD PERCIVAL BAKER, electrical engineer, and FREDERICK CLARENCE STUBBS, electrical engineer, trading together in co-partnership as the Sheffield Electric Construction Co., 124, Pond Street, Sheffield.—The public examination of these debtors was held recently at the County Court Hall, Sheffield. The unsecured liabilities were returned at £522, while the assets were estimated to realise £316. Debtors stated that they commenced business with a capital of £10 each. They were successful until the slump. Machinery to the value of about £200 had been purchased, while the profits had been put into the business. The examination was closed.

JOHN HEPHER, trading as the Croft Electric Cabinet and Joinery Works, Dunn's Terrace, Spital Tongues, late 7, Croft Street, Newcastle-upon-Tyne, wholesale cabinet maker.—The adjourned first meeting of creditors was held recently at the Official Receiver's Office, Pearl Buildings, 4, Northumberland Street, Newcastle-upon-Tyne. The statement of affairs disclosed a deficiency of £1,527. Debtor attributed his position to bad trade owing to miners' strikes, depreciation in value of stock, heavy cost of removal of stock and machinery to present premises, and loss on a contract for the purchase of property. It appeared that he started business in Leazes Park Road, in March, 1908, with about £3 capital. In June, 1920, he removed to Dunn's Terrace, and he stated that the cost of this removal amounted to £400. Proper books of account had not been kept prior to June last. The creditors appointed Mr. J. A. Gardner, chartered accountant, of Grey Street, Newcastle, as trustee of the estate, assisted by a committee of inspection.

TOMAS, J. H., electrical engineer, 13, Gray's Inn Road, London.—Trustee, H. J. de C. Moore, 2, Gresham Buildings, E.C. 2.

THOMAS, B. E., electrical engineer, 12, Castle Meadow, Norwich.—Last day for receipt of proofs for dividend, July 30th. Trustee, H. F. Gould, 8, Upper King Street, Norwich.

PEASE, W. H., electrical engineer, York and Doncaster.—Supplementary dividend of 19s. 6d. in the £, payable at Official Receiver's Office, 14, Fig Tree Lane, Sheffield.

DALE, B. T., electrical engineer, Erick Street, Newcastle-upon-Tyne.—Petition filed June 18th; order made July 7th.

GEE, G. H., electrician, 10, Front Street, Annfield Plain, Durham.—Petition filed June 7th; order made July 12th.

CARPENTER, C. A., electrical engineer, 4 to 5, Masons Avenue, Basin Road Street, London, E.C.—Petition filed June 10th; order made July 11th.

TAYLOR, J. H., electrical engineer, 99, Blackhorse Street, Bolton.—Receiving order made July 16th on debtor's petition.

Company Liquidations.—W. G. C. HAYWARD & Co., LTD.—A petition for the winding-up of this company has been presented by the Victoria Tube Co., Ltd., of Tipton, and will be heard on July 26th.

ELECTRICAL MAINTENANCE CO. (LIVERPOOL), LTD., 8, Victoria Street, Liverpool.—Winding-up, with Mr. J. Airey as liquidator. Meeting of creditors, July 21st. Claims must be sent in to Mr. Airey without delay.

LITTLE WONDER BATTERY CO., LTD.—Creditors must send particulars of debts, &c., to the liquidator, Mr. E. G. Fye, 26, Budge Row, E.C., by August 19th.

SIGNAL ELECTRIC CO., LTD.—Meeting called for August 28th, to hear an account of the winding-up from the liquidator, Mr. E. H. Hawkins.

STOLTS ELECTROPHONE CO. (1914), LTD., London.—Meetings of creditors and contributories, July 26th, at Carey Street, W.C.

SURREY ELECTRICAL CO., LTD.—Meeting at Gresham House, E.C., on August 22nd, to hear an account of the winding-up from the liquidator, Mr. E. W. E. Blandford.

Dissolution of Partnership.—A. O. WALKER & Co., electrical and mechanical engineers, 13, Queen Street, Liverpool.—Messrs. A. H. O. Walker and T. Storey have dissolved partnership. Mr. Walker will attend to debts and continue the business.

Trade Announcements.—Among the new Scottish companies registered last week was—ROSS & Co. (ELECTRIC), LTD., 62, Robertson Street, Glasgow. Capital, £20,000 in £1 shares. Private company, to acquire and carry on the business of manufacturers and agents for electrical accessories and supplies. Subscribers:—J. Smith, A. Thomson, jun., and Ernest F. Smith, electrical engineers, 62, Robertson Street, Glasgow.

MESSRS. SCHOLEY & Co., LTD., Victory Works, Croydon, have recently appointed Messrs. Alston Scott & Co., of 50, Wellington Street, Glasgow, their representatives for the whole of Scotland. Stocks of "Croydon Premier" electric suction cleaners, "Kutmore" electric drills, small fractional h.p. motors, &c., will be held at the Glasgow address.

MESSRS. WILLIAMS & PELL, of 5, Chancery Lane, W.C., ask that all future communications should be sent to them at their new address as follows:—Williams, Pell & Baring, 4, Regent Square, W.C. 1.

THE TURBINE FURNACE CO., LTD., have recently removed from their general offices at 5, Budge Row, to larger offices at 238B, Gray's Inn Road, W.C. 1.

MR. J. D. MCKENZIE is starting in business as an electric light and power contractor, at 37, Dundas Street, Edinburgh, and desires to receive catalogues.

MESSRS. UNDERWOOD (MANCHESTER), LTD., of 53, Brown Street, Manchester, have been appointed sole importers of Moonstone scientific illuminating glassware for the British Isles. New catalogues are in the printers' hands. Large stocks of all types are held in Manchester, the company having special stores at Pine Street for this purpose.

MESSRS. B. KEWELL & Co. have purchased the business of Mr. William Drysdale, electrical engineer, 24, Paxton Street, Barrow-in-Furness.

Catalogues and Lists.—INTERNATIONAL FILM TRADERS, 5, Denmark Street, Charing Cross Road, W.C. 2.—An illustrated leaflet advertising portable electrical floor, table, and hanging fountains. Priced.

HELIQAN ELECTRIC, LTD. (formerly Forrester & Fox, Ltd.), Beehive Wharf, Brentford, Middlesex.—An illustrated and priced catalogue of conduit fittings, grips, boxes, bands, &c.; several views of the works are given.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—Catalogue Section "J," giving very full particulars of the "Simplex" colliery lighting system. Extracts from the rules governing the use of electricity in mines are given, and the compliance of the "Simplex" system with these rules is noted. The list gives prices and illustrations of joint-boxes, lanterns, cables, &c.

THE OVERSEAS ENGINEERING CO., LTD., 163-165, Great Portland Street, W. 1.—List No. 66, giving specifications and prices of "National" d.c. motors and dynamos; List No. 185, describing and illustrating "Overseas-National" small lighting sets and accessories; and List No. 83, dealing with the "Home" and "Camp" ice-making machines.

MESSRS. GEORGE ELLISON, Perry Barr, Birmingham.—A well-produced illustrated catalogue (76 pp) giving details of circuit-breakers, a.c. starting-gear, and crane-control equipment.

THE J. G. BRILL CO., 150, Southampton Row, W.C. 1.—An illustrated magazine describing the application of various types of Brill cars and Birney safety cars to a number of railways and tramways.

THE BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, E.C. 4.—Price list No. 10,957, illustrating and describing "All-Nite-Lite" transformers for providing energy from an ordinary lampholder to a small low-voltage lamp.

MESSRS. DANIEL ADAMSON & Co., LTD., Dinkinfield, Manchester.—A booklet describing the progress and productions of the firm in steam and pneumatic-power machinery.

THE MIDLAND ELECTRIC MANUFACTURING CO., LTD., Barford Street, Birmingham.—List No. 124, giving prices, illustrations, and descriptions of "Baby Paragon" ironclad switches and combined switches and fuses.

THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., 109-111, Bank Buildings, New Oxford Street, W.C. 1.—Lists 68 and 69 giving full particulars and illustrations of d.c. and a.c. motors respectively; also List No. 70 dealing with d.c. generators.

MESSRS. F. J. SHENTON & Co., LTD., 68 and 69, Shoe Lane, E.C. 4.—An illustrated and priced leaflet describing the "Supreme" fan regulator and "indestructible" electric bells.

Catalogues Wanted.—THE SLOAN ELECTRICAL CO., LTD., of 8-12, Golden Lane, London, E.C., desires to receive catalogues from manufacturers of electric motors, starters, heating and cooking apparatus, wires and cables and accessories.

THE CENTRAL ELECTRIC CONSTRUCTION CO., of Hallamshire Works, Rockingham Street, Sheffield, wishes to receive catalogues and prices of lamps, cable, motors, switchgear, and general accessories.

Inquiries.—A reader asks for information regarding the "Zanda" electric "horse." The makers of the "Brous" heavy-oil engine are asked for.

For Sale.—The following plant, &c., is advertised for sale in our advertisement pages to-day:—Electric drilling machines, 10-ovt. electric crane, 1-ton electric crane, generating sets, dynamos, motors, cable, lamps, accumulators, switchboards, &c., by Mr. Chas. D. Phillips (by order of the Disposal Board), at Swindon. Machinery, equipment and ship's fittings, including a large quantity of electrical equipment, by Messrs. Robson & Perrin, at Shoresham Shipyard. Two 1,000-kW British Westinghouse turbo-alternators with condensing plant and auxiliaries, by Rotherham Corporation. Fuse wire, wood blocks, "opal" bowls, telephones, motors, dynamos, &c., by the Assets Auctions Co., Ltd., London, S.E. 1.

A Domestic Appliances Exhibition.—THE WESTMINSTER ELECTRIC SUPPLY CORPORATION, LTD., has again arranged an attractive exhibition of electrical appliances at the Eocleston Place showrooms. While the devices to be seen are generally of the usual types, there are one or two items worthy of particular mention. One of these is a small cooker recently designed by Messrs. Belling & Co., specially for installation in a workman's dwelling or other situation where space is precious. Cheapness has also been aimed at, and the result is an efficient cooker at a very low price. The construction is very simple; the body of the cooker is of unlagged sheet steel, and two 1,400-watt elements are fitted, with separate three-heat controls. The upper element is let into the top, so as to be exposed both to the inside of the oven, and to the atmosphere; in this way it serves a dual purpose as an oven-heater and a boiling ring. A more elaborate electric oven is that made by Messrs. Greens, of Englefield. This is a stoutly-built cooker with three-heat oven elements, two hot plates and a grill. Some special saucepans for employment with these cookers are on view. These are made in segmental shape, so that three may be fitted in together to stand on a hot-plate, thus using heat which, with circular saucepans would be wasted. A colour-matching lamp of American manufacture is shown. This has a large bronze-finished reflector, and the light is passed through special glass. The "Utility" light exhibited is a silvered glass reflector with numerous indentations used in conjunction with a 150-W gasfilled lamp, giving a powerful flood light. Fires of all descriptions, decorative and severely plain, are included in the show, and boiling rings, irons, fans and suction cleaners are well represented. A rather simple, but, it is stated, effective device for heating water in an ordinary kettle is displayed. This is a circular copper band which fits round the outside of a kettle. The band is heated by a nichrome strip connected to two plugs. Many lighting bowls of alabaster and glass are shown, as well as highly-coloured lamp standards and shades. The Corporation is doing a great deal to improve its domestic load, and the rates at which it hires out cookers, fires and irons are certainly a strong inducement to consumers to adopt them. The exhibition is not merely a spectacle—every appliance is demonstrated on request, so that intending customers may know what they are getting.

New Japanese Company.—The electrical engineering department of the Mitsubishi Shipbuilding Co., at Kōbē, is to be made an independent joint-stock company capitalised at ¥15,000,000. It will take the name of the Mitsubishi Electrical Engineering Co., and a large new factory for its use is already in course of construction in the suburbs of Nagoya. This development draws attention to the enterprise being shown by Japan in electrical engineering. Japan already exports large quantities of electrical goods to China, besides supplying the home market. The quality of these products has been severely criticised, but the improvement noted in certain directions during the past 12 months is very apparent.—*Eastern Engineering*.

The Italian Electrical Industry.—Not the least remarkable feature of the electrical industrial position in Italy is the almost complete elimination of German interests, notwithstanding the fact that before the war the Germans practically controlled the market. It is proposed that Italy shall produce almost the whole of her own requirements in electrical material, and there is a strong movement towards patronising home trade only. This has seriously upset the plans of the United States manufacturers who had prepared to take the market by storm after a diligently-organised publicity campaign and the dispatch of a small army of commercial travellers authorised to conclude contracts upon highly advantageous terms. The market, however, is still short of raw material, particularly large generators, transformers, and steel pipe for penstocks. Aluminium cell lightning arresters, which hitherto have not been manufactured in Italy, are also in request. Again, while large quantities of switchboards and auxiliary apparatus are made locally, there are certain special types of instruments, such as synchronising indicators and frequency indicators, that must still be imported. Other electrical supplies which are still in demand include incandescent lamps, telephones, self-starting single-phase motors, constant-current transformers, and carbon electrodes for electric furnaces.—*Reuter's Trade Service* (Milan).

Catalogues Wanted for Riga.—In connection with the catalogue and sample room recently established at the British Consulate at Riga, the British Vice-Consul (Mr. W. Skelton) reports that while a number of trade catalogues and samples have been received, the collection is not sufficiently comprehensive to meet local requirements, and he would therefore be glad to receive additions to it. Catalogues dealing with machinery and accessories for asbestos manufacture are particularly required. The Vice-Consul points out the advantage which will ultimately accrue from this method of advertising even though there is no immediate demand for the particular article dealt with. Copies in duplicate of catalogues or other trade literature (preferably in Russian or German) should be sent. As there is at present no parcel post in Riga, the Department of Overseas Trade in London is endeavouring to arrange for the collection and dispatch in bulk of catalogues and small samples.

Mining Plant for Canada.—The proprietors of one of the oldest mines in Canada are desirous of entering into communication with United Kingdom manufacturers of steel hardening furnaces, electric mine hoists for a depth of 2,000 ft., and other mining equipment and supplies, of which they are regular purchasers. The name and address can be obtained by United Kingdom manufacturers and exporters on application to the Department of Overseas Trade in London.

Cost of Living, Wage Reductions, and Unemployment.—The average level of retail prices of all the commodities taken into account in the statistics prepared by the Ministry of Labour (including food, rent, clothing, fuel, and light, and miscellaneous items) on July 1st was, states the *Labour Gazette* (the organ of the Department), 119 per cent. above that of July, 1914. This figure is the same as that for June, decreases in the prices of some articles having been counterbalanced by increases in the prices of others. Reductions in rates of wages reported as having come into operation in June, in the industries for which statistics are compiled by the Ministry of Labour, affected about 1,060,000 workpeople. The number affected by increases in rates of wages was only about 14,000. The net effect of all these changes was a reduction in weekly full-time wages amounting to nearly £420,000. Since the beginning of the year, changes in the rates of wages reported to the Department have resulted in a reduction of about £1,770,000 in the full-time weekly wages of over 4,300,000 workpeople, and an increase of £83,000 in the full-time weekly wages of 350,000 workpeople. Following on the drop of 9,172 in the number of unemployed on July 1st, as compared with June 24th, the weekly figures issued by the Ministry of Labour show a further fall of 50,000 for July 8th—evidence of the gradual resumption of industry following on the settlement of the coal dispute. The following totals indicate the number of wholly unemployed on the Live Registers of the Employment Exchanges throughout the United Kingdom on July 8th as compared with July 1st (the latter figures being in parentheses):—Men, 1,548,113 (1,567,010); women, 434,503 (466,965); boys, 77,109 (80,539); girls, 60,776 (65,883); total, 2,120,201 (2,177,397). On July 8th there were 182,985 persons registered as wholly unemployed among 23 Exchanges in the L.C.C. area. This number, which is 3,744 less than the previous week, was composed as follows:—Men, 126,523; boys, 7,278; women, 43,020; girls, 1,634.—*Morning Post*.

To Finance Electrical Undertakings in Poland.—The Elektrobank is the name of a new company which has lately been formed in Warsaw with a capital of 150,000,000 Polish marks, to finance electricity supply undertakings throughout Poland.

New Electrical Companies in India.—Among the new companies recently formed in India in connection with the supply of electricity for lighting and power purposes, are the Western India Electric Co., 7-11, Elphinstone Circle, Calcutta, capital, 100,000 rupees; and the Central Province Electric Supply Co., Jubbulpore, capital, 2,500,000 rupees.

Australian Tariff Board.—The Federal House of Representatives has passed the Bill to constitute a Tariff Board, composed of three members, to which the Minister for Trade and Customs may refer matters relating to the classification and value of dutiable goods, the necessity of tariff and excise increases and reductions and the granting of bounties. An amendment proposed by the Labour Party was adopted empowering the Tariff Board to inquire into the refusal of manufacturers to sell goods of a value under £50.—*Reuter's Trade Service* (Melbourne).

Canada and Overseas Trade.—The Department of Trade and Commerce is extending its overseas service to the East with offices at Calcutta and Singapore.—*Reuter* (Ottawa).

Electrical Goods in China.—Figures just issued in relation to the trade of China show that there is a growing market for electrical materials. The demand for electric lighting in most cities in China where plants exist generally exceeds the supply, most of the plants being overloaded, which fact is leading to an increasing disposition among Chinese to put down small private plants. This trade is now largely in the hands of Americans. In many cities there are merchants sufficiently progressive to install small plants for the purpose of lighting their own and several adjacent premises. The latest Customs report says that "there is a tendency in the more important establishments to install larger units, and whilst a few years ago 200 and 400 kW were considered large, it is now quite common to install units of 1,000 kW and upwards, and it is reported that a large number of orders has been placed for privately-owned power stations for the purpose of supplying power to cotton and flour mills. Although, says *Finance and Commerce*, a fair amount of this business has materialised, it must not be thought that the Chinese are falling over each other to get plant. In many instances it takes a good deal of nursing, but the business is there to be done. The importation of electrical materials into China amounted to 2.3 million taels in 1915, 5 millions in 1919, and 6.8 millions in 1920.—*Reuter's Trade Service* (Shanghai).

The Currency Position and Trade Depression.—The Federation of British Industries, on July 12th, addressed a communication to the Prime Minister on the subject of currency deflation and trade depression. The policy of the Treasury and the Bank of England is at present based upon the report of the Cunliffe Commission, and aims at a gradual deflation of the currency, in order to get back as soon as possible to the pre-war gold standard. The Cunliffe report, however, was issued in 1918, when prices had already risen far above the pre-war level. Since then conditions have changed considerably, and the trade boom has given place to serious trade depression. Under these changed conditions, the Federation points out that the policy of currency deflation is calculated to prolong the trade depression, and recommends the Prime Minister to appoint a Committee on the lines of that presided over by the late Lord Cunliffe, to examine the currency position in the light of present facts.

Belgian Commercial Mission to Latin-America.—H.M. Legation at Brussels states that the keen interest which is being shown in Belgium in the development of trade with South America is again made manifest in the proposal to send a commercial mission to South and Central America countries. The countries to be visited are Brazil, Uruguay, Argentina, Chile, Bolivia, Peru, Ecuador, the Central American Republics, Mexico, Cuba, Haiti, San Domingo, Colombia, and Venezuela. The members of the mission will consist of delegates of each section of the "Comité Central Industriel," and leading banks have also been requested to designate delegates with a view to the organisation of credit in South America. On the arrival of the mission, lectures will be given in the Spanish and Portuguese languages with a view to making known the power of production of the Belgian nation. Catalogues of Belgian manufacturers will be compiled in Spanish and Portuguese, and it is intended to hold an exhibition of these catalogues, and also, if possible, of samples, in every town visited. In addition, a special pamphlet is being prepared by the "Comité Central Industriel" with a view to broadcast distribution. The Mission will not only be concerned with Belgian trade propaganda, but will also carefully study markets in the countries visited. It will inform itself of the desiderata of possible customers, and take note of their preferences and local customs in order that Belgian goods may conform to the classes of articles usually preferred.—*Board of Trade Journal.*

The Electrical Contracting Industry.—The report of the three Associations connected with the electrical contracting industry, for the year 1920-21, shows that the membership was once again augmented. The membership totals on May 1st were as follows:—E.C.A.I., 688; N.E.C.T.A., Ltd., 573; N.F.E.A., 694. A number of resignations are recorded, these being attributed to (1) members ceasing to carry on business; (2) members objecting to the N.E.C.T.A. Trading Agreements; and (3) members opposing the institution of the Subsidy Fund. For the first time in their history the income of the Associations has exceeded their expenditure. N.E.C.T.A. reports a surplus of £1,957, of which £594 is carried forward after payment of a dividend and contributions to reserve fund and staff provident fund. The E.C.A. hopes to secure the registration of contractors at an early date. The same Association is also endeavouring to arrange a line of demarcation between its activities and those of the I.M.E.A., to remove several grievances arising from municipal trading. Negotiations with the E.L.M.A. have resulted in the new grading terms for lamps, which would have adversely affected the contractor, being withdrawn. The C.M.A. agreements have been renewed, resulting in an income of £25,000 to members over and above the ordinary trade discounts. The official journal, *The Electrical Contractor*, has again had a successful year. The report reviews the wages settlements which have been effected during the year and later, and states that a great part of the work of the N.J.I.C. for the industry seems to have fallen upon conferences of the N.F.E.A. and the E.T.U.

Industrial Waste.—At a Conference of employers and Trade Union officials organised by the Industrial League and Council (Birmingham Branch) and held during the week-end at Diocesan House, Colehill Park, Birmingham, Mr. Robert Stelling read a paper on "Industrial Waste of the Past and Present." He dealt with the question from the point of view of the responsibility of managers, foremen, and workmen in relation to waste of time and materials in the management of factories and in the workshops. Altogether three sessions were devoted to the consideration of the subject on the Saturday and Sunday, and the debate, which was participated in by all present, was very exhaustive.

New German Engineering Combine.—The *Times* correspondent in Berlin gives particulars of an important new fusion of interests in the West German industrial world which is to take place shortly. At a board meeting of the Rhenish Metal Goods and Machine Works, at Düsseldorf, the reorganisation of the undertaking was decided upon with a view to securing the construction of locomotives and trucks and developing the firm's other branches on a permanent basis. It is intended to link up with Krupp's, the Allgemeine Elektrizitäts Gesellschaft, Linde-Hoffmann, and other concerns, and to extend activities to include several new branches of electrical construction. The Cologne firm of Wolf is to be included in the new combine on account of its favourable connections abroad. The capital of the Düsseldorf Machine Works will be raised by 75,000,000 marks (about £300,000). The prosperity of the undertaking was emphasised by the chairman of the board, who stated that a great deal of progress had been made in locomotive building, and that the prospects in kindred branches of industry were very favourable.

The Berlin correspondent of the *Daily Chronicle* referring to the same matter, says:—"In essentials this gigantic scheme has a still wider purpose. It represents another stage in the great project German industrialists have in preparation for what they are convinced is the quickly approaching age of electricity in transport. The A.E.G., of which Herr Rathenau, the recently appointed Minister of Reconstruction, is the head, is a trust second only to that of Hugo Stinnes, and is world famous for its electrical machines and articles. Already it had acquired the largest existing locomotive building and repairing shops in Germany, the Linde-Hoffmann works in Breslau, turning out 300 locomotives and 80,000 railway wagons yearly. It specialises in electric locomotives."

The Christiania Fair.—The second Norwegian Industries Fair, which is to be held in Christiania in September, will include

(*inter alia*) the following groups:—Machines and implements; electricity and gas metal manufactures and tools, instruments; iron and steel, and glass, porcelain, and similar products.

"Germany Ready to Undersell the World."—"Germany to-day is in a position to undersell the world on most manufactured articles," said Charles G. Du Bois, president of the Western Electric Co. on his return to America from six weeks of intensive data gathering in France, Switzerland, Austria, Hungary, Germany, Belgium, and England.

"Industrially Germany seems to be as efficient as ever. With wages low, as measured in the currency of other countries, with highly competent workers eager to produce, and with the reparation question in a more settled state, Germany is in a position to go ahead in building up her industries to handle export business. At present she can turn out many lines of manufactured articles to sell profitably for less money than any other country.

"As nearly as I can calculate it, the cost of German labour in the metal working trades is about one-sixth of the cost of equivalent labour here. While in all probability this will lead to protective measures on the part of competing countries, such as taxes on German exports and other measures for the encouragement of home industries, yet wages in such countries are now decreasing, and this tendency is likely to continue if they effectually meet German competition in foreign trade.

"Looking at the other side of the picture, however, we see not exactly unrest, but a grave question arising as to whether the working population can, or will, continue to accept its present low standard of living. The danger in Germany, therefore, is of a social overturn more than anything else. Politically, the various Socialist parties seem to be in the majority, but the anti-Socialists are in control of the Government, largely because the Socialists do not care to assume control at a time when they cannot hope to make good all their promises.

"Looking below the surface, the immediate situation in England is serious," Mr. Du Bois continued. "Hundreds of thousands of people are out of employment. Rail transportation is seriously impaired. The Labour Unions as well as the employers are agreed that there must be lower wages, but the bone of contention is the amount by which wages must be reduced. In due course the British always appreciate the logic of circumstances, and it seems certain that an agreement will soon be reached. England in the meantime is losing heavily in trade balance.

"There is one thing, however, common to all European countries: The people everywhere are thinking and talking about earning a living. This is a change from my visit in 1919, when world movements, world politics, and world improvement seemed to engross their thoughts. Now there is a much clearer realisation of the long-continued hard work necessary before normal conditions can be restored."—*Electrical World.*

Petition Dismissed.—A petition for the winding-up of the E.B.C. ELECTRICAL CO., LTD., of Eagle Street, London, presented by Mr. L. C. Harvey, a consulting engineer of Westminster, a shareholder, was dismissed by Mr. Justice P. O. Lawrence, on Tuesday. His Lordship held that the petitioner, not having paid up the calls on his shares, was not entitled to succeed. The company was formed for the manufacture of electric lighting sets, and electric starters for motor-cars.

Copper and Lead Prices.—MESSRS. F. SMITH & CO., reported on July 19th:—Copper (electrolytic) bars, £75 10s., 40s. decrease; ditto sheets, no change; ditto wire rods, £91 10s., 40s. decrease; ditto h.c. wire, 11½d., ½d. decrease; silicon bronze wire, 1s. 3½d., ½d. decrease.

MESSRS. JAMES & SHAKESPEARE reported on July 20th:—Copper bars (best selected), sheet and rod, £105, £7 decrease; English pig lead, £24 15s., 5s. increase.

The Dover Dispute.—The dispute between the Dover Corporation and members of the staff of the electricity works seemed likely to result in a withdrawal on the part of the staff on Tuesday last. We learn from the secretary of the E.P.E.A., however, that as the outcome of negotiations, the Electricity Committee decided to recommend the continuance of the salaries payable under the "E.P.E.A. Award," with certain adjustments, and a stoppage was averted. The Corporation has since accepted the recommendations of the Committee.

Standardisation of Contract Forms.—Great interest has been evinced in the Federation's decision to undertake an inquiry into the conditions of Government and municipal contracts and tenders, with a view to the elimination of existing difficulties, and, if possible, to standardisation of type. A large volume of evidence and of proposals on various points has been received from different quarters, which will require detailed consideration. It was accordingly decided at the last meeting of the full committee that a small sub-committee should be formed to investigate the fundamental clauses essential to all contracts, and to report to the main committee. The following gentlemen were asked to serve:—Mr. Thomas Biggart (chairman); Mr. D. A. Bremner, B.E.A.; Mr. D. N. Dunlop, B.E.A.M.A.; Mr. M. Mannberg, National Federation of Iron and Steel Manufacturers. In view of the wide scope of the committee's work, it was also agreed at the meeting to alter its name to the "Government and Public Bodies' Contracts Committee." The detailed investigation and comparison of various forms of contract and tender involved in the inquiry will necessitate some time before constructive proposals can be evolved.—*Bulletin of the F.B.I.*

The British Empire Exhibition.—At a recent meeting of the executive committee of the British Empire Exhibition, it was stated that there had been a delay in the acquisition of Wembley Park. In order to retain the Park for the Exhibition, however, Mr. Hiam, of Cambridge, had agreed to purchase it and hold it at the committee's disposal. It was suggested that a meeting should be held for the purpose of obtaining guarantees; this was referred to the administrative committee.

South Africa.—**TRADE AND INDUSTRIES.**—Mr. Malan, Acting Prime Minister, has appointed a Board of Trade and Industries with a strong personnel, which includes Sir Edmond Gorges, to hear and examine complaints and recommendations made as to the working of the Customs and Excise tariffs, and to advise the Government as regards (1) the recasting of the Customs tariffs and the adjustment of anomalies; (2) such action as may be necessary or advisable for assisting and developing the industries of the Union; and (3) such other matters as the Government may refer to the board.—*Reuter's Trade Service* (Cape Town).

Holidays.—The works of the MIDLAND ELECTRIC POWER INSTALLATION CO., at Wolverhampton, will be closed from the evening of Friday, July 29th, until the morning of Monday, August 8th.

MESSRS. HIGGS BROS., Sand Pits, Birmingham.—Works and offices entirely closed from Wednesday, July 27th, to Tuesday, August 9th.

Inter-Allied Colonial Exhibition.—The Paris Municipal Council has been discussing various plans for the organisation of an important inter-Allied Colonial exhibition, to be held in the French capital in 1923. A plan for the establishment of the exhibition in the Bois de Boulogne was rejected, as was also a plan for the holding of the exhibition in Paris itself, on the ground that nowhere could sufficient space be found. Finally, it was decided that a great part of the exhibition, including all the cumbersome exhibits, should be held in the Bois de Vincennes. It is estimated that the cost of the exhibition to the city of Paris will amount to about 50 million francs.—*Reuter's Trade Service* (Paris).

The Spanish Customs Tariff.—The *Gaceta de Madrid* publishes a project for a new definitive Customs tariff prepared by the Permanent Commission of the Junta de Aranceles y Valoraciones. The Government announces that claims and petitions in connection therewith will be received during a period of two months, at the end of which they will be considered by the Junta, and a definitive tariff prepared as soon as possible. The proposed tariff represents a profound modification in the organisation of Spanish commercial relations with foreign countries, owing to the introduction of a first and second tariff in the import section, the increase in the import duties, and the changes in the export duties on lead, iron, and copper ore, for instance. It is expected that many protests will be raised against the changes in the duties, but not many of these protests appear likely to meet with success unless serious concessions are made by the other contracting parties.—*Reuter's Trade Service* (Madrid).

Manufacturing Works in Austrian Succession States.—The General Deposit Bank of Vienna has issued a memoir in connection with the celebration of the fiftieth year of its existence, showing the economic efficiency of the States resulting from the partition of Austria-Hungary. In the case of electrical manufacturing, the memoir indicates that the works remaining in Austria employed 20,000 workpeople in 1913, and produced manufactures of the then value of £10,410,000; the works now comprised in Czechoslovakia had 5,000 workers, and turned out electrical goods worth £2,680,000; and the figures for Hungary were 3,000 and £1,040,000 respectively.

Electrical Equipment in New Zealand.—The Public Works Department will shortly be calling for electrical equipment to the value of £250,000. The material for which tenders will be invited includes generators, transformers, and insulators.—*Reuter's Trade Service* (Wellington).

German Metal Workers' Union.—The membership at the end of last year of this Union, the largest trade union in Germany, was 1,608,932, says the *Daily Intelligence* of the International Labour Office. Its turnover was 140,000,000 marks; 16,000,000 marks was spent on unemployment relief during the year, and 11,500,000 on health insurance.—*Financial Times*.

Developments on the Congo.—The *Times'* Brussels correspondent states that the Belgian Minister of the Colonies has outlined an extensive programme of public works, which Belgium proposes to carry out in the Congo, and which are expected to cost £120,000,000, in the next five years.

The Postal Congress at Stockholm, 1924.—The *Times* states that delegates from various countries are meeting in August at Zermatt to prepare for the Postal Congress at Stockholm in 1924.

Book Notices.—"Science Abstracts." Vol. 24. Part 6. Sections A, Physics, and B, Electrical Engineering. London: The Institution of Electrical Engineers. Price 2s. 6s. per part. "The Theory of the Induction Coil." By E. Taylor-Jones, D.Sc., F.Inst.P. (217 pp. 98 figs.) London: Sir Isaac Pitman & Sons, Ltd. Price 12s. 6d. net.

LIGHTING AND POWER NOTES.

Argentina.—**ROSARIO.**—A new 11,000-kW Escher-Wyss turbo-alternator is being installed at the Sorrento power-station of the Société d'Electricité de Rosario.

Australia.—**SYDNEY.**—At a recent meeting of the City Council, the Lord Mayor stated that the accounts of the electricity undertaking for the past year's working would show a loss. He pointed out, however, that, although prices of other commodities had increased by from 50 to 150 per cent., as compared with pre-war prices, electricity charges had remained the same. In fact, in several instances they were actually lower.

Barnes.—**YEAR'S WORKING.**—The results of working of the electricity undertaking during the year ended March 31st last were as follows (the figures for the preceding year are given in parentheses):—Revenue, £37,672 (£25,316); working expenses, £27,038 (£17,910); gross profit, £10,634 (£7,446); net profit, £2,798 (£1,627); units sold, 2,771,643 (2,063,221).

Birmingham.—**ELECTRICITY DISTRICT SCHEME.**—At its meeting, last week, the Birmingham City Council had under consideration the scheme for the supply of electricity to the South-West Midlands District under the Electricity (Supply) Act, 1919. In view of the fact that approximately 98 per cent. of the supply in the district is generated by the Birmingham Corporation and the Shropshire, Worcestershire, and Staffordshire Electric Power Co., and of the fact that both give an ideal output of three-phase, 25-period, alternating-current at a pressure of 5,600 volts, the Electric Supply Committee considered that the requirements of the district could best be served by retaining the organisations of the Corporation electricity supply undertaking and of the Electric Power Co. as separate entities, rather than by the formation of a joint electricity authority for the district; the Electric Power Co. agreed, and a joint scheme on these lines has been prepared. It is proposed that the district as provisionally determined by the Electricity Commissioners shall be modified by the omission of the rural district of Atherstone and a portion of the rural district of Tamworth. The Birmingham Corporation is to be responsible for the electrical development of the City of Birmingham and of that portion of the district situated in the County of Warwickshire. The Power Co. is to be responsible for the development of the remainder of the district situated in the Counties of Shropshire, Worcestershire, and Staffordshire. The two undertakings are to be ultimately linked together and save as may be agreed from time to time between the parties concerned, the Birmingham Corporation and the Power Co., respectively, are to exercise control of the generating stations and main transmission lines belonging to them in their respective portions of the district; are to be responsible for the capital expenditure incurred by them, respectively, in the areas for which they are responsible; and the financial arrangements regarding capital and revenue accounts are to continue on a separate basis as heretofore.

A Committee, to be described as the South-West Midlands District Electricity Committee, is to be established (consisting of four members, two of whom will represent the Birmingham Corporation and two the Power Co.), with advisory functions only upon such matters as the operating time tables of the undertakings; the best load factor obtainable; conservation of fuel; proper return upon the capital moneys expended and to be expended; the standardisation of systems; regularising the supply, and generally to carry out the directions of the Electricity Commissioners.

NEW PLANT.—The Council sanctioned, in June, 1920, an additional 30,000 kW of plant, with buildings, at the Nechells power-station, with underground mains and other works, involving an expenditure of £1,757,800, subject to the Finance Committee's being able to raise the necessary money. The Finance Committee reported at the same meeting that it had no funds in hand or in sight for this purpose. The Committee, therefore, in February last, recommended proceeding immediately with:—(1) The installation of a 5,000-kW generating set, with boilers, at a cost of £120,000; (2) the piling of the site in anticipation of the larger extension, at a cost of £20,000; and (3) certain mains extensions at a cost of £30,000, in order to enable it to carry on the supply for a period of 12 months, and so postpone the necessity for proceeding with the larger extension. The City Council sanctioned this proposal, subject to the Finance Committee being able to raise the necessary money. The Committee is now informed by the Finance Committee that the Council would not be taking an undue risk if the Electric Supply Committee were authorised to provide a 15,000-kW generating set with three boilers, which will be part of the original scheme sanctioned in June, 1920, and for which it will only be necessary to raise the money in instalments between 1922 and 1925.—*Birmingham Post*

Bradford.—**YEAR'S WORKING.**—The accounts of the Corporation Electricity Department for the past financial year show an income of £435,692; working expenses, £331,972; leaving a gross profit of £103,720. Revenue charges absorbed £93,117, leaving a net profit of £10,603. The number of units sold was 55,700,000, an increase of 6,400,000.

Bury.—**YEAR'S WORKING.**—The total revenue of the Corporation electricity department for the year ended March 31st last was £98,406, as compared with £77,430 in the preceding year. Working expenses amounted to £77,873, as against £58,364, leaving a gross profit of £20,633 (£19,066). The net profit, after deduction of capital charges, &c., was £2,419, almost the same as last year's

profit of £2,377. The number of units sold rose from 15,367,885 to 16,931,907, the maximum simultaneous demand being 6,095 kW. The bulk of the capital expenditure (£37,000) was in connection with the Chamber Hall Works and plant.

Chichester.—PURCHASE OF UNDERTAKING.—The City Council has arranged to take over the undertaking of the Chichester E.L. & P. Co. at a price of £16,500.

Chipping Norton.—PROPOSED PRICE INCREASE.—The Electric Supply Co. has given notice to the Town Council of its intention to apply for an order to increase the maximum prices for electricity. The Council has decided to object, as it is considered that the present time is one for decreases rather than increases in prices.

Continental.—SPAIN.—The Department of Overseas Trade is informed by the British Vice-Consul at Granada that a company has been formed at Granada under the name of "Sociedad Anonima Fuerzas Motrices del Valle de Lecrin," with a capital of five million pesetas, with the object of erecting and working hydro-electric power stations in the Valle de Lecrin. It is proposed to erect the first station on the River Dural, where a fall of 758 metres will be utilised and 4,000 h.p. produced.

SWEDEN.—Seventy-eight associations have applied for loans amounting in all to over kr.12,000,000 for the purpose of carrying out local electrification schemes. *—Reuter's Trade Service (Stockholm).*

Conway.—BULK SUPPLY.—The North Wales Power Co. has submitted draft proposals to the Conway Corporation for the laying of transmission trunk lines for the supply of electricity in bulk to the Corporation, which now has the agreement under consideration.

Darlington.—COAL DISPUTE LOSS.—Alderman Sir Charles Starmer stated, at a meeting of the Corporation, that there had been about £4,000 additional cost at the electricity works as a result of the coal dispute, but, with a reduction of 6s. per week in the men's wages and various economies, together with increased consumption, the Committee hoped to make up this amount without increasing the charges either for power or lighting purposes.

Dominican Republic.—NEW HYDROELECTRIC PLANT.—*The Times Engineering Supplement* states that a new hydro-electric works is to be built on the Jiminosa River, in the Republic of Dominica. The locality chosen is in the mountainous interior of the Province of La Vega, about 25 miles south-east of the nearest railway station. Owing to the difficulties of transport only a 1,000-h.p. plant will be installed at first, the intention being to construct a light electric tramway from La Vega before installing the larger plant, which will then supply light and power to La Vega, Salcedo, San Francisco-de-Macoris, Moca, and other small places in Cibao, as well as to Santiago and Puerto Plata, which are now supplied from the last-named town.

Eastbourne.—YEAR'S WORKING.—The annual report of the borough electrical engineer (Mr. J. K. Brydges) for the year ended March 31st last, shows that the year's revenue was £62,895, as compared with £50,834 in 1919-20. Working expenses totalled £41,381, as against £29,101, leaving a balance of £21,514 (£21,739). Capital charges were heavier than those of the previous year, and the net result was a profit of £3,785, as against £5,766. Capital expenditure during the year amounted to £28,079 on account of extensions. The total number of units sold rose from 2,521,437 to 2,905,640.

Elland.—NEW STATION.—The plant installed to deal with a bulk supply of electricity from the Yorkshire Electric Power Co. has been put into operation. The installation comprises two 800-kW rotary converters, with transformers, and a 50-kW motor-generator set. Accommodation has been provided for an additional 500-kW rotary if, and when, this becomes necessary. The e.h.p. switchgear and cables have been provided by the Power Co.

Glasgow.—YEAR'S WORKING.—The accounts of the Electricity Department for the year ended May 31st, 1921, show revenue amounting to £1,311,951, an increase of £334,465 over the revenue of the preceding financial year. The working costs were £902,424, an amount which is £188,973 in excess of the previous year's costs. After providing for interest, sinking fund, and depreciation, amounting to £409,374, there remains a surplus of £151, contrasted with a deficit last year of £54,614. A statement issued by the Electricity Committee sets forth that in view of the adverse circumstances, due to shortage of plant (which was accentuated by the breakdown of new generators at the Dalmarnock Works in December last), and the drop in the consumption of electricity caused by the long dispute in the mining industry, the result of the year's operations is more favourable than might have been expected. The Electricity Committee, it is added, in view of the increased rate of interest on capital and other outgoings, coupled with the depressed state of trade, will have a difficult year to face, and the matter of the rates of charge will call for serious consideration.

King's Lynn.—YEAR'S WORKING.—The financial results of the working of the Corporation electricity department during the year ended March 31st last were as follows (the preceding year's figures are given in parentheses):—Total revenue, £16,659 (£13,807); working expenses and capital charges, £16,765 (£12,588); net result, £106 deficit (£1,219 profit). The number of units sold rose from 786,201 to 882,314.

Kendal.—YEAR'S WORKING.—The gross profit upon the electricity undertaking for the past financial year was £62, as against £336 in the previous year. The net result was a deficiency of £1,207, as against £962.

Leigh (Lancs.).—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking show that during the year ended March 31st last the income advanced from £26,265 to £33,603, while the total working expenses increased from £18,395 to £23,036. The units sold increased by 14 per cent., from 2,427,888 to 2,778,867. The general trade depression, more particularly in the textile industries, had an adverse effect on the latter portion of the year's operations; but, notwithstanding this, a gross profit of £10,566 was made. Interest, repayment of debt, and sinking fund charges absorbed £7,622, and after providing a further sum of £834 for all new meters bought during the year, the net result of the year's working was a profit of £2,109. Trade depression, strikes, and reduced hours of working had their effect on the load factor, which has gradually fallen from 83·3 per cent. in 1918 to 18·2 per cent. for the year under review.

Landover.—ELECTRIC LIGHTING SCHEMES.—Three separate schemes are suggested for the electric lighting of the town. The cost ranges between £6,237 and £8,000.

London.—BERMONDSEY.—The price of electricity is to be increased by 5 per cent.

Mansfield.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £2,236 for feeders and distributing mains in connection with the housing scheme at Mansfield Woodhouse.

Rickmansworth.—OPPOSITION TO TIME EXTENSION.—The Urban District Council has informed the Electricity Commissioners that it still maintains its attitude of opposition to any further extension of the Rickmansworth and Chorleywood Electric Lighting Order, 1914, held by the Colne Valley Electric Supply Co., Ltd., adding that another authority is willing to supply the district. The company has informed the Commissioners that it has arranged for a supply to be taken from the sub-station at Pinner. This would necessitate the raising of a sum of £30,000.

Rushden.—BULK SUPPLY.—The Urban District Council has approved an application of the Northampton Electric Light Co. to supply electricity in bulk to the district, provided that the company undertakes to bear all expenses in connection with the laying of mains and the reinstatement of roads, &c.

Sevenoaks.—OVERHEAD TRANSMISSION.—The Rural District Council has granted permission to the Sevenoaks and District Electricity Co. to erect overhead lines in the district for the supply of electricity to villages in the Council's area.

Telgoumouth.—AMENDED ORDER.—The Urban District Council has agreed to amendments to the Electric Lighting Order obtained in 1914 by Messrs. Purves, of Exeter, with a view to electricity being provided for the town of Shaldon, and the firm is to submit, as early as possible, a draft of the amended Order.

Tisbury.—ELECTRICITY SCHEME.—At a meeting of the United Parish Councils, last week, an electric lighting scheme for the town, submitted by Messrs. Edmundson's, the cost of which is estimated at £5,000, was accepted, and a Committee was formed for the purpose of promoting a limited company to carry out the scheme. Messrs. Edmundson's offered to take up half the ordinary shares (£2,500).

West Riding.—LAW COMMITTEE'S CRITICISMS.—The Law and Parliamentary Committee of the West Riding County Council submitted a report recently dealing with the Leeds and Bradford borough extension scheme inquiries and the recent inquiry at Leeds by the Electricity Commissioners into the three schemes for the Aire and Calder Electricity District. The Committee voiced the opinion that, in view of the present state of legislation in relation to electricity, the holding of the inquiry was premature, as the schemes in their essentials were *ultra vires*, and, therefore, beyond the authority of the Commissioners to confirm. The report stated that this fact was admitted by the Commissioners themselves, and that the Commissioners and the promoters alike are relying on future legislation. Having regard to these considerations and to the general financial situation in the country, the Committee expressed the opinion that all electricity schemes involving a change of ownership of large undertakings, consequent capital outlay, and probable additional burdens on the public purse, should be deferred.

TRAMWAY AND RAILWAY NOTES.

Bradford.—ACCIDENT.—On July 11th a car proceeding along Church Bark, a steep incline, commenced to run backwards, the action of the brakes and the application of sand to the track failing to arrest its motion. As it was near the bottom of the incline, it collided with another car, which acted as a buffer and prevented the runaway car's overturning in a manner to a car which ran away in 1907. The collision caused slight injuries to five passengers.

Brazil.—**ELECTRIFICATION OF THE PAULISTA RAILWAY.**—*Commerce Report* says that the initial order which has been placed in the United States by the American contractors for the electrification of the Paulista Railway comprises material sufficient for the first 45 km., the Jundiahy to Campinas section. Two of the four engines to be furnished by another American company are passenger locomotives of 2,000 h.p., weighing 121 tons each, one being capable of a speed of 104 km. on a 1'60 m. gauge. The remaining two are freight engines of 1,600 h.p., weighing 87 tons each with a speed of 64 km. per hour. An overhead circuit of 3,000 volts direct current will furnish the energy. The entire electrification when completed will cover about 160 km.

Cannock Chase.—**NEW LIGHT RAILWAY.**—The London and North-Western Railway Co. is promoting a new light railway between Cannock Chase and Wolverhampton, a distance of 6½ miles.

Continental.—**BELGIUM.**—As a protest against the reduction of their wages by 1 fr. (5d.) a day, the tramway workers of Antwerp went on strike on July 15th, and the tramcars ceased running entirely.—*The Times*.

Glasgow.—**ANNUAL REPORT.**—Some interesting information is contained in the report of the Corporation Tramways Department for the year ended May 31st last. It is seen that although the coal consumption at the Pinkston generating station was reduced by 4,730 tons, the cost rose by £18,818, representing an increase of 7s. 7d. per ton. There was a falling-off in the number of passengers carried, although the car-mileage increased. The average fare per passenger rose from 81d. to 1'28d., an increase of 58 per cent. The 1½d. fares showed the highest return (31 per cent.), while only a small proportion of the revenue was derived from fares of 3d. and above ('02 per cent.). The capital expenditure during the year was £88,576. The single-track mileage of the system was about 198 at the end of the year. The year's financial details were given in our issue of July 1st.

Huddersfield.—**NEW DEPOT.**—The new tramcar and omnibus depot, erected at a cost of £51,690, was formally opened by the chairman of the Tramways Committee on July 15th. The accommodation includes a dining room, kitchen, lavatories, store rooms, and a large recreation room. The depot is able to house 100 cars on 13 lines of track. The total area covered by the building is 5,113 sq. yd.

London.—**L.C.C. TRAMWAYS.**—The Highways Committee of the London County Council has had under consideration the advisability of promoting a Bill in the ensuing Parliamentary Session to obtain powers to construct a number of new routes, including lines along Farringdon Road, New Bridge Street, Holborn, and Charterhouse Street, and Tottenham Court Road, as well as a number of suburban extensions. The Committee has come to the conclusion that the Council would not be justified in promoting such a measure in the 1922 Session, owing chiefly to the opposition of a number of road authorities.

Pontypridd.—**SUNDAY SERVICES.**—The Council has deferred consideration of an offer of £600 per annum from the Rhondda Tramways Co., which undertakes to provide the staff and power, for permission to run cars on the Council's system on Sundays.

TELEGRAPH AND TELEPHONE NOTES.

Germany.—**U.S. MISSION.**—It is reported that the American Mission which recently visited Berlin with a view to arranging for the laying of a direct cable between Germany and the United States has left without coming to an agreement.—*The Times*.

The Telegraph Service.—**FOREIGN TELEGRAM RATES.**—The rates of charge per word for telegrams to the undermentioned places have been revised:—Brunel, Cuba, New Hebrides, East Africa (formerly German East Africa), and West Africa (French Colonies and possessions).

The Telephone Service.—**ADDITIONAL EXPENDITURE.**—A memorandum on the Telegraph (Money) Bill states that in accordance with the general practice of meeting capital expenditure of a reproductive nature out of loan money, provision for the development of the telephone system is made by advances of capital which are repaid by means of terminable annuities charged upon the Post Office Vote. The last Act was passed (Money Act, 1920) and authorized the up to £2,000,000, which owing to the heavy rate to be overtaken, will be exhausted in October 1921. Bill authorizes the Treasury to borrow a further telephone development. The actual expenditure in works to be carried out are subject to approval.—*Financial Times*.

Commons went into Committee on the financial section with the Bill on July 13th.

Mr. Kellaway, Postmaster-General, explained that the total capital expenditure out of telephone capital was, in 1920-21, £6,867,000. It was proposed for the present year to spend out of capital a total of £9,000,000. Of that, £2,350,000 was for trunk lines, £6,150,000 for new exchanges and subscribers' circuits, and £600,000 for sites and buildings. The money was principally required for contracts already made and for work which was now in progress. During the first five months of this year—the period during which the new tariff was first in operation—the Post Office received 1,400 orders a month for telephones in London and 2,500 a month in the provinces. They had to refuse a large portion of those orders, and there were at the end of May, 23,000 persons who required telephones whose applications could not be accepted because of the shortage of plant.

There was a great shortage of exchanges, and although new ones were springing up, a great number more were wanted, and the Government hoped to make considerable improvement if it got the £5,000,000 asked for. Recounting the progress made in laying underground trunk lines, he said that the three largest roads which were now approaching completion were (1) London to Manchester, which would be completed near the end of this calendar year; (2) London to Bristol and thence to Newport and Cardiff; and (3) London to Southampton with a spur to Portsmouth. The number of rural call offices opened in 1919 was 149; in 1920 it was 383, and in the first quarter of this year 116 had been opened and 105 were in course of construction. Arrangements were being made to open call offices at rural post offices where there was a telegraph line that could be converted to telephone purposes and a reasonable probability of business being done.

On the question of the new telephone tariff, he said that the number of subscribers who, as the result, had surrendered their telephones, was 23,000, 47 per cent. of the total number. During this time they had accepted 27,000 new subscribers, and had had to refuse 23,000. The bulk of the complaints he had received about the service related to the difficulty which those who desired to have the telephone installed found in getting it installed.

The resolution was carried by 99 votes against 26.—*The Times*.

LONDON "TOLL" EXCHANGE.—The Postmaster-General announces that in order to relieve the pressure on the London Trunk Exchange, a new telephone exchange is in course of erection, and is expected to be opened towards the end of the summer. The new exchange will be situated near Fleet Street, and will be known as the London Toll Exchange. It is of an entirely new type, and has been designed so that the telephone traffic between London and the nearer provincial towns may be handled with greater dispatch. At the date of opening, the trunk lines between London and provincial towns which are within a distance of approximately 25 miles radius from the City will be transferred to the Toll Exchange from the London Trunk Exchange. The area served by the new exchange will contain about 300 exchanges and rural call offices, and will include the following towns:—Aylesbury, Luton, Dunstable, St. Albans, Watford, Brentford, Dorking, Leatherhead, Woking, Weybridge, Hertford, Ware, Maidenhead, Uxbridge, and Sevenoaks. Additional trunk lines are being provided, and when it is desired to put a call through to any of the towns which are included in the Toll area the public will ask for "Toll" instead of "Trunks," as at present. The local exchange will then connect the caller to the toll exchange, where the operator will have access to all the trunk lines, or toll lines, which are connected to that exchange. If all the lines to a particular town are engaged, the telephonist will record the details of the call, and ring the subscriber as soon as a connection can be given. Full details of the new service will be published in the Press, and an explanatory circular sent to each subscriber in the London telephone area in a few weeks' time.

United States.—**TELEPHONE RATES CUT.**—The Public Service Commission recently ordered the reduction of 10 per cent. of the extra allowance of 20 per cent. for exchange service granted to the New York Telephone Co. by the old Commission last March. The telephone company in a statement says that this action will reduce the company's additional revenue from approximately \$1,600,000 to \$800,000, which will be sufficient for dividends, but not enough to give a fair return on the value of the property.—*Reuter's Trade Service* (New York).

Wireless Telegraphy.—**EMPIRE CHAIN.**—The Subcommittee of the Imperial Conference on Empire Communications, on July 14th, dealt with the subject of wireless telegraphic and telephonic communication throughout the Empire. It is understood, says the *Daily Mail*, that the Prime Ministers are unanimous about the importance of development in this direction, and that it remains to settle only the financial details.

ATMOSPHERIC DISTURBANCES.—Mr. Marconi, who has just returned to London, announces that he has been for the last few weeks testing a new method of wireless reception developed by one of the company's engineers which has enabled him to receive continuously from the United States without being in any way interfered with by atmospheric disturbances which are particularly prevalent at this time of year, and more severe than usual in recent weeks in consequence of the abnormal spell of hot weather. Mr. Marconi regards this advance as of the greatest importance, for it enables a wireless telegraph service to be conducted, notwithstanding atmospheric disturbances, during the whole 24 hours and at high speed during the greater part of the time. He says that it would be difficult to exaggerate the practical value in commercial long-distance wireless telegraphy of this latest achievement.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the *ELECTRICAL REVIEW* in which the "Official Notice" appeared.)

OPEN.

Australia.—**TASMANIA.**—August 15th. P.M.G.'s Department. Switchboard material. (July 8th.)

Aylesbury.—July 29th. Sewage works. Five electric motors and centrifugal pumps. Mr. W. H. Taylor, Borough Engineer and Surveyor (returnable deposit of £1 1s.).

Battle (Sussex).—July 29th. Union. New accumulator plates for 28 cells. Sizes $16\frac{1}{2}$ in. \times $10\frac{1}{2}$ \times 8½ in. (July 15th.)

Belfast.—August 22nd. Electricity Department. Required for the New Harbour power station. The manufacture, delivery and erection of one 12,500-kW turbo-alternator, with condensing plant and auxiliaries. Four water-tube boilers, with superheaters and forced draught fans. Four fuel economisers. Two steel chimneys, with four electrically-driven suction draught fans. One electrically-driven centrifugal pump, capacity 18,000 g.p.m. (See this issue.)

Bristol.—August 15th. Corporation Electricity Department. The supply of one 3,000-kW, single-phase, 93-cycle, 2,200-V turbo-alternator and condensing plant and auxiliaries; and one 6,000-kW, three-phase, 50-cycle, 6,600-V ditto. (July 15th.)

Chile.—August 31st. Chilean State Railways. Emery and grind-stones, bolts, nuts, cotter pins, rivets, nails and screws, telegraph and telephone apparatus, chemicals, &c. (estimated value \$44,000).*

It is understood that the representative of the Chilean State Railways in Paris (88, Boulevard St. Michel), has been instructed to obtain prices in the United Kingdom, and remit these by cable on the day previous to the opening of tenders.

France.—August 3rd. French State Railway authorities. Five electrically-operated capstans. Particulars may be obtained from the Service Electrique, 43, Rue de Rome, Paris.

Manchester.—July 29th. Electricity Committee. Five 2,500-kW rotary converters and other plant and switchgear. (July 8th.)

August 3rd. Electricity Committee. Low-pressure steam and water pipes and valves for Barton station. (July 15th.)

Newport (Mon.).—July 25th. Electricity Department. 750-kW rotary converter, transformer and switchgear. (July 8th.)

New Zealand.—**WELLINGTON.**—November 1st. Public Works Tender Board. One 200/260-b.h.p. oil engine and one 3-phase, 50-cycle, 190-kW at .8 power factor, alternator, with exciter and switchgear.*

November 1st. Public Works Department. Fresh tenders for the supply and erection of steel pipe lines and fittings, required in connection with the Mangahao power plant, are now being called for. While the quantities, &c., of the material would appear to be substantially the same as those specified in the original call for tenders, it may be mentioned that some of the conditions applicable to the contract would appear to have undergone modification.*

South Africa.—**Rand Water Board.** September 28th. Contract No. 203. Tenders for supply, delivery, and erection at the Board's Intake Pumping Station, Transvaal Bank of Vaal River at Vereeniging of (1) Two vertical spindle centrifugal pumps, direct-coupled to electric motors, with all accessories, and (2) one 10-ton travelling crane. Also for main pumping station site, Vereeniging, two horizontal spindle centrifugal pumps, direct-coupled to electric motors, with all accessories.*

Warrington.—August 9th. Corporation Electricity Department. Circulating pumps. (July 15th.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Edinburgh.—The contract for cables for the Portobello electric power station, mentioned in this column last week, was placed with Messrs. Walsbams, of London, for cable manufactured by Messrs. Ateliers de Construction Electriques, Charleroi.

Great Yarmouth.—The Town Council Electricity Committee has placed an order for two sets of furnaces for Babcock boilers with the Turbine Furnace Co., Ltd., of London.

London.—**HANMERSMITH.**—Electricity Committee. Recommended:—

100 30-A. house service fuses, three types, 14s. 6d., 12s. and 19s. 6d. each. — Lucy & Co., Ltd.
Conduit for mains extensions. — Doulton & Co., Ltd.
60 350-A switch panels, £26 2s. 6d. each. — Edmond Swan Electric Co., Ltd.

STOKE NEWINGTON.—Electric Lighting Committee. Recommended:—

Overhead travelling crane, £360. — H. Morris, Ltd.
E.h.p. machine cables, £81. — W. T. Henley's Telegraph Works Co., Ltd.
Alterations to buildings, £1,170. — Goodall & Son.

Trindon (Durham):—

Electric light extension from Trindon Grange Colliery to Trindon Village, £1,414. — Cox, Walker & Co. (Darlington).

NOTES.

The Electro-Harmonic Society.—The annual general meeting of the Society was held on Wednesday last at the Institution of Electrical Engineers. The report of the committee stated that during the past season 70 new members had been elected, six had died, 67 had resigned, and 28 had been removed from the register; the membership now numbers 603. The statement of accounts showed a deficiency of £23, and it was proposed, in order to maintain the standard of the concerts, to raise the annual subscription to 21s. A resolution was passed, expressing "high appreciation of the inestimable services rendered to the society" by the late Mr. T. E. Gatehouse, joint founder and hon. musical director of the Society since its inception 35 years ago.

Electric Vehicles in U.S.A.—According to the *Electric Vehicle*, the American Railway Express Co. has a fleet of 1,284 electric vehicles, forming more than half of its total fleet.

Thermionic Discharges in Tungsten Lamps.—The starting point of an investigation into the pulsating thermionic discharges which take place in evacuated tungsten lamps, which is described by Mr. A. G. Worthing in the *Journal* of the Franklin Institute, was the observation of peculiar, periodic, automatic changes in brightness of a tungsten ribbon filament in an evacuated lamp bulb. Several other lamps were investigated at the Nela Research Laboratory, only a few of which showed similar discharges, and none to the extent shown by the one in which the discovery was made.

All of the lamps tested contained a third insulated terminal, by means of which thermionic discharges in the lamp could be measured. Simultaneous observations of thermionic currents and of filament brightness by means of an optical pyrometer showed conclusively that the original variations noted in the filament brightness were directly connected with changes in the thermionic discharges in the lamp. These discharges may take place either from the filament to the insulated terminal, or from one leg of the filament to the other.

The tungsten ribbon filament in the lamp tested was V-shaped, with sides about 2½ cm. long, and with an apex slightly truncated so as to give an approximately square surface 1 mm. on edge, which in the mounting faced the third terminal, also of tungsten. The lamp was evacuated in the ordinary manner. In one test a direct current of 8.2 A was used in heating the filament to a temperature of about 2,280° K. The negative terminal of a 44-V battery was connected to one of the leads to the ribbon filament through a voltmeter with 5,000 ohms resistance; the positive terminal of the battery was connected to the insulated terminal in the bulb.

The thermionic currents represented by the voltmeter readings showed discharges of a pulsating character in which, without any alteration of conditions by the experimenter, the currents rose from a moderately steady minimum, at first slowly and then with great suddenness, to a maximum value at least 4.8 times the minimum value. The period of the discharge [eight minutes] was constant for nine successive intervals to within 4 per cent. Small characteristic variations in the form of the curves were repeated also.

Different temperatures of operation, different applied voltages and resistances in the voltmeter circuit, yielded discharges differing in period, minimum and maximum current values, and ratios of maximum to minimum current values. Temperatures beyond a certain value and resistances below a certain minimum in the thermionic current circuit (other conditions remaining unchanged) tended towards pulsations which gradually diminished in intensity and disappeared, leaving a steady thermionic discharge.

No definite explanation is offered for this action. However, the blue glow discharges which were obtainable in the lamps used would seem to indicate that it might be connected with the residual gases in the lamps.

Protection against X-Rays and Radium.—The committee formed to inquire into the precautions that could be taken by those engaged in the use of X-rays or radium recently issued a preliminary report reviewing the state of present knowledge and stating the belief of the committee that the dangers can be entirely averted by suitable means. Details are given of the protective measures recommended to suit various conditions. Copies of the report can be obtained from the hon. secretaries of the X-Ray and Radium Protection Committee, care of Royal Society of Medicine, Wimpole Street, W. 1.

The Measurement of Frequency.—An heterodyne method of measuring frequency by comparison with a calibrated valve oscillator is described by Messrs. B. S. Smith and G. F. Partridge in the *Proceedings* of the Physical Society of London. The calibration is performed by means of two valve oscillators, which are capable of giving frequencies of, say, 1,000/sec. and upwards. The frequency of the oscillators is raised alternately to give a beat note whose pitch is determined by comparison with a fork. Intermediate frequencies are found by interpolation on the calibration curve, and a method of checking the capacities of the oscillator condensers is described. For the measurement of acoustic frequencies the sounds are converted to alternating currents by means of a suitable transmitter. The method has been found very useful for determining the frequency of heavily damped steel diaphragms, and it would be possible to use it with a Galton whistle if some means of picking up the sound at such high frequencies was available.

Are We Behind America?—Those who maintain that this country is in a great many respects far behind the United States, may be interested in the *novelty* displayed by the following *Reuter* note which seems to announce a discovery:—“The Street Railway Commission of this city (Detroit) is advertising for tenders for 50 ‘trackless’ trams, a combination tramcar and omnibus. The new type of car is operated by electricity provided through the usual trolley, but runs on rubber tires and does not require any tracks. The pole will swerve to permit the car to pass any other vehicle in the street.”

Electricity in Agriculture.—Electrical stimulation of plant growth is being tried “on a large scale” at the Rothamstead Experimental Station, and the results already attained were described on July 15th, when, on the invitation of Lord Bledisloe, chairman of the Lawes Agricultural Trust Committee, members of the county agricultural committees visited the station, which is near Harpenden. According to the *Daily Chronicle*, experiments have been proceeding for some time, some of which the visitors saw in operation. A pressure of 15,000 V is used in a network of wires 10 ft. above the ground over a growing crop of barley, and trials are being made with alternating and continuous discharges, and with negative and positive discharges. No actual decision has yet been come to, but the average increase of growth caused by electrical discharges over field crops is about 21 per cent. That, however, is just below what is necessary to make it an economical proposition. In other words, says the *Daily Chronicle*, the increase of the crop barely pays for the cost of the electricity. But the experiments are still being continued.

Mining Dangers Research Board.—The Board of Trade has set up a Mining Dangers Research Board to deal with the causes and prevention of mining dangers, and all communications on the subject should be addressed to Mr. Edward Fudge, at 46, Victoria Street, S.W. 1.

Service Note.—WIRELESS TELEGRAPHY COURSE.—No. 2 “A” wireless telegraphy course for officers of the Royal Corps of Signals will assemble at the Signal Training Centre, Maresfield, on October 3rd, and terminate on November 28th. This course is intended for officers and subalterns who have not attended a short wireless telegraphy course or the wireless telegraphy portion of the Royal Corps of Signals officers’ qualifying course. Applications for vacancies should be forwarded by Commands to the War Office as early as possible.—*The Times*.

The Industrial League and Council.—This organisation, the object of which is the improvement of the relations between employers and employed, recently gave a dinner at the Holborn Restaurant to welcome Messrs. Ernest J. P. Benn, C.B.E., and Frank Elliott on their return from a five-weeks’ visit to the U.S.A. In the absence of Viscount Burnham, the Right Hon. G. H. Roberts, M.P., president, was in the chair, and, following the usual loyal toasts, Messrs. Benn and Elliott gave their impressions of their visit to America.

A Novel Magneto-Optical Effect.—In *Nature* of July 14th, further particulars are given by Prof. Elihu Thomson regarding this effect, described in our issue of July 1st, page 3. Experiments have shown that the fumes from an iron arc form only a confused deposit on a glass slide in the absence of a magnetic field, but when a magnetic field is applied strings of brownish particles are deposited in striated form with brush-like tufts at the ends. These strings on the microscope slide have the property of polarising light. Smoke from the arc enclosed in a glass flask and traversed by a beam of light shows increased luminosity in an alternating field; when the field is weak the steady luminosity is replaced by a flickering, which keeps pace not with the alternations of current in the magnetising coil, but with the cycles only. This effect is observed even at a distance of 12 ft. from the small magnetising coil. Messrs. R. Whytlaw-Gray and J. B. Speakman, of Eton College, in the same issue of *Nature*, describe similar experiments with various oxides dispersed in air, irregular chains or strings of particles being formed which, when examined with the ultramicroscope, exhibit rapid Brownian motion under molecular bombardment. In an electrostatic field the strings straighten out and arrange themselves parallel to the lines of force, and on reversal of the field they rotate through 180°. The particles appear to be held together by invisible threads.

Educational.—The REGENT STREET POLYTECHNIC (Engineering Department) announces the commencement of day courses (three years) for the Polytechnic Diploma on September 20th. Evening courses extending over a period of from one to five years, and preparing for the A.M.I.E.E. and the City and Guilds final examinations commence on September 26th.

SUNDERLAND TECHNICAL COLLEGE.—Mr. R. A. Bartram, a Sunderland shipbuilder, has presented 10,000 guineas to the Sunderland Technical College.

VIENNA.—The condition of the University is very serious. Many professorial chairs are vacant, their holders having abandoned them because they were unable to live on their pay. Austrian professors and men of science are migrating to Germany. It is possible that the University may have to close.—*Economist Review*.

Appointments Vacant.—The following vacancies are advertised in this issue:—Ledger clerk (£310-£390), for Hackney Borough Treasurer’s Department (Electricity Section); assistant sub-station attendant (£4 8s. per week), for the Stoke Newington Borough Council.

War Inventions.—On Monday last the Royal Commission on Awards to Inventors began the hearing of a claim put forward by Messrs. Henry Hughes & Son, Ltd., for the invention of a magnetic compass for use on aeroplanes.

Wounds Cured by Electricity.—A method of destroying by electricity the microbes which infect wounds has been worked out and applied at the Royal Sussex County Hospital, Brighton. Dr. P. C. Collingwood Fenwick, surgical officer of the hospital, holds the opinion that electrical treatment will play an important part in combating disease in the future. The new method of bringing about a cure was described in a recent issue of the *British Medical Journal* by Dr. Fenwick. In one case a man had a very bad septic forearm, which did not improve under the usual treatment. The arm was placed in a porcelain bath filled with a solution of salt, and then electricity was passed through it. “The following day the arm looked very much cleaner. Each day it improved, and in 10 days with daily baths it was almost healed.” Deep gunshot wounds were treated with equal success. Electric baths are being used with excellent results in the out-patient department of the hospital.—*Daily Mail*.

Electrically-Propelled Ships.—A paragraph which recently obtained considerable prominence in a number of daily papers deploring the lack of electrically-propelled ships in Japan was out of date before it reached this country, for the Toyo Kaien Kaisha took over last May from the Asano Shipbuilding Co., of Yokohama, an electrically-propelled ship of nearly 9,000 tons carrying capacity. This is believed to be the first electrically-driven ship built in Japan. The turbines are steam-driven and the machinery was made by the Swedish Ljungstrom Co.—*Financialist*.

Setting a Recording Pyrometer for Cold-Junction Temperature.—A recording pyrometer of the deflection or millivoltmeter type, on which it is necessary to set the galvanometer for the cold-junction temperature of the couples connected to it, often offers considerable difficulty to an accurate cold-junction setting because the lowest graduation on the scale or chart is seldom less than 75° F., while the actual cold-junction temperature is often as low as 50° F. When the cold-junction temperature is higher than the lowest chart or scale division, the galvanometer can be set to this temperature as closely as the instrument can be read, but when the cold-junction temperature is lower than the lowest division this setting cannot be made so accurately, because there is a scale division on only one side of the setting to serve as a guide.

In many cases very little attention is paid to cold-junction settings; but for those users of pyrometers who endeavour to maintain their equipment as accurate as possible, the following method for setting deflection instruments when the cold-junction temperature is lower than the lowest scale division may be of some value:

Disconnect the instrument from the couple and set the galvanometer pointer on the lowest scale or chart division. By means of a potentiometer, Wheatstone bridge or other source of a small variable e.m.f. connected to the instrument, deflect the galvanometer an amount equal to the difference between the actual cold-junction temperature and the lowest scale division. With the source of e.m.f. unchanged and still connected to the instrument, reset the pointer to the lowest scale division by means of the zero adjuster. Then when the source of e.m.f. is disconnected from the instrument the zero or cold-junction setting will correspond with the actual cold-junction temperature as closely as the instrument can be read.—KIRTLAND MARSH, in *Chemical and Metallurgical Engineering*.

Atmospheric Electricity as a Source of Energy.—M. Hermann Plauson, on the basis of recently conducted experiments, is of opinion that an inexpensive and unlimited supply of electrical energy may be obtained from the atmosphere. He has published a book on the subject, entitled *Gewinnung und Verwertung der Atmosphärischen Elektrizität* (Extraction and Utilisation of Atmospheric Electricity), published by Boysen and Maasch, Hamburg, 1920. According to the *Schweizerische Chemikal-Zeitung*, he uses as an antenna a captive balloon having a metallic cover provided with a large number of pointed projections, or spikes, and allows it to ascend to a height of 1,000 or 1,600 ft. above ground. Positive electricity is thereby collected from the air and transmitted to the ground by means of a wire rope fitted with a spark gap, which, in turn, produces oscillations in the circuit. Electromagnetic waves are also produced in an additional circuit by resonance, and can be utilised to drive a specially-designed resonance motor. By inserting condensers and spark gaps the efficiency and safety against lightning are increased. M. Plauson obtained from one balloon, at a height of 1,000 ft., a supply of 17.28 kWh per diem, and with two balloons 81.6 kWh; he calculates that a battery of 10 balloons should give an annual supply of 210,000 kWh.—*Technical Review*.

The Conductivity of Glass.—In *Nature* of July 7th Mr. H. H. Poole gives an account of experiments which indicate that the conduction current through glass is not, as has been surmised, of an electrolytic nature, at ordinary temperatures.

Fire.—An outbreak of fire occurred, on July 14th, at the Dalziel Steel Works (Messrs. D. Colville & Sons) electrical station, Motherwell. It is supposed that a wire fused and ignited a wooden platform erected over the main cable system. The flames spread rapidly, damaging about 100 other cables of the main installation. For a time it was feared the engine-house would be involved, but the firemen succeeded in preventing the fire from spreading. The loss is estimated at about £1,500.

Automatic Operation of Sub-station.—The effectiveness of automatic sub-stations for light and power service was shown recently when trouble occurred on the system of the St. Paul Gas Light Company. The trouble began on one of the trunk lines and caused a momentary drop in voltage. The line was not cleared immediately, and all of the synchronous apparatus at the manual station was put out of service. The automatic sub-station cleared itself from the line but was restored automatically to service in a few seconds. It helped to take care of the direct-current network, which was immediately picked up automatically by a storage battery at the manual station. The voltage on the direct-current system dropped from 240 to 180. The contactors on the line panel of the automatic sub-station opened, cutting in resistance. This station continued giving service, however, through the resistance until enough of the manual station equipment was brought back into operation to restore the service to normal. The period of trouble lasted for about five minutes. This was the first automatic sub-station ever put into use in light and power work, according to the Westinghouse Electric & Manufacturing Co. The sub-station was placed in operation some months ago, and the result has been entirely satisfactory.—*Electrical World.*

The Value of Meter Inspection.—In an article in the *Electrical World* by Mr. A. L. Johnston, various instances are quoted of inaccurate registration of a consumer's supply. In one case the current transformers were of the wrong ratio, and for three years the meter registered only 50 per cent. of the load, involving a loss of \$10,000. In another case the wrong gear train was used in a meter on a 400-kW load, under-registering by 50 per cent., and this condition existed for years. Two-phase supply with three-wire and four-wire connections offers openings for metering errors. In one instance a consumer challenged his meter reading, and the meter was tested and found correct; it was observed, however, that the meter recorded one-third of the normal load when no load was on. Investigation revealed the fact that on the consumer's side of the meter the connections were three-wire. This would not have affected the meter in the ordinary way, but it happened that another consumer was supplied from the same transformer on the four-wire system, and by accident one wire of each phase was interchanged with the other. The result was that the two phases on this consumer's premises were in series, but the connection of the two phases on the other consumer's circuit enabled the motors to run satisfactorily, while one meter ran at half speed and the other, which gave rise to the complaint, ran 50 per cent. fast. Lastly, on a load of about 500 h.p., the series coils of an indicating wattmeter were connected in parallel with the series coils of a watt-hour meter, and the latter ran about 50 per cent. slow for no less than 15 years before the error was discovered.

Training Disabled Ex-Service Men as Electricians.—In addition to the ordinary workshop practice in electrical manipulation which forms a large part of the training of disabled ex-Service men at the Leeds Technical School, under the auspices of the Ministry of Labour, the men in training have recently completed the construction of a 20,000-volt transformer to work on the Leeds Corporation a.c. supply. This 2-kW transformer was of a special design to meet the requirements of the Leeds University, and has been delivered and tested in the Electrical Engineering Laboratory there. It was interesting to find that the testing pressure could be forced up to 100,000 volts, i.e., five times the normal capacity, before discharge took place between the coil terminals. This result speaks well for the practical knowledge and skill of the instructors, and indicates careful and accurate workmanship on the part of the trainees who actually carried out the work.

Besides the armature winding section in which the above-mentioned work was done, there are also sections for training fitters and instrument-makers and electrical wiremen. In the electrical fitting section the trainees have recently constructed a commutator of unusual design. The brushes work on the inside instead of the outside surface. It is 19 in. in external diameter, and is built up of 299 bars.

In the installation section the wiremen in training have been given ample opportunity for carrying out practical work on a fairly large scale in various departments of the school requiring electrical extensions or alterations. In one piece of work of this kind, comprising 163 lights and four 3-phase motors, the official insulation test of the Corporation Electricity Department gave an "infinity" reading for the lighting system and 16 megohms for the motor circuits. This also indicates very careful attention to details on the part of the trainees.

A Self-Starting Synchronous Motor.—A synchronous motor which will start and come up to speed under load was developed recently. It makes use of a new principle of design in a squirrel-cage starting winding. For this winding copper or brass tubing is used, instead of solid bars. Obviously the outer diameter may remain the same for all standard designs, this feature in connection with standard manufacture eliminating the necessity of using various index dies for the pole punchings. The resistance, however, of the tubular conductor may be varied over a wide range by changing the wall thickness of the tubing. Inside this tubing are embedded conductors of magnetic material, such as iron or steel. The bars are fastened to end-ring segments, which also serve as upper coil supports for the field coils. These end-ring segments,

forming a continuous ring, are connected together between poles by the use of a split sleeve which fits into holes drilled on the job when the poles are assembled. A taper pin is driven in to ensure contact and mechanical stability.

At starting the frequency in the squirrel-cage winding is the same as in the line, but as the rotor comes up to speed the frequency will fall off to zero. Owing to the skin effect the inner bars of magnetic material will not be effective at starting, but a high starting torque is established if the copper or brass tubing has the proper resistance. As the rotor, however, is accelerating, the inner conductors will become effective and in the neighbourhood of synchronous speed will furnish a high pull-in torque in addition to the rather small torque furnished by the tubing at that speed. It is possible by changing the squirrel-cage winding to make the torque characteristics adapt themselves to various applications of synchronous motors.—*Electrical World.*

The Use of Coke-oven Gas.—The Board of Trade has recently endeavoured to obtain information regarding the quantity of coke-oven gas produced in the United Kingdom and the proportions used for various purposes, or entirely wasted.

The output of gas per ton of coal carbonised varies from 9,000 to 12,000 cubic feet, 10,000 cubic feet being the average quantity evolved. The calorific values vary from 420 to 550 British thermal units gross per cubic foot. A total quantity of 37½ thousand million cubic feet per annum appears to be utilised by the coke-oven proprietors for purposes other than the heating of the coke-ovens, and a total of 7½ thousand million cubic feet per annum, including upwards of 805 million cubic feet run to waste, is at present available for disposal.

Indicators for Heating Appliances.—The *Industrial Australian and Mining Standard* states that Mr. G. H. Loft, Hobart district manager for the State Hydro-Electric Department, Tasmania, has designed an indicator for electrically heated devices consisting of a buzzer, the sound produced by which can be varied as desired. The advantages claimed for the devices are: (1) That only about 1/15th of the energy used by a lamp indicator is required for the buzzer type, (2) cost of maintenance is less than with the lamp indicator, (3) the apparatus may be fixed in the flexible cord or anywhere else in the circuit; it may also be made inoperative, in the case of attachment to a laundry iron, when the iron is in use.

Mr. Loft has also designed an improved cut-out arranged to open the circuit when an iron reaches a predetermined temperature.

Canals and Waterways.—The Committee on Inland Waterways has submitted a second interim report to the Minister of Transport, in which it states that "certain important waterways, where they given a fair chance and put under unified and competent management, would be capable of playing a very important part in the transport of the country. The Committee divides the principal inland waterways into seven groups or systems, and suggests that a beginning should be made with one or two only of the groups, selecting those which present the best prospect of success with the least amount of capital expenditure. With this in view, the group comprising the River Trent and its connections is selected as pre-eminently suited for the first experiment."

In the *Financial Times* of Tuesday last the proposition was fiercely attacked by Mr. Harold Cox as a "sentimental fad."

Electric Haulage on Canals.—At the recent inland navigation congress, held at Rouen, M. Du Bousquet, of the Société de Halage Electrique (Lens Mining Co.), and M. Tumerelle, of the State Department of Roads and Bridges, presented a joint report on electric haulage on canals. The report stated that after having been established before the war in the canalised in the North, electric haulage had been introduced by the Government since the Armistice on the lateral canal to the Oise, the canal of Saint-Quentin, and the Haut-Escaut, the total length worked being 86 miles. A trial has also been made in the Foug tunnel, on the Marne canal to the Rhine, the results responding to expectations.

Use of Electricity in Scottish Coking Seams.—On June 1st, 1920, an explosion occurred in the coking coal seam of the Auchengrigh Colliery, Lanarkshire, belonging to James Nimmo and Co., Ltd., by which two men were killed and five injured. The explosion was caused by the ignition of gas, due, as was alleged, to a spark from the electrical coal-cutting machine which was in use in the seam. The Divisional Inspector of Mines gave the mineowners notice that the use of electricity in the coking seam would, on account of the risk of explosion of gas or coal dust, be dangerous to life, and required them to desist from using electricity in the seam at, or within, 50 yards of the face for coal-cutting or for any purpose other than shot firing or obtaining light by means of electric safety lamps. The owners refused to comply with the notice, being of opinion that the use of electricity in the coking coal seam at, or within, 50 yards from the face would not involve danger to life. The Home Office thereupon, in terms of the Coal Mines Act, applied for the appointment of a referee to determine the question, and Mr. J. Gemmell, mining engineer, Edinburgh, was appointed by the Reference Committee. The hearing has now taken place. Evidence was led on behalf of the Inspector of Mines and of the owners, and, after hearing counsel, Mr. Gemmell said he would take time to consider his decision.—*Iron and Coal Trades Review.*

INSTITUTION NOTES.

Institution of Electrical Engineers.—ROYAL CHARTER.—Notice is given in the *London Gazette* of July 15th that a petition has been deposited praying for the grant of a Charter of Incorporation to the Institution, and that all petitions for or against such grant should be sent to the Privy Council Office, Whitehall, on or before August 1st.

A.M.I.E.E. EXAMINATION.—It is proposed, if a sufficient number of candidates make application, to hold an examination for Associate Membership in London and at other places (at home and abroad) in October, 1921. An entry form and full particulars may be obtained on application to the Secretary of the Institution, Savoy Place, Victoria Embankment, London, W.C.2.

WESTERN CENTRE.—On Monday next the annual meeting will be held at Hereford. Afterwards places of interest will be visited, under the guidance of Mr. W. T. Kerr, city electrical engineer.

Association of Consulting Engineers.—At the last meeting of the Committee of the Association of Consulting Engineers, Mr. W. Vaux Graham was unanimously elected chairman for the ensuing year.

Electrical Power Engineers' Association (Southern Division).—A lecture on "Boiler Design: Latest Developments," is to be delivered by Mr. J. Canthery, at Central Hall, Westminster, S.W. this evening (July 22nd), at 7 p.m.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

THERE was an exceptionally large attendance in the Deputation Room of the G.P.O. on the 13th inst., when Sir William Noble, on behalf of the whole staff of the Engineering Department, offered a handsome parting gift to MR. ARTHUR J. STUBBS, assistant engineer-in-chief, on his retirement. Sir William expressed the feeling of a loss of a personal friend which they all had on this occasion, and said it was peculiarly gratifying to realise that Mrs. and three of the Misses Stubbs (all of whom, with Master Cuthbert, were present) had such a practical share in the gift. Mr. Stubbs entered the Engineering Department 41 years ago, after training



Photo by]

[C. Vandy,

ARTHUR J. STUBBS.



Photo by]

[Elliot & Fry,

ALEXANDER MOIR.

as an architect. He became first-class technical officer in 1899; superintending engineer in 1902, and was promoted to his present position in 1907. In thanking his colleagues for their most generous gifts, Mr. Stubbs claimed that the five bicycles were really a far more sentimental gift than some of them realised—the life-long memory of his little daughters that the delight of their first bicycle was given by their daddy's office friends, was fiercer than the possession of a silver teapot; and, although Mrs. Stubbs was by no means above a love for pretty jewellery, the ownership of the highest-grade and sweetest-toned gramophone that she had ever heard, was a surprise gift that gave her a pleasure quite beyond expression. The beautiful silver casket, with an address and signed cards of the contributors, would form the heirloom that so many of them desired, and that he and his family would value and treasure as a perpetual token of the friendship of those who were so numerously represented at the meeting.

At the same gathering a handsome pedestal-type gramophone was presented by the engineer-in-chief, the assistant engineers-in-chief, the staff engineers, the superintending engineers, and a few others to MR. A. MOIR, O.B.E., to whom the main presentation from his own staff as superintending engineer of the London District was made early in June, as recorded in the *ELECTRICAL REVIEW* of 10th ult. Mr. Moir can claim to be the "father" of the engineering department, inasmuch as he entered it in 1878. In a brief speech subsequently, Mr. T. B. Johnson, superintending engineer, testified to the general esteem of the superintending engineers for their *doyen* who was always their friend, and also made feeling reference to the recognition by the whole of the staff that Mr.

Stubbs had himself (as he said he advised a junior lately) not only worked hard and played the game, but that he had always been characterised by the exhibition of the highest principles in all his relations.

In a farewell letter to the staff, Mr. Stubbs says "consciously I have not an enemy, and consciously I feel assured of a host of friends. It is splendid to be able to say this at the end of a long official career." The many-aidedness of the Post Office engineer's interests is indicated by the fact that besides close acquaintance with telegraphs and telephones, staff organisation and engineering accounting, Mr. Stubbs has a wide experience in the construing of contracts, and an expert knowledge of fire alarms. He has worked on "safety first" principles in their post office application, and has taken up "welfare" work; he is a representative of the Post Office on the Interdepartmental Patents Committee, and on several committees of the British Engineering Standards Association, and has been a British delegate on the International Electrotechnical Commission. He is also a member of the Committee of the Decimal Association.

MR. ALEX. R. MCCALLUM, B.Sc., A.C.G.I., who is leaving the London Electric Railway Co. to take up an appointment on the staff of Messrs. C. P. Sandberg, of Westminster, has had a wide experience in connection with electric traction; serving a pupilship at Messrs. Dick, Kerr & Co.'s Preston Works, he joined the London United Tramways in 1908, and later took a post on the staff of the London Underground group, becoming, in March, 1916, chief assistant to the mechanical engineer; in this capacity he had charge of all rolling stock, workshops, and running repairs to trains, gaining unique experience in these matters. In the autumn of 1919, in company with three other officials, he visited the United States to make a study of electric traction conditions in that country.

CAPTAIN W. HALL, Tyne Electrical Engineers, having attained the age limit, is placed on the retired list of the Territorial Force, and retains at the same time his rank of captain. Captain Hall was appointed to No. 1 Company in October, 1914, and was promoted captain in June, 1916. LIEUT. R. F. WOOD-SMITH, London Electrical Engineers, has retired under the age-limit rule after serving with the corps since the opening of the late war, a portion of which time he held the acting rank of captain, which rank has been given him on retiring after five years' service. LIEUT. R. H. SMITH, of the same corps, which he joined during the war, has been similarly retired.

The Hammersmith Electricity Committee has appointed MR. F. V. JORDAN, of Biggleswade, to the position of assistant mains engineer, at a salary of £412 per annum.

The Electric Lighting Committee of the Stoke Newington

Borough Council recommends that the salary of MR. H. L. LARGE deputy borough electrical engineer, be increased to £385, as from August 1st.

MR. C. H. DURRAN LANG, director of Messrs. Lang & Squire, Ltd., of Acton, was married on July 20th, to Miss E. M. Talbot White, daughter of Mr. Geo. H. White, of West Heath Drive, Hampstead.

The Rhyl Urban District Council has appointed MR. E. B. WRIGHT temporary electrical engineer to the end of the present financial year. He is taking the place of his brother, who has been ill, and is taking a year's rest.

MR. H. H. SPENCER has been appointed assistant manager of the Glasgow Branch of Messrs. Crompton & Co., Ltd. Mr. Spencer has been connected with Messrs. Crompton for a number of years, and served throughout the war in the Royal Engineers. He has been hon. secretary of the Chelmsford Engineering Society for some considerable time.

Obituary.—MR. A. FALLEN.—Mr. Albert Fallen, a member of the staff of the Kaministiquia Power Co., West Fort William, Canada, recently received a 22,000-V shock, from which he died the following day. He was 45 years of age.

The daily Press announces the death, in his 53rd year, of MR. ALBERT CHORLEY ROGERSON, C.B.E., general manager of Beyer Peacock & Co., which took place suddenly at Cleveleys, on Sunday morning.

Willis.—MR. JOHN MELVILL BOUSTEAD, late of Boustead Bros., and a director of several companies, including the Colombo Electric Tramways and Lighting Co., left £21,000.

REVIEWS.

Induction Coils. A Practical Manual for Amateur Coil Makers.

By G. E. BONNEY. Pp. x+198; figs. 80. London: Sir I. Pitman & Sons. Price 6s. net.

This is a sound, useful little work, which carries out its intention of helping amateur coil makers who have no elaborate appliances. Perhaps the title should not lead us to expect a very full account of the accessories, but the part dealing with interrupters seems rather meagre, while that relating to batteries is disproportionately full, especially in view of the growing facilities for the purchase and charging of accumulators; few amateurs would want descriptions of so many different types of cell and the effects of the speed of interruption and of the time of prolongation of contact might receive fuller attention at the expense of this section.

It is refreshing to find in a popular book of this type a much clearer indication of the function of the condenser than is generally given; though anything like abstruse theory is carefully avoided it is possible to obtain a good elementary idea of this very vital matter.

Induction-coil Design. By M. A. CODD. Pp. 238+59; figs. 165. London: E. & F. Spon, Ltd. Price 21s. net.

Of two or three books on induction-coils which have reached us recently, that by Mr. M. A. Codd will appeal most to the more highly specialising reader.

It is by far the most ambitious in scope, and embodies an admirable attempt to elucidate the theory of the subject by means of an exhaustive series of oscillograms that reveal many interesting facts. In some cases, however, it is not very easy to follow the interaction between primary and secondary phenomena, and the time or time-scale displacement which seems to cause disagreement between e.m.f. and rate-of-change of flux in corresponding curves in fig. 6 would be less confusing were it adjusted or its cause explained. The book is thorough and systematic, and should prove valuable to all designers and makers of coils except those whose long experience has been crystallised in set forms and methods.

Such blemishes as are evident suggest the need for a little scientific polishing, as, for instance, on p. 35, where peak-voltages are given as 1,013 volts and 1,945 volts—figures which claim an accuracy of 0.1 per cent. in the measurement of quantities which are only capable of rough evaluation.

The only feature which makes us really sad is fig. 67. This is called a "filing" figure, but by some interpenetrant or fourth-dimensional method shows the directions of the filings in the interior of the magnet. If, however, we even allow these lines to be conjectural, we are not comforted, for their interior distribution brings us to the startling conclusion that a magnet is divided longitudinally into two regions in which the magnetisation is opposite in sense or direction, so that a secondary coil wound on the middle of the magnet would enclose a flux having zero effective value.

The author describes bald patches at the poles, and draws them as neat circular areas where there are presumably no lines of force at all.

We hope this figure will not give readers the bad dreams which haunted us after seeing it.

On constructional detail the book seems thoroughly sound and most valuable; it represents great and painstaking labour, and is a frank disclosure of workshop methods about which some makers pretend to draw an unnecessary veil of secrecy.

In conclusion, we may say that there are valuable tables and curves and a small bibliography—a welcome feature which we note with satisfaction.

The absence of any kind of index is a blemish which we do not expect to find in a modern technical publication, especially when, as in this case, the table of contents is meagre.

NEW COMPANIES REGISTERED.

Malleable Fittings, Ltd. (175,707).—Private company. Registered July 13th. Capital £500 in 21 shares (5,000 10 per cent. cumulative preference). To take over the business of an electrical, agricultural, domestic and general engineer and boiler maker, carried on by J. T. Lowke, at Kingswell Street, Northampton, as "Lowke and Sons." The subscribers (each with one ordinary share) are: J. T. Lowke, 13, Kingswell Street, Northampton, engineer; H. A. Bassett-Lowke, 18, Albion Place, Northampton, engineer. The subscribers are to appoint the first directors. H. A. Bassett-Lowke is the proposed managing director. Registered office: 18, Kingswell Street, Northampton.

Lowke & Sons, Ltd. (175,681).—Private company. Registered July 13th. Capital £10,000 in 21 shares (5,000 10 per cent. cumulative preference). To take over the business of an electrical, agricultural, domestic and general engineer and boiler maker, carried on by J. T. Lowke, at Kingswell Street, Northampton, as "Lowke and Sons." The subscribers (each with one ordinary share) are: J. T. Lowke, 13, Kingswell Street, Northampton, engineer; H. A. Bassett-Lowke, 18, Albion Place, Northampton, engineer. The subscribers are to appoint the first directors. H. A. Bassett-Lowke is the proposed managing director. Registered office: 18, Kingswell Street, Northampton.

Ross & Company (Electric), Ltd. (11,798).—Private company. Registered in Edinburgh July 13th. Capital £20,000 in 21 shares. To acquire the business of Ross and Company, manufacturers and agents for electrical accessories and supplies, 62, Robertson Street, and 391, Parliamentary Road, Glasgow. The first directors are: J. Smith, 62, Robertson Street, Glasgow, electrical manufacturer and supplier; A. Thomson, junr., 62, Robertson Street, Glasgow, electrical engineer; E. F. Smith, 62, Robertson Street, Glasgow, electrical manufacturer and supplier. Qualification: 100 shares. Registered Office: 62, Robertson Street, Glasgow.

Sussex Electricity Supply Co., Ltd. (175,686).—Private company. Registered July 12th. Capital £20,000 in 21 shares. To take over the business carried on by W. Simms and J. Prior as the "Sussex Electricity Supply Co.," and to carry on the business of electrical engineers, fitters and suppliers of electric current and fittings, etc. The first directors are: H. W. Humphries, 64, Woodhouse Valley Road, Tonbridge, Surrey; W. Simms, Hamilton Road, Felixstowe, Suffolk; E. Prior, 30, Church Road, Burgess Hill, Sussex; A. K. Hunt, 30, Church Road, Burgess Hill, Sussex. Qualification: £500. Remuneration as fixed by the company. Secretary: G. Clough. Registered Office: 88, Oldbourne Street, E.C.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Automobile Electrical Repairs, Ltd.—Particulars of £1,000 debentures, authorised June 14th, 1921, present issue £500, charged on the company's undertaking and property, present and future, including uncalled capital, all paid.

Drake & Gorham, Ltd.—Mortgage and Land Registry Charge on 36, Grosvenor Gardens and 36, Grosvenor Gardens Mews, South, both dated June 20th, 1921, to secure £12,000. Holders: North British and Mercantile Insurance Co., Ltd.

Metropolitan Electric Supply Co., Ltd.—Trust deed dated July 5th, 1921, securing £500,000 7½ per cent. extension debenture stock, 1921, charged on the company's undertaking and property, present and future, including uncalled capital subject to capital stock covered by trust deeds dated July 20th, 1894, July 4th, 1899, and May 15th, 1917. Trustees: British Trusts Association, Ltd., 33, Bishopsgate, E.C.

Johnson & Phillips, Ltd.—£175,000 satisfied and new debenture stock for £350,000 issued. A memorandum of satisfaction in full on July 1st, 1921, of trust deed dated September 28th, 1905, securing £175,000, has been filed. Particulars of £350,000 first mortgage debenture stock, authorised March 24th and covered by trust deed dated July 1st, 1921, has also been filed, the whole amount being now issued. Property charged: Certain lands, premises, easements, rights and privileges in Charlton, and the company's undertaking and property, present and future, including uncalled capital. Trustees: Law Debenture Corporation, Ltd., and London General Investment Trust, Ltd.

James Keith and Blackman & Co., Ltd.—Satisfaction in full on May 15th, 1921, of debentures dated October 29th, 1901, November 3rd, 1902, March 31st, 1903, and May 30th, 1913, securing £300.

Northampton Electric Light & Power Co., Ltd.—Issue on June 16th of £250,000 7½ per cent. debenture stock, parts of a series already registered.

A. Robinson & Co., Ltd.—Debenture dated June 14th, 1921, to secure £10,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: James Scott, Ltd.

Southern Brazil Electric Co., Ltd.—Particulars of £176,500 8 per cent. notes, debentures (including £146,500 already registered) authorised June 24th, 1921. Present issue £28,000, charged on the company's undertaking and property, present and future, including uncalled capital (subject to £750,000 1st mortgage debentures).

Cleveland & Durham Electric Power, Ltd. (89,539).—Return dated May 24th, 1921. Capital £700,000 in 21 shares (350,000 preference and 350,000 ordinary), 333,705 preference and 157,600 ordinary shares taken up. £411,003 paid. £80,302 considered as paid. Mortgages and charges, £384,806.

Brompton & Kensington Electricity Supply Co., Ltd. (25,913).—Return dated March 31st, 1921. Capital £300,000 in 25 shares (30,000 preference and 40,000 ordinary), 5,501 preference and 34,499 ordinary shares taken up. £195,000 paid. £5,000 considered as paid. Mortgages and charges nil.

Urban Electric Supply Co., Ltd. (57,986).—Return dated May 4th, 1921 (filed May 5th). Capital, £540,000 in 80,000 ordinary shares of £3 each, 50,000 preference shares of £5 each, and 150,000 undenominated shares of £1 each. 80,000 ordinary and 50,000 preference shares taken up. £430,000 paid. Mortgages and charges, £434,952.

CITY NOTES.

The *Sydney Daily Telegraph* for May 17th stated that when moving the adoption of the report at the annual meeting, Mr. A. A. Stewart expressed the reluctance with which the board had recommended the passing of the dividend. During the year under review, he said, 10 per cent. had been more than earned, and they had large balances in cash. Commitments, however, were heavy, and these were not times in which they were warranted in looking to their bankers, accommodating as they had been in the past, for more than temporary assistance in the carrying out of their contracts. They must, therefore, provide out of share capital or debenture loan what was necessary to complete and equip their new workshops. The estimated cost a year ago was £150,000, to be provided by the issue of debentures. Only £113,600 had been issued at date of balance. The shops would cost £130,000, or about 25 per cent. more than estimated, and including unremunerative expenditure at Concord, a total of £201,000. To meet a further expenditure of £90,000 they had at date of balance £50,000 less £11,000 owing to cash creditors, leaving £39,000. A dividend of 10 per cent. and one-tenth of profits to "A" ordinary shareholders would have reduced this to £13,000, or £47,000 less than their requirements. The handing of contracts totalling £500,000 would probably lock up a considerable sum, and in that connection when entering into the agreement with the English Electric Co., Ltd., they had reason to believe that they would receive substantial help from them, if necessary, in capital. They had been disappointed. They were not expected to exercise their option of 100,000 shares at 25s. Standing on the letter of their agreement, they could prevent the Australian com-

pany from making any increase of capital except by consent. Assuming that they could arrange with their London associates they had had under consideration the raising of £50,000 or £60,000 additional capital by the issue of new shares, either with or without preferential rights. The payment of a dividend must, therefore, be postponed until they got the consent of the "A" ordinary shareholders. They wanted to make a fresh issue and pay the usual dividend. The financial situation dominated everything, but he knew of no engineering business in a sounder position.

Electric Supply Corporation, Ltd.

Mr. J. G. B. Stone (chairman) presided at the nineteenth annual general meeting, held at Salisbury House, E.C., on July 14th. The directors' report then submitted showed that the gross earnings for the year ended December, 1920, were £82,665, an increase of £22,550 for the year. The sum taken into net revenue account was £17,791, against £13,519 for 1919. After paying interest on debenture stock, and the actual cost of the year's repairs and renewals, and including the balance brought forward, there is a surplus of £3,403, out of which £3,000 is to be put to the reserve fund and £403 carried forward.

Year.	Equivalent in 32-W Lamps connected.	Units sold.	Gross earnings.	Profit, including dividends on investments.
1919	598,857	6,992,455	£60,085	£13,519
1920	822,957	7,957,292	82,665	17,791

The Hendon Electric Supply Co., Ltd., distributed a dividend and bonus of 15 per cent. for 1920, and the Dumbarton Burgh & County Tramways Co., Ltd., a dividend of 5 per cent. upon its ordinary shares. The total amount received is included in these accounts. The following generating stations belonging to the company were complete, and in working order on December 31st, 1920:—

LAMPS CONNECTED. (EQUIVALENT IN 32-W LAMPS).

	1920.	Increase.
Chelmsford	45,775	3,741
Jedburgh	7,381	373
Melrose	7,300	991
Dalkeith	11,934	994
Dollar	4,062	274
Toines	8,809	552
Exmouth	27,354	2,927
St. Andrews	28,439	4,327
Hitchin	19,691	3,598
(a) Dumbarton	129,242	3,362
Falmouth	26,400	2,413
Total	332,957	238,857, a net increase of 24,100.

- (b) Hendon, Jan. 10th, 1908 215,138 252,061 36,925
(c) Dawlish, June 20th, 1911 7,116 10,700 3,584
(d) North Berwick, Sept. 15th, 1913 3,767 5,082 1,245
- (a) These figures take no account of the supply to the Dumbarton Burgh and County Tramways which used 640,240 units in 1920. The Company holds 29,840 £1 Ordinary Shares (out of 80,000 issued) in the Dumbarton Burgh and County Tramways Company. The traffic receipts of the Tramways were £41,549 in 1919 and £42,721 in 1920.
- (b) The Company holds 4,109 £5 Ordinary Shares in the Hendon Electric Supply Co., Ltd.
- (c) The Company holds 336 £1 Ordinary Shares in the Dawlish Electric Light and Power Co., Ltd.
- (d) The Company holds 1,600 £1 Ordinary Shares in the North Berwick and District Electric Light and Power Co., Ltd.

At the meeting, the chairman, in comparing the figures for the two years, said that the increase in gross revenue was £22,550, apart from the income from investments, which showed a small decline of £51. The revenue figures were largely increased owing to the rise in the price of coal, which in the case of their large contracts they were able to hand on to their consumers. For the same reason they found their working costs had increased £18,256, an increase which, although principally due to coal, was also due to higher wages. They took into net revenue account £17,792, an increase of £4,272 over last year. If, as on previous occasions, he excluded the Dumbarton undertaking and the return on investments, the gross profit on the other undertakings was £6,836, an increase of £3,887 over 1919. In turning to the net revenue account, they had to deal with an adverse comparison. Repairs which, as in former accounts, were excluded from the revenue account and brought into net revenue account, amounted to £7,196, an increase of no less than £3,935 over 1919. The cumulative effect of the increased cost of repairs, interest charges, and the reduced carry forward was that the balance on this account was reduced from £3,621 to £3,403, which was the net result of operations for the year 1920. These figures showed that their position would have been materially better than in 1919 had it not been for the increased cost of repairs. The cost of repair work was somewhat higher in 1920, and they had had a good deal of battery renewal to carry out at very high prices. They had still got a good deal of battery repair in front of them. Apart from the batteries the principal repair items had been machinery and switchboards at Chelmsford and to a lesser extent in the other towns. The credit balance on the Dumbarton undertaking which was £5,644 in 1919 had increased to £6,080, and if as they hoped there was a settlement of labour troubles in the ship-building industry and a revival in trade, they anticipated a considerable increase in their business in this town, as they had secured additional important contracts. Last year he gave some figures showing the output and increase in costs in their towns other than Dumbarton, which was excluded, as they were there taking a bulk supply of electricity and were not so directly interested in the cost of production. Similar figures for 1920 were as follows, the

comparison being with 1914, which they considered as a pre-war basis. In 1914 they supplied 1,416,534 units, and in 1920 1,743,652 units. The increase in the average selling price was 50 per cent. The cost of production had risen 149 per cent. Coal which cost £5,040 in 1914 cost £17,213. Stores costing £565 in 1914 cost £1,417. Wages costing £4,385 cost £11,930 in 1920. The capital account showed an increase of £11,068 during the year. Apart from small mains extensions, meters, and such like, the principal increases had been at Chelmsford and Dalkeith on plant, and in Dumbarton on high-pressure mains for power supply. There was an item of £14,161 realised loss on the Dumbarton plant. This stood at £14,423 in 1919. They had been able to reduce it by selling some more of the disused plant, and since the close of the year further sales had been effected. With regard to their maximum rates, they had now got the bulk of their undertakings in a satisfactory position, having obtained revised rates without any condition attached thereto, such as was required under the Temporary Increase of Charges Act, and under the existing law these revised rates could not be altered for five years as from the beginning of this year. The maximum rate was now 1s. per unit in all towns except St. Andrews, where it was 10d., Dumbarton 6d., Exmouth 8d., and Hitchin 7d. He pointed out last year that in the case of Exmouth and Hitchin they were excluded from getting the proper increase owing to the form in which they carried on these undertakings. The new Electricity Act would, if passed, relieve them, he thought, from this incubus. Their investments in the Dumbarton Tramways and in Hendon had again yielded them dividends of 5 per cent. and 15 per cent. respectively, and once more he regretted to report that the Dawlish and North Berwick companies had made no distribution. The sum of £82,213, representing the cost of their investments, showed a reduction due to their having disposed of some of their Hendon investment in order to provide capital to meet the requirements of their undertakings, and the investments now included £11,124 of their own debenture stock. The average return on their investments was maintained at just over 7½ per cent. A large proportion of this was free from income tax. Reviewing generally the position of the company, it was encouraging to note that apart from the item of repairs, their position was considerably improved, and they had reason to think that the repairs charges would be materially reduced when they had got over the arrears due to the war and the high cost of such work. There was no doubt that engineering prices were now coming down. As to their own cost of production, the high-water mark in wages had now been reached, and the tide was falling with the fall in the cost of living, but he wished they were more certain as to the trend of coal prices. They were now higher than they had ever been, and it was not known what course they would take. There was still an active demand for electricity.

Sir HOME GORDON seconded the motion, and it was carried without discussion.

Crompton and Co., Ltd.

The annual meeting was held on July 14th at Winchester House, E.C. Mr. A. A. Campbell Swinton, the chairman, was presided, said that in the balance sheet freehold land and premises had increased to £357,167, as compared with £264,655 last year. This further expenditure appeared owing to the completion of the main buildings and the plant therein and the enlargement of premises at Chelmsford. They began to feel the benefit of these increased facilities about January, and they were, therefore, able to speak of these benefits in the light of experience of their value. As to stock in trade, there had been a heavy fall in the prices of nearly all of the commodities which were used in their business, and the directors, therefore, had thought it wise to write down this figure in the balance sheet, and the amount therein shown was a very conservative one. A large allowance had been made for bad debts, but the bad debts actually incurred were considerably less than the reserve set aside. Investments were £10,949, as compared with £29,242 in the previous balance sheet, the £19,000 having been written off for depreciation. There appeared a loan of £7,000 to the Corporation of Chelmsford in connection with its housing scheme. This was part of a total sum of £10,000, the loan being repayable at six months' notice. Turning to the other side of the balance sheet they would see that the capital remained practically the same as last year; the balance of the new capital was received in March, 1920, and therefore came into the last accounts. Sundry creditors also showed a substantial increase, but this item included reserve set aside against taxation. The actual profit earned on trading during the year was extremely good, but, as he had already remarked, there had been a great fall in the cost of raw material, and from the profits the stocks had to be written down to a safe figure. There had been a considerable expansion of the foreign and colonial trade, which was most encouraging; but the fall in value of the rupee had considerably depleted the profits of the Calcutta business. As usual the profits were shown with taxation (corporation tax, E.P.D., and income tax) deducted. Excess profits-duty came to an end with the completion of the last financial year, and this was a matter of congratulation. To show how heavily taxed the company was, out of every £1,000 earned over and above the standard the Government took £734, and left them with £266. E.P.D. was at the rate of 60 per cent., as against 45 per cent. last year. It was, therefore, with much satisfaction that the directors were able to show a net profit of £68,292.

against £52,878 last year. There was some £84,468 to deal with, or £79,601 if they deducted the interim preference dividend. Of this it was proposed to place £19,500 to general reserve, bringing up the total to £75,000, and to pay a dividend of 6½ per cent. on the preference shares, making 10 per cent. for the year, and a dividend of 10 per cent. on the ordinary shares, carrying forward £18,370. Shareholders might be interested in some further figures which gave an idea of the total taxation in various forms and total dividends in the last three years. Wages, &c., were three-quarters of a million in round figures, taxation was £150,000, while, in the same three years, dividends totalled £66,000—less than 10 per cent. of the wages and salaries, and a little more than a third of the taxation. In view of this the shareholders could hardly be described as "bloated capitalists." Last year at that time they had been in the fortunate position of being able to turn away business. To-day things had entirely altered. It was true that at the end of the year they finished with a considerable amount of work in hand, but in the present condition of trade business was extremely difficult to get. There were plenty of inquiries, but few orders were being placed. However, the settlement of the coal strike, and more recently, the engineers' difficulty, should make matters more easy. If there was a revival of trade, the company was ready to take full advantage of it.

The resolution was seconded by Mr. O. F. Tufnel, and carried unanimously.

Anglo-Portuguese Telephone Co., Ltd.

In their report for 1920, just issued, the directors mention that the interim dividend of 3 per cent., less tax, paid last November, absorbed £7,778, which is £213 in excess of the amount now available. The final result, as shown by the accounts, does not admit of the payment of any further dividend. The fall in exchange, combined with the ever-increasing value of imported material, high Customs duties, and sterling salaries was disastrous in its effects on what would otherwise have been a profitable year.

French Companies.

The Forges et Acieries Electriques Paul Girod report net profits of 371,000 fr. for 1920. At the recent meeting it was decided to draw upon the reserve funds in order to reduce the debit balance of 15,430,000 fr. to 2,500,000 fr.

The directors of the *Société des Constructions Electriques et Mécaniques de Suresnes* report a loss of 3,339,000 fr. for 1920, which is attributed to the transition from war to peace manufactures and the consequent reorganisation of operations, supplies, and equipment.

The Compagnie du Chemin de Fer Metropolitain de Paris has declared a dividend at the rate of 4 per cent. out of net profits of 3,932,000 fr. in 1920. Under the new agreement with the City of Paris the concessions for all the lines will expire at the end of 1955, and the expropriation of the company in any case cannot take place before January 1st, 1931.

The Compagnie du Nord-Sud, which has declared a dividend at the rate of 4 per cent. for 1920 out of net profits of 3,560,000 fr., has entered into a new agreement with the City of Paris similar to that concluded between the latter and the Metropolitan Railway Co. The right of purchase also cannot be exercised by the City before January 1st, 1931, and the final expiration of the concession has been fixed for December 31st, 1955.

The Société des Constructions Electriques de France reports that the directors had leased from the Etablissements Singrün the Golbey-les-Epinal works, thus permitting of an increase in the capacity of the turbine department without awaiting the completion of the works at Tarbes. The acquisition had rendered possible the starting of the construction of ten hydro-electric sets of 10,000 h.p. for the stations being erected by the Southern Railway Co. for the electrification of its system. In addition the company had obtained control over the Compagnie Générale de Téléphonie et d'Electricité, which produces apparatus according to the Berliner patents. During the year the works at Lyons-Venissieux was extended so as to be able to construct rolling stock and electrical plant as from July, 1921. The credit balance of 76,000 fr. for 1920 has been carried forward.

The report of the *Société des Ateliers de Constructions Electriques du Nord et de l'Est*, of Paris, for last year shows a profit of only 4,619,912 fr., as compared with 5,878,424 fr. in the preceding twelve months.

German Companies.

The accounts of *Siemens Elektrische Betriebe*, of Berlin, indicate profits of 5,866,000 marks from electricity works and participations in 1920. After providing for normal depreciation and placing 3,531,000 marks to reserve for equalisation of exchange, there remains a slight balance to be carried forward; no dividend was paid for 1920.

The Kontinentale Gesellschaft für Elektrische Unternehmen, of Nuremberg, reports net profits of 1,759,000 marks for 1920, as contrasted with 1,084,000 marks in the previous year. The directors recommend a dividend at the rate of 5 per cent. on the preference shares, which comprise practically all the share capital, as against 3 per cent. in 1919.

The directors of the *Hochfrequenz Maschinen A.G.*, for *Draklose Telegraphie*, of Berlin, reporting on the year 1920, state that it was uncertain what amount the company would receive for its 44,000 Marconi shares which were seized in London and sold. They recommend a dividend and bonus of

35 per cent. on the A shares for 1,600,000 marks and 92.8 per cent. on the B shares for 500,000 marks. It is proposed to increase the share capital by the issue of new A shares for 1,400,000 marks.

The report of *Brown, Boveri & Co.*, of Mannheim, states that the turnover in 1920 considerably increased, as compared with the preceding year. The output of large machines had not yet again reached the pre-war level, although greater activity was being displayed, and a separate factory had been acquired for the construction of large rectifiers. As net profits the accounts show the sum of 5,961,000 marks, as against 834,000 marks, and a dividend at the rate of 10 per cent. has been declared on share capital of 40,000,000 marks, (as contrasted with 6 per cent. on 9,000,000 marks in 1919. The share capital is now to be raised to 80,000,000 marks.

Monterey Railway, Light & Power Co.—According to the *Financial News*, the affairs of this company have now reached a position which enables the company to submit a scheme of reorganisation, and the 5 per cent. first mortgage debenture stockholders' protective committee strongly recommends that this scheme should be accepted. The scheme entails the funding of the arrears of interest due to the 5 per cent. first mortgage debenture stock holders and to the Canadian Bank of Commerce, and the surrender by the 5 per cent. first mortgage debenture stock holders of one-sixth of their nominal capital; but, as a set-off for the above, they obtain securities payable at their option in Canada in dollars or in London in sterling, a provision which it is hoped will create a market for the new securities in Canada, and consequently, an enhanced value on the London Stock Exchange. Further, the new securities will have sinking funds, which there was no obligation to provide for the present 5 per cent. debenture stock.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Committee under Rule 148a:—

Ever Ready Co. (Great Britain).—12,000 ordinary shares of £1 each, fully paid, Nos. 230,001 to 242,000; 3,636 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 130,008 to 133,643.

Puebla Tramway, Light & Power Co.—£1,317,500 prior lien 5 per cent. 50-year gold bonds, Nos. A1,001 to A1,855 (\$100) and C501 to C1,732 (\$1,000).

Pernambuco Tramways & Power Co.—The accounts for 1920 show a profit, including balance brought forward, &c., of £109,567. After utilising £51,149 for debenture interest, £10,230 to capital reserve, £6,800 to interest on 8 per cent. notes, £4,177 interest, discounts, &c., and £7,338 for exchange, there remains available £29,873, out of which the directors have placed £10,000 to renewals and general reserve and £1,500 to amortisation account, leaving £18,373 to be carried forward.

Canadian General Electric Co.—With reference to the dividend of 20 per cent. announced in our issue of July 8th, we gather from the financial Press that resolutions have been passed by the company that out of the accumulated surplus of the company arising from the appreciated value of capital assets, as appearing on re-appraisal, there be capitalised the amount of \$1,800,000 and that fully-paid common stock be issued to the respective holders of common shares to the amount of 20 per cent. of their holdings by way of stock dividend.

New Issues.—*Shropshire, Worcestershire & Staffordshire Electric Power Co.*—An issue was advertised yesterday of £300,000 7½ per cent. ten-year convertible stock at 97; it will be guaranteed by the B.E.T. Co.

Calcutta Electric Supply Corporation, Ltd.—250,000 ordinary shares are to be offered to shareholders at par.

Lima Light, Power & Tramways Co.—The profit for 1920 totalled £P263,710, less bond service £P51,124, bond amortisation £P49,320, European expenses £P1,571, interest and discounts £P15,345, provision for bad and doubtful debts £P3,000, leaving £P143,347, plus brought forward £P95,091, making £P238,438, of which dividends on share capital absorbed £P113,546, to cost of stores £P15,000, to cost of extraordinary repairs £P5,200, to reserve for bad and doubtful debts £P9,600, leaving £P95,091, which the board proposes to carry forward.—*Financial Times*.

Cape Town Consolidated Tramways & Land Co., Ltd.—Last week, Mr. Justice P. O. Lawrence had before him a petition by this company asking the Court to sanction a scheme of arrangement with its debenture holders and to confirm special resolutions for a reduction of its capital. His lordship made the orders asked for.

Yorkshire (Woollen District) Electric Tramways, Ltd.—After putting £8,000 to reserve, a dividend of 6 per cent. for the year is to be paid on the ordinary shares and £9,336 is to be carried forward.

Para Electric Railways & Lighting Co., Ltd.—It is stated that owing to the uncertainty in Brazil on account of the low exchange, the directors have decided not to make any interim dividend payment on the preference or ordinary shares until the results of the year are known.

Clontarf & Hill of Howth Tramroad Co., Ltd.—Interim dividend of 3s. per share.

Simms Motor Units, Ltd.—The directors recommend a dividend at the rate of $\frac{7}{8}$ per cent. per annum, carrying forward £10,689 (subject to E.F.D. and corporation tax).

Bournemouth & Poole Electricity Supply Co., Ltd.—Interim dividend on the ordinary shares for the half year ended June 30 at the rate of 5 per cent. per annum, less tax.

Greenwood & Batley, Ltd.—Final dividend of $2\frac{1}{2}$ per cent. on the ordinary shares, making 5 per cent. for the year, and $3\frac{1}{2}$ per cent. on the preferred, making 7 per cent.

STOCKS AND SHARES.

TUESDAY EVENING.

UNTIL the Bank Rate is reduced to $5\frac{1}{2}$ or 5 per cent. the Stock Exchange markets will continue to hope, Thursday by Thursday, for the Rate to be lowered, and thus bring into market channels some of the £1,700,000,000 deposits which rest at present in the banks. In advance of the reduction, investment securities continue to show strength, except in the cases of a few British Government issues, which are suffering by reason of the competition introduced by the new $5\frac{1}{2}$ Treasury Bonds offered at 97. So far as can be seen at present, the latter investment is not being taken up with any marked degree of enthusiasm, and this fact is considered sufficient to render it highly probable that the Bank Rate will be lowered in order to give the Treasury Bonds a fresh impetus. It is seldom that the Bank Rate falls at this season of the year; though, with times so much out of joint as they are at present, the prevailing sentiment is that "anything might happen."

While the Treasury Bonds remain on tap, as they are likely to do for some indefinite period, it is understood that a kind of tacit agreement has been reached that there shall be no fresh issues of large amount offered to the investor. How far this can be expected to operate in the case of industrial undertakings, it is difficult to estimate. In point of fact, several new issues are said to be almost ready for public subscription, issues that may make their appearance before the August Bank Holiday ushers in the month of school holidays, with its consequent paternal disinclination to bother about Stock Exchange securities. Meanwhile, quotations for the recently issued Debentures are well maintained. The General Electric Company's 7 per cent. Debenture stock, which came out at 92 $\frac{1}{2}$, and dipped to 4 discount on the underwriters being left with over 40 per cent. of their obligations, rose on Monday in this week to a small premium. Apparently this invited selling, because the price went back to its "par" level, at which it still looks cheap, considering the character of the security.

The North Metropolitan Electric $7\frac{1}{2}$ per cent. Debenture, which came out at 95, keeps firm at 4 premium, and Metropolitan Electric $7\frac{1}{2}$ per cent. Extension Debenture, after being $\frac{1}{2}$ premium, eased off to 6 premium. Melbourne Harbour Trust $6\frac{1}{2}$ per cent. Debentures, issued at 98, now stand at 1 premium. City of London Electric 8 per cent. Preference, after touching 22s. 6d., shed a few pence, while the new Ordinary remain steady at 23s. There is a ready market for nearly all the newly-issued stocks and shares of good class, and money goes steadily into these investments. Concurrently, demand has arisen for the Debenture and Preference stocks of the Home Railway Companies, including those of the Underground group. After being difficult to sell for four or five weeks past, these stocks have come into fresh favour, with the result that practically every day a dozen stocks add to their quotations.

Rumours of an impending issue by the Underground Electric Railways of London brought about a sharp fall in the prices of the company's £10 shares, and of the shilling shares, to 2 $\frac{1}{2}$ and 6s. 6d. respectively. The Income Bonds were not greatly affected. Up to the present, neither confirmation nor denial has been obtainable, but that fresh money will have to be provided sooner or later would surprise nobody who travels on the line, and observes the frequent advertisements drawing attention to the sums that are being spent upon fresh rolling stock, &c. The conclusion of the coal strike is helping Home Railways, other than the Undergrounds, to an appreciable extent, although the average investor still declines to take any active interest in the Ordinary stocks of the Home Railway industry at a time when it is about to be handed over to private control, after seven years' operation by the Government. The reports of the Underground companies are expected to be out on the Thursday evening in this week, when probably some intimation will be given as to what new capital proposals may be regarded as necessary.

Charing Cross Ordinary at 34 are the fraction better, and there are small rises, also, in Metropolitan Preference and South Metropolitan Preference. The electricity supply market is good as a whole, and there are very few shares on offer. The new Columbia shares are quoted at 34—6d. premium. Probably the Shropshire, Worcestershire and Staffordshire Electric $7\frac{1}{2}$ per cent. 10-year Debentures, to be offered at 97, will be out before the end of the week. The issue is guaranteed by the British Electric Traction Company. Lancashire Power First Preference at 16s. 6d. are sixpence lower.

In the cable group, Anglo-American deferred stands out with a rise of 5s. at 16 $\frac{1}{2}$, while the Eastern issues are all steady, with Globe Ordinary 5s. better on the week. United River Plate Telephones have improved to 5 $\frac{1}{2}$, and there is decided improvement in the Bonds and stock of the various Canadian and American companies upon which the interest is payable in dollars. Shawinigan Common hardened to 122 $\frac{1}{2}$. Rio Firsts are better at 91 $\frac{1}{2}$, and a number of other rises are recorded as the result of the way in which the value of the dollar continues to advance. The price of Canadian General Electric at 103 is ex about 25 for the value of the stock-dividend deducted this week.

Siemens Ordinary and Preference are both better at 23s. 8d. British Aluminium stiffened to 16s. 3d. General Electric Ordinary fell back to 20s. 6d., but recovered to 21s. 10 $\frac{1}{2}$ d. English Electric 8 per cent. Notes are $\frac{1}{2}$ higher at 93 $\frac{1}{2}$. The market in manufacturing shares is generally firm. A better tendency developed in the rubber list, in consequence of the expectation that the measures now being taken by the Rubber Growers' Association for drastic curtailment of the output of the material, will have the desired effect. The best prices, however, were not maintained. Armament and engineering shares are inclined to be a little easier, with Vickers offered at 13s. The foreign traction group shows no particular changes other than further improvements in the stocks of the British Columbia Electric Railway. Para Electric Railways and Lighting Ordinary and Preference are somewhat nominal at 5s. and 7s. 6d. respectively, on the directors' decision not to pay any interim dividend on either. This is dictated by the uncertainty in Brazil on account of the low exchange; the question of the dividend-payments is to be postponed until the results of the year's working are known.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price	Yield.
	1919, 1920.	July 19, 1931.	1931. n.c.
Brompton Ordinary...	12 12	8	210 0 0
Charing Cross Ordinary...	7 8	82	10 8 8
do. do. $\frac{1}{2}$ Pref...	4 4 $\frac{1}{2}$	92	7 4 0
Chelsea...	6 8	84	9 4 8
City of London...	18 14	13 $\frac{1}{2}$	11 4 0
do. do. 6 per cent. Pref...	6 8	17	7 1 2
County of London...	6 8	84	9 17
do. do. 6 per cent. Pref...	6 8	86	7 7 8
Kensington Ordinary...	7 9	84	10 18 0
London Electric...	24 24 $\frac{1}{2}$	1	7 10 0
do. do. 6 per cent. Pref...	6 8	98	10 18 0
Metropolitan...	6 7	88	9 10 0
do. $\frac{1}{2}$ per cent. Pref...	4 4 $\frac{1}{2}$	92	7 16 8
St. James' and Pall Mall...	12 12	6	10 0 0
South London...	6 7	92	10 18 0
South Metropolitan Pref...	7 7	75 $\frac{1}{2}$	8 12 4
Westminster Ordinary...	10 10	62	9 6 0

TELEGRAPHS AND TELEPHONES.

	Dividend	Price	Yield.
	1919, 1920.	July 19, 1931.	1931. n.c.
Anglo-Am. Tel. Pref...	8 8	88 $\frac{1}{2}$	7 2 0
do. Def...	14 14	10 $\frac{1}{2}$	8 10 0
Chile Telephone...	6 6	42	8 0 0
Cuba Sub. Ord...	7 7	92	8 0 0
Eastern Extension...	10 10	164 $\frac{1}{2}$	6 8 0
Eastern Tel. Ord...	10 10	164 $\frac{1}{2}$	6 8 0
Globe Tel. and T. Ord...	10 10	162	6 8 0
do. do. Pref...	6 6	94 $\frac{1}{2}$	8 1 0
Grand Northern Tel...	29 24	80	9 18 0
Indo-European...	10 10	80	8 8 8
Marconi...	25	24 $\frac{1}{2}$	16 18 0
Oriental Telephone Ord...	12 12	94	10 10 0
United E. Plate Tel...	8 8	68	10 10 0
West India and Panama...	Nil Nil	68	Nil.
Western Telegraph...	10 10	164	16 1 8

HOME RAIL.

	Dividend	Price	Yield.
	1919, 1920.	July 19, 1931.	1931. n.c.
Central London Ord. Assented...	4 4	494	8 1 8
Metropolitan...	14 14	264	14 8 18 0
do. District...	Nil Nil	17	Nil
Underground Electric Ordinary...	Nil Nil	17	Nil
do. do. "A"...	Nil Nil	66	6d. Nil
do. do. Income...	4 9	24	2 8 6

FOREIGN TRAMS, &c.

	Dividend	Price	Yield.
	1919, 1920.	July 19, 1931.	1931. n.c.
Anglo-Arg. Trams, First Pref...	82 194	29 $\frac{1}{2}$	10 0 0
do. do. 2nd Pref...	Nil Nil	24	9 11 4
do. do. 5% Deb...	5 5	64	7 16 0
Brasil Traction...	Nil Nil	91	Nil
British Columbia Elec. Pty. Div...	5 5	64 $\frac{1}{2}$	8 12 4
do. do. Preferred...	5 5	67	8 8 8
do. do. Deferred...	5 5	53 $\frac{1}{2}$	10 18 0
do. do. Deb...	42 42	604	7 10 0
Mexico Trams 5 per cent. Bonds...	Nil Nil	624	Nil
do. do. 6 per cent. Bonds...	Nil Nil	984	Nil
Mexican Light Comm...	Nil Nil	114	Nil
do. do. Pref...	Nil Nil	104	Nil
do. do. 1st Bonds...	Nil Nil	724	Nil

MANUFACTURING COMPANIES.

	Dividend	Price	Yield.
	1919, 1920.	July 19, 1931.	1931. n.c.
Babcock & Wilcox...	15 16	168	6 14 8
British Aluminium Ord...	15	128	12 8 8
British Insulated Ord...	15	118	9 19 0
Callenders...	15 15	17	10 8 8
do. $\frac{1}{2}$ Pref...	6 6	174	7 8 7
Crompton Ord...	15 16	168	12
Edison-Swan...	10	106	12
do. do. 5 per cent. Deb...	5 5	68 $\frac{1}{2}$	7 7 1
Electric Traction...	10 10	168	12 8 8
English Electric...	6 6	174	12 8 8
do. do. Pref...	6 6	174	8 0 0
Gen. Elec. Pref...	6 6	168	7 17 0
do. Ord...	10 10	1	10 8 0
Heavy...	15 16	168	12 8 8
do. $\frac{1}{2}$ Pref...	44 44	84	6 18 0
India Rubber...	10	12	Nil
Mes. Vickers Pref...	8 8	132	8 16
Siemens Ord...	10 10	104	10 18 0
Telegraph Com...	30 30	304	16 17

* Dividends paid free of Income Tax.

THE ENGINEERING CONFERENCE, 1921.

(Continued from page 93.)

Battery Locomotives.

By JAMES DALZIEL. (Abstract.)

ELECTRIC shunting locomotives may be either operated from overhead wires or from a self-contained battery. Certain limitations imposed by the battery roughly define the respective spheres. Generally speaking, for yards where the work is moderate and fairly uniform, especially where fairly long lengths of infrequently worked siding are involved, battery locomotives will economically replace horse or capstan shunting. A probable field for battery traction on electrified main lines is that of working wayside sidings with a battery tender to supply the main-line locomotive. Some branch lines may be worked economically with battery locomotives. Shunting in large goods yards will probably be best effected by locomotives combining overhead conductor with battery supply, the battery dealing with the lightly worked sidings. Where the obstruction of an overhead wire is objectionable, as on quaysides, battery operation is the only form of electric traction possible.

Supply by battery alters for the worse the operating characteristics of an electric locomotive, especially as regards overload capacity. Straight battery working is not suitable for heavily worked sidings, or those out of which an occasional heavy lift has to be made, and the same applies to lines having heavy gradients, or which at certain hours require specially heavy trains to be handled. In such cases overhead conductors should be used; undue increase in battery capacity and weight, or the provision of special types, prohibitively enhances costs. Mid-day boosting charges are adverse to the life of all batteries of whatever type.

Many existing sidings where locomotive operation may be contemplated are equipped with turntables. If it is, as it may be, impossible to substitute points for these, a capstan may be fitted to the locomotive, so as to enable it to pass over such turntables and into the sidings they serve.

A typical battery locomotive was built by the Midland Railway in 1913 to supersede horse shunting in a London coal yard; its dimensions are as follows:—

Weight, 17 tons 7 cwt.; draw-bar pull, 6,400 lb. max.; normal load, 8 wagons (90 tons); maximum load, 12 wagons; speed, 7 m.p.h.; unloaded speed, about 12 m.p.h.; yard capacity, about 100 wagons; average weight per haul, about 30 tons; average length of haul, about 50 yards; annual ton miles, about 45,000 (excluding locomotive weight).

Regarding design and construction, standard wagon parts can in general be used. Hand brakes are sufficient. Special attention is required to be given to battery box ventilation and insulation. Motors should be wound specially for low speed and single reduction gear. The Midland locomotive motors are of 22 h.p. at 220 r.p.m., nose-suspended and spur geared 15-68. A single controller is fitted in the driver's cab of ordinary tramway type with rheostat braking.

Special batteries of the road vehicle type are unnecessary for rail traction; a flat plate type battery is sufficiently good for the service, and it is anticipated that battery contractors will guarantee such batteries for up to ten years at an annual charge of 10 or 15 per cent. of their first cost. On the Midland engine the battery is by the D.P. Battery Co., consisting of 108 train-lighting type cells in wooden lead-lined boxes, the capacity being 300 ampere-hours at the ten-hour rate.

Charging arrangements should be sufficiently automatic to enable technically unskilled labour to be normally employed. In the Midland case charging is done from the Corporation mains through a motor generator; the generator is wound with shunt and reverse series coils, so that the maximum voltage that can be impressed on the battery is about 2.6 per cell with 10 amperes only passing, while with 70 amperes passing the voltage becomes only 2.1 volts per cell. The shunt coils can be adjusted by field regulation, so as to bring up the voltage to 2.7 per cell for gassing charges, which are given periodically under skilled technical supervision.

In a self-contained yard such engines can be driven by the yard staff, who can also perform other duties. If the engine has to work on or to cross the main line a qualified driver would have to be employed. The energy consumption of battery locomotives is necessarily high. In addition to the normal losses by frequent stops and braking, there are the special losses in the battery and charging plant. In the Midland case the energy consumption measured at the Corporation meter averages about 100 watt-hours per ton mile. The overall efficiency is about 50 per cent. *i.e.*, a battery locomotive consumes about double the energy of a conductor-supplied locomotive on the same work. On the other hand, rail bonding in yards presents some difficulties; moreover, in most cases an earthed return is not permissible; motor generator losses are thus inevitable unless double overhead wires are used.

A locomotive of the type and capacity described would cost (pre-war) approximately £900 with, say, about £200 in addition for charging plant. This locomotive replaced five horses and four men (pre-war), the annual value of which, at to-day's prices, is about £1,600. The working cost of the locomotive for the year 1920 was about £100; adding provision for battery renewal, interest, and depreciation at to-day's prices and rates,

the total cost amounts to about £800, so that in most conditions such an engine could be installed to-day to save £500 per annum over horse shunting.

DISCUSSION.

Mr. J. DALZIEL's paper was read and discussed on the third and last day of the Conference, when Mr. C. P. SPARKS presided over Section VII.

Sir H. FOWLER opened the discussion by explaining that one advantage of the type of engine under review was that it could go anywhere that a truck could go. On the Midland Railway they had only experienced one accident in ten years, and he was of the opinion that battery locomotives would prove very useful on the small branch lines, of which there were many in this country over which there was very light traffic, and which it would not be advisable to electrify in the usual way.

Mr. C. H. MERZ said that a good deal could be done by battery locomotives at a small expenditure. More trials of the kind mentioned by the author would be very beneficial, as the subject had not received enough attention, and it was only by such trials that the exact battery capacity, the best charging conditions, plate improvements, and other data could be determined.

Mr. R. T. SMITH wanted to know whether difficulty was experienced from the spilling of acid when the open battery was used, and whether any precautions were taken as in the case of train-lighting batteries? The shunting of mineral trains by horse haulage had cost £3,000 per annum, but by replacing the horses by "Clyde" electric capstans that figure had been reduced by half. Moreover, a horse could only haul one truck at a time, whereas a capstan could handle a whole train of 200 tons. Capstans could be operated by the ordinary yard staff, and the cost of electricity came to between £20 and £40 per annum. If a qualified driver was provided for a battery locomotive, £200 must be added to the annual cost, and whether such locomotives would displace capstans depended entirely on whether they could be operated by the yard staff or not. He agreed about the usefulness of battery engines on branch lines, and complimented the author on his use of ordinary wagon parts for building the locomotive. That reduced the capital cost to at least half what it would have been had a special design been employed, and he recommended other engineers to copy the author's practice.

Mr. F. LADALL thought that the author's locomotive had given a very good performance, but it was too small to be of much use in main-line goods yards. An average of 103 tests in 66 American yards showed an average length of run of 628 ft., an average time of run of 7.5 secs., an average time of stop of 53 secs., an average speed in motion of 5.4 m.p.h., and an average speed, including stops, of 3.24 m.p.h. with an average load of 306 short tons. However, that service was probably well above what would be required in small English yards. For dealing with full trains of from 600 to 700 tons the battery would have to be very large, unless it could be recharged at very frequent short intervals. The author's remarks about boosting were not strictly correct; was it practicable to intermittently charge an accumulator from an overhead conductor or third rail?

A speaker, on behalf of the battery makers, pointed out that battery locomotives were being used in shipyards, coal mines, &c. If a boost was necessary (up to the full charge) it did no harm whatever to the battery. The use of flat plates might make the height of the latter too great. He only knew of one explosion in 100 locomotives.

Sir P. DAWSON asked for more information, as the subject was one of much importance.

Mr. ELLIOTT explained that heavy batteries would last between seven and eight years, whereas the life of the lighter types was only two or three years.

Mr. P. EDWARDS expressed the opinion that if railway electrification developed in this country battery engines would have to be built very much larger and heavier than they had been so far, and suggested that regenerative braking might be adopted as a means of charging the accumulators.

Lieut. Col. F. A. CORRY LAURENCE was in agreement with the author as regarded the use of battery locomotives on branch lines and sidings, the equipment of such lines was not expensive and, therefore, it would be most efficient to equip them in the ordinary way. He emphasised the importance of control, and suggested that Edison or Exide batteries would be more suitable than the Plant type, on account of the rough handling shunting engines received in such yards. The type of battery used for platform trucks (which vehicles worked very satisfactorily, and were exceedingly robust) would be suitable for locomotives. He endorsed what Mr. R. T. Smith had said about capstans, and pointed out that labour conditions necessitated two men being allocated to each electric locomotive. Did drivers insist upon being placed on the same footing as drivers of steam engines? Before the war he had seen in Hungary petrol-electric engines working economically and well, and he thought there was an opening on English branch lines for such locomotives in place of the battery type. They must have large experience, and

it was foolish to condemn a certain type because one or two samples did not work well. It was of the opinion that there was a very large field in this country for electric shunting in busy yards; considerable money would be saved by electrification, and there was plenty of opportunity for locomotive designers.

Mr. A. C. AGNEW drew attention to the disappointing results that were often obtained with battery locomotives from the point of view of cost. The Edison battery was very durable, but its energy efficiency was low compared with the lead type. Mid-day or boosting charges could not do any harm, and the author was sanguine if he expected makers to guarantee their batteries at 10 per cent. per annum. All drivers expected to be dealt with on the same level.

Mr. F. W. CARTER suggested that battery locomotive motors should be compound instead of series wound, so as to enable them to regenerate, and to increase the radius of the engine. That would increase the switching arrangements, but patent No. 16,997 of 1908 showed that something in that respect had been done in the case of road vehicles.

Mr. BROTFELL was of the opinion that for yard work the engine must be light, and it was no good attempting to handle 200-ton trains. A main-line locomotive would probably weigh 100 tons; a battery tender would double its weight so that the speed would be very low; they must do the work cheaper and quicker. The efficiency of the present battery locomotive was too low, but there were two ways of improving it: To alter the control and do away with some of the rheostatic losses, and to turn the waste energy from the brakes into the battery.

The CHAIRMAN (Mr. C. P. Sparks) thought they were in the hands of the battery makers, and that a special battery (not the lead type) was needed for such service.

Mr. J. DALZIEL, in reply, said that battery explosions could be prevented by adequately ventilating them, and he had experienced no trouble from the spilling of acid. Edison batteries were liable to explode at any time, although they were not harmed at all thereby. The weight of a battery was really an advantage, because the difficulty was not in starting but in stopping a train; the battery tender could be carried behind in place of the brake van. Battery traction was no good for heavy work, and the advantage of a battery engine over capstans was in the capital cost. He estimated the cost of ten capstans at £6,000, and if the choice was left to the track department, the battery locomotive would be preferred every time. They had had no trouble with the staff at all.

(To be continued.)

THE THERMAL EFFICIENCY OF HEAT POWER PLANT.

(Continued from page 100.)

A discussion in "Air Heating for Boiler Furnaces" was opened by Mr. W. H. PATCHELL, vice-president, who pointed out that 80 years ago air heating was practised. In the mercantile marine it was very largely used in connection with the forced-draught system of Messrs. James Howden & Co., of Glasgow; that the heater was commercially efficient was beyond question. The application of the Ellis & Eaves system of air heaters and induced draught to boilers installed by Messrs. John Brown & Co. at Sheffield Electricity Works enabled them to burn soft Yorkshire coal without the production of smoke, which without the hot air supply was copious. Detailed tests of boilers with and without air heaters were hard to get; such figures as were available had been analysed, and the results were given in tabular form. Tests on a Belleville boiler fitted with a superheater, fan, and air heater showed the following results:—

	Efficiency.	CO ₂ .	Excess air.
With the air heater	69.2%	16.0	80
Without the air heater	60.2%	7.57	110

The excess of air had been calculated from Bunte's formula, 18.9% CO₂, and was therefore only approximate.

The following data are extracted from the table above-mentioned:

AIR HEATERS.											
Year.	Type of boiler.	Type of boiler.	Type of air heater.	Temp. of gases leaving boiler, Fahr.	Temp. of air entering furnace.	Rise in temp. of air.	Excess of air over that necessary.	Extra efficiency of boiler due to air heater.	Efficiency of boiler and air heater (including superheater).	Efficiency of air heater.	
1914	...	Stirling	Underfeed, travelling	Uscu	526	147	129	28	3.1	85.3	79
"	...	"	"	"	564	202	131	61	4.0	83.6	69
1913	...	"	"	"	588	217	165	47	4.2	83.3	71
1912	...	Woodeson	Class E, Underfeed	"	591	230	153	36	3.9	80.5	76
"	...	"	"	"	648	272	181	54	5.3	79.5	—

The calculated "extra efficiency" did not take into account any gain from improved combustion or anything but the thermal units returned to the furnace with the air. There were no figures available showing the moisture in the air supply—an important point. It was noteworthy that when the air supply was cut down to the minimum required for the best boiler efficiency, the extra efficiency due to the air heater was lower

than when, as in ordinary boiler practice, a large excess of air was admitted. With regard to the effect of hot air on the grate or stoker, stokers of the retort type, where the grates were more heavily covered, could be safely operated with a hotter air supply than stokers of the chain or travelling grate type, where the fuel bed was thin. The hot air could be supplied above the grates. The characteristics of the fuel required very careful consideration, with regard to the ash, clinker, &c. The effect of the hot air would be to raise the temperature of the furnace, and in the case of large boilers there might be more anxiety regarding the maintenance of the refractories than of the boiler proper.

The ordinary form of Howden heater had straight steel tubes fixed in steel plate casings. The "Uscu" and the "Thermix" were of the leaf or diaphragm plate type.

The removal of dust from air heaters would require as much consideration as the cleaning of the boiler tubes.

Steel uptakes and chimneys had been largely used, and where condensation did not take place the maintenance had been light. Mr. Patchell hoped that better records of tests would be forthcoming; the extra efficiency of the boiler as shown by arithmetical analysis was certainly not enough to encourage the purchase of air heaters, but it was a fact that air-heaters had given great satisfaction, and there was an overall commercial advantage in using them.

Supplementing the paper, Mr. PATCHELL said that a big combustion chamber and high tube clearances were necessary, as had been shown by himself and Mr. Miller years ago, but the boiler-makers would not then follow their lead.

In a written communication, Mr. D. WILSON commented on the lack of evidence that success had been attained with air heaters.

Mr. OWEN (Messrs. Howden & Co.) pointed out that air heating was in very extended use in the mercantile marine. Messrs. Rowan, of Glasgow, made tests over a long period, showing an economy of 15 per cent. The system had its best chance where the cost of coal was high. The combustion of the fuel was the main phenomenon, and needed the most careful attention; great quantities of air were admitted to furnaces in excess of the necessary minimum, and could be reduced by heating the air, which should have the first claim on the heat contained in the waste gases, in order to improve the conditions of combustion.

Mr. BENNIS considered it remarkable that the makers of air heaters did not themselves make thorough tests of the efficiency obtained.

Mr. S. E. FEDDEN described plant which he had installed 22 years ago, which increased the evaporation of the boilers from 11,000 to 14,000 lb. per hour. He used a steam jet to cool the fire bars. There were risks of corrosion due to cold feed water, and of injury to the furnaces by excessive temperatures; he was not convinced either way, but on the whole he preferred to be without the air heaters.

Mr. C. ERITH pointed out that at sea water economisers could not be used, so that air-heaters had a better opening. In many power stations water economisers were being dispensed with, owing to the high efficiency attained by boilers of modern type. The high cost of coal at present created a tendency to reopen the question of air heaters, but there was not much to be gained from them. Perfect combustion could be achieved nowadays with cold air.

Mr. S. UTING said that the faint praise accorded to air-heaters reminded him of the history of the superheater; failures had taken place, but it was only a matter of improvement in design and construction. To extract the heat from the flue gases the best scheme would be that which entailed the lowest capital and running costs; with air heaters they could do this at a lower capital cost than with water economisers, but could they fully utilise the hot air? The makers of stokers set a limit on the temperature of the air. In the case of a new installation, they might cut down the cost of the water economiser and replace part of it with an air heater. Where hot air was needed for manufacturing processes, it could be heated by the flue gases. Owing to the higher steam pressures in vogue, the cast-iron tube economiser would have to go, and be replaced either with steel tubes or air heaters.

AIR HEATERS.

Mr. TANSLEY preferred cold air with steam jets to hot air without, and Mr. GILLESPIE referred to marine practice.

In reply, Mr. PATCHELL mentioned that in up-to-date practice in the United States, with large boilers worked economically and feedwater heated by steam, water economisers were cut out. At Chicago, using a pressure of 350 lb. per sq. in., a steel economiser was installed in series with an air heater,

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

ANNUAL CONGRESS.

The annual general meeting and Congress was held at Caxton Hall, Westminster, London, on Friday, July 15th.

Mr. C. G. TEGETMEIER presided at the annual general meeting and formally proposed the adoption of the Council's report and accounts for the past year. In doing so, he gave a short review of the work of the Council during that period. The total revenue for the year amounted to £799 and the expenditure to £774. The balance of £25 increased the assets of the Association to £670. The work done during the past year, he said, must be regarded in conjunction with the work of the Conference of tramway and light railway companies, which was a separate body from the Association itself, although constituted within it for dealing with matters relating to the tramway industry outside the scope of the Association as such, more particularly with regard to wages and labour questions generally. One of the important functions of the Conference was to elect representatives of the industry to sit on the National Industrial Joint Council, and the Municipal Tramways Association had now a similar organisation. Thus the municipal and tramway undertakings had representatives who met on common ground to deal with matters of common interest. During the past year, as in the preceding two years, labour and wages questions had constituted the most important matters which had had to be dealt with, and much time and work had been devoted to them by the various representatives on the National Joint Council. Mr. Tegetmeier related the difficulties which had had to be encountered, especially with regard to wages, which culminated in the trouble of last year when strikes were threatened and, indeed, in some places, actually took place. The position now was, however, that undertakings had been graded into three groups according to local conditions and financial capacity to pay certain rates of wages, and the latest settlement had been to take the best rate of wage in each district and add 3s. 2s., and 1s. per week respectively, there being a slide up or down according to the index figure for the cost of living; the rise or fall was 1s. for every 5 complete points, and the adjustment was made every three months, the index figure upon which the adjustment was to be made being 135. At the moment the index figure was 119, so that, assuming that no other change took place before the next quarterly revision, there would be a reduction of 3s. per week in wages. The large increases in wages which had been taking place had put the tramway industry in a very difficult position, and it had only been able to carry on by reason of the Temporary Increase of Charges Act of 1920, which enabled the undertakings to charge such fares as would give them a reasonable profit and a reasonable return on their capital. Such increases, however, could only be made after application to the Ministry of Transport, and already 75 undertakings had obtained orders under the Act. Others had been able to make increases in their fares under their own private Acts of Parliament. Among the other matters which had called for the attention of the Association during the year was some relief for tramway undertakings from the heavy burdens imposed upon them in respect of road maintenance, but certain amendments proposed by the Association to the Roads Bill of 1920 were not accepted by the Minister of Transport. More recently further representations had been made on the subject, but a communication had been received from the Minister of Transport to the effect that he could not see his way to promote legislation for the purpose of relieving tramway authorities from their statutory obligations under Section 28 of the Tramway Act of 1870 or to make any contribution to the cost referred to out of the Road Fund. There, unfortunately, the matter remained for the present.

The following members of Council retired:—Messrs. F. Cootts, E. H. Edwards, H. England, A. L. C. Fell, Alderman R. Mayne and Mr. W. Shearey. To fill the vacancies the following were elected:—Messrs. W. V. Edwards, R. J. Howley, — McGill (Balfour, Beatty & Co.), P. E. Gripper, J. K. Bruce, and I. Bullin.

The annual business meeting closed with the reelection of the Hon. Auditor, Mr. A. W. Chalmers.

Two papers were then read and discussed, Alderman Smithson of Leeds being in the Chair. The first was "Tramway Track Maintenance," by Mr. R. B. Holt.

Tramway Track Maintenance.

By ROBT. B. HOLT, M.I.Mech.E., M.I.Inst.C.E.E. (Abstract.)

The standard of track maintenance has suffered a serious setback in consequence of the war and its aftermath of industrial unrest, high wages, shorter working hours and increased cost of materials. The standard today on many tracks is that of over 15 years ago. In consequence of the almost entire neglect, during the war, the whole of the improvements effected during the reconstruction period have been lost; the standard has deteriorated, and, as a natural consequence, slower speeds and uncomfortable travelling are general. As reserve funds have vanished, in most cases, and revenues do not as yet permit of an adequate amount of reconstruction, renewals are of rare occurrence, and the life of rails and pavement is being prolonged to the fullest extent by means of rail hardening,

groove deepening, the building-up of hammered joints by the arc and autogenous welding processes, the reversal of paving setts, and the replacement of sett paving by monolithic surfaces of asphalt and tarred macadam.

With regard to new rails, recent experience indicates that it is essential that rails shall be rolled with deeper grooves from steel of a more durable quality than that obtained under the standard specification. In this country rail grooves about 1½ inches deep have been adopted by the Liverpool, Hull, and Doncaster tramways. There is no disputing the fact that a deep groove is essential, and it is the duty of the Standards Committee to take cognisance of this and other requirements in order that they may direct the necessary changes, for without their supervision the elements and advantages of standardisation will be lost. One square inch of additional sectional area represents approximately a 10 per cent. increase in the total weight of the rail, and the writer suggests that this might be counterbalanced by reducing the width of the flanges. At the same time the rolling mill difficulties would be decreased. There is no reason for any paved-in British tramway rail to have a flange 7 inches wide; this could be reduced to as little as 5 inches with advantage.

The wear of rails is exceedingly variable, and comparisons are not readily made between the wear of rails on different undertakings in consequence of variations in the design and equipment of the rolling stock and the local conditions.

Gaugings obtained by means of the Sandberg Rail Wear Gauge, which has been specially designed to record accurately to within 4/1,000ths of an inch, show that the wear of the rail profile varies considerably on different systems. On many of the rails where track brakes are used there is a pronounced increase in the inclination of the tread towards the groove; whilst very little wear is taking place on the outside of the rail tread, a very considerable loss of metal takes place on the gauge side, and if this rate of wear continues the wheel flanges will soon touch the floor of the groove.

At last year's Conference of the Association Mr. Ireland, in the discussion on Mr. Pringle's paper, stated that the worn profile of the rail was brought about chiefly by the shape of the tire, and that "the area of contact had a definite bearing on the subject." He had discovered by actual experiment that "the load per square inch of contact was about 65 tons, from which it was obvious that the tire was being overloaded to such an extent that it would not keep its shape for any length of time, and that loss of metal through detrusion took place, and that it followed that whatever the shape of the rail to begin with, it was ultimately rolled to the shape of the tire." The writer agrees with Mr. Ireland in regard to the over-stressing of the metal in both the tire and the rail tread, and it is obvious, in many cases, that the elastic limit of the steel is exceeded. In view of the increase in weights and speeds of tramway cars it is up to the track engineer to safeguard his rails against the effects of the excessive compressive stresses, which are admittedly responsible for abnormal tire and rail wear which result in detrusion, battering, and, in the opinion of many authorities, in rail corrugation.

The precise cause or causes of rail corrugation have not yet been determined, but the Rail Corrugation Committee, on which members of the Association served, definitely established the fact that corrugations do not exist in the rails as received from the mills. Whatever the origin of the force may be, its culminating effect is to exert such pressure, through the wheel, on the rail tread that the elastic limit of the steel is exceeded. It is evident that consideration should be given to the manufacture of rails possessing superior wearing properties. For many years the writer has endeavoured to bring the fact home that rails of the standard composition and quality are not suitable for the work they have to perform. The tensile strength of the standard rails is approximately 45 tons per square inch, and the elastic limit is only about 20 tons per square inch, the Brinell hardness number being less than 200. Mr. Stephen Seldon recommended, as a preventative of rail corrugation, that the elastic limit of the steel should be raised to 60 tons per square inch, and in view of Mr. Ireland's statement it would appear that even this is barely sufficient, with heavy cars of the London County Council type, to resist the pressure exerted through the wheel tire and to prevent the detrusion of wheel and rail metal.

The time is apparently opportune for the Standards Association to consider the revision of the Tramrail Specification, and in doing so it is recommended that in specifying the chemical composition this should be merely a guide for the manufacturer as to the composition and limits of impurities considered to be likely to produce a material of the required mechanical properties. The specification should not insist on the composition being rigidly adhered to, provided the mechanical and special tests are fulfilled.

Many factors, such as bad conditions of casting, improper heat treatment, burning, &c., may introduce defects infinitely worse than the mere presence of a few hundredths per cent. of sulphur and phosphorus, and such defects may, without careful supervision, fail to be revealed by either the ordinary mechanical or chemical tests. The tendency is for an inflated

value to be placed on the results of chemical analysis, and most specifications overlook one of the most important mechanical properties of steel in relation to its behaviour in service, *i.e.*, the elastic limit, and to attach undue importance to the ultimate strength, to which it bears no necessary or fixed relation. The most advisable method of obtaining a high elastic limit combined with the necessary toughness as by means of suitable heat treatment.

The superior physical and wearing properties possessed by rails treated by the Sandberg Sorbobic process, which is applied at the rolling mills, are demonstrated by the very severe operating tests which have been carried out on the Turkey Hill curve of the Pennsylvania Railroad, U.S.A., over a period of two years, and it has been ascertained that the increased life of the sorbobically treated rails was 85 per cent. During the test the actual loss of metal on the treated rails was a little over 7 lb. per yard, whilst on untreated rails the loss was over 13 lb. per yard. The effect of the sorbobic treatment is to increase the elastic limit of the steel by approximately 10 tons per square inch.

The Woods-Gilbert re-modelling process is an effective method of prolonging the life of existing rails. By this process the floor of the rail groove is milled away to the extent of about 5/16ths of an inch, thus allowing the wheel flanges to travel free of the groove for a considerable period, and clearing away the irregular ridges of extruded metal near the gauge line. The depth of the metal remaining in the groove after the milling operations should not be less than 5/16ths of an inch.

Excellent salvage work has been carried out on numerous undertakings throughout the country in the way of repairs to hammered joints by means of the electric arc and autogenous welding processes. Considerably more use is now being made of the arc welding process than in pre-war days, and from what the writer has seen it is likely to develop in popularity, as it is independent of outside sources in regard to supplies. The deposited metal should be of the same chemical composition and hardness as the rail itself. The metal in many of these repaired joints is much softer than the rail upon which it is deposited, and analyses reveal that the deposited metal is generally lower in carbon. Such metal cannot be expected to withstand the effects of a heavy high-speed car service satisfactorily for any length of time. It is essential to ensure that a sufficient amount of carbon passes through the arc or flame into the deposited metal. This can be arranged to some extent in the case of the arc welding process by regulating the length of the arc. In repair welding of this description it is well worth the additional expense to have the fishplates spot-welded to the rails as in the practice of the Rail Welding Company, London. Where the joints are not too badly battered, excellent results are being obtained by means of a single Thermit weld.

In the "Insitu" Rail Hardening Process, patented by Mr. C. P. Sandberg over four years ago, an oxy-acetylene installation mounted on a truck is propelled slowly by hand along the track, whilst the flames from specially designed burners impinge upon the tread of the rail; a small area of the tread is raised to a temperature above the critical range, and immediately behind the flames jets of water are sprayed upon the rail, thus quenching and cooling the treated portion. The treatment produces a hardening effect for a depth of about 1/4 in., the outer portion to a depth of fully 1/2 in., consisting of martensite, and therefore of the maximum hardness. Up to date over 100 miles of track have been treated on 23 of the most important tramways in the kingdom, and orders have been obtained for the treatment of a further 30 miles of track. On the average, the wear of the untreated rails is about 21 times that of the treated rails.

A very considerable difficulty has been experienced during the past few years with regard to the maintenance of the track paving. Very satisfactory track pavements can be obtained from the use of both asphalt and tarred macadam, either with or without a course of setts alongside the rail. The cost of points and crossings and tramway layouts is a very serious item in these days, and engineers are building their own junctions with scarfed crossings; a much better job can be made than formerly, in consequence of the availability of the arc and autogenous welding processes. Considerable economies could be effected by the use of shorter and lighter points and crossings. The design of points and point mechanism requires considerable simplification.

Mr. Holt added that the description in the paper of the Rail Welding Company's process was not quite up to date. He understood the present practice was to entirely weld up the horizontal joints between the head and the flange of the rail and the fish plates, and not to cut out defective joints.

DISCUSSION.

Mr. A. NORTON said that the post-war cost of maintenance had kept rails in service long after their effective life, but the Sandberg process, according to the paper, had been instrumental in getting a very much longer life out of the rails. At the same time, the operation seemed a somewhat costly one. He agreed with the author that to deepen the depth of the groove of train rails from 1 1/2 in. to 1 3/4 in. would be a good thing. With regard to special track work, it was frequently specified that the depth of the groove should not exceed 5/16 in., but the effect of that was that the tire often ran over the grooves, which wore the tire away and did not stop the bumping which took place at the special track

work. It would be very much better to keep the depth of the groove at the special track work the same as the height of the tire flange, which was fixed at 9/16 in. for most sections on British tramways. It was reduced there was a risk of the tire mounting the special track work when going at high speeds. With regard to the effect of detrusion, referred to in connection with Mr. Ireland's paper before the Association last year, with which the present author agreed, it would be interesting to know the width of the tires and also the angle of inclination as originally placed in service, because that had an important bearing on the question. Considerable importance also attached to the tires on the same axle being of equal hardness. With the tendency to increase the hardness of the tires, one would imagine that there would be a proportionate increase in the hardness of the rails. A recent American specification shewed 0.7 to 0.85 carbon, 0.2 silicon and 0.6 to 0.9 manganese, the maximum stress being 50 tons and the elongation 8 per cent. Brittleness had not the same vital effect in the case of tramways as railways, because in the former case the rails were supported over their entire length. At the same time, brittleness could be overcome by suitable heat treatment, and the greater expense thus involved was more than compensated for by the longer life. Moreover, experience had shown that a slightly higher percentage of phosphorus and sulphur than usual was not deleterious. There was a good deal yet to be learned by the steel makers in the production of perfect rails. Referring to the British Standard Specifications, Mr. Norton said that these did not always receive the publicity they deserved, but he believed that steps would be taken in future to remedy that. The tire specification had been a work of years, but it was now completed and would be published in a few days. Whilst a standard width had been adopted, the question of standardising the wheel centre was a very much more difficult matter. If users could standardise their wheel centres it would help the makers very much indeed.

Mr. W. V. EDWARDS (Hastings) asked for more information with regard to the regulation of the arc in rail welding. He had been welding rails by this means for some years, and although a good job could be made in building up joints of the ordinary rails, there was considerable difficulty in making a satisfactory job with manganese steel points and crossings. He had tried several different classes of electrode but had never yet found anything reliable. If they could be told the length of arc, which was an important factor, it would be interesting. Also, would the author recommend the use of manganese steel in building up special track work or even for ordinary rails.

Mr. W. THOM, speaking of narrow *versus* wider flanges for rails, said his experience was that the wide flange was the best. Many of the rails bought years ago were quite as good as the best that could be obtained now. They wanted to have the rails made in this country if possible, but if the manufacturers would not support them by giving them the right article at a proper price, there was no alternative but to go abroad.

Mr. E. B. PICKERING said that some time ago the author published a book in which he urged steel rail makers to make long points for special track work, and as a result he induced his firm to take the matter up. That was done, but now he noticed the author advocated 8 ft. 6 in. points instead of 15 ft. points, and he would like to know the reason for the change. The reason originally put forward for the longer manganese steel points was that they gave very much sweeter running on the special track work. The maintenance of points was an important matter, and there could not be such satisfactory maintenance with an 8 ft. 6 in. point as with the longer point.

Mr. R. J. HOWLEY referred to the difficulties of bringing out standard specifications, many of which took such a long time to agree upon that they were out of date by the time they were published. Most standards were a sort of compromise, owing to the conflicting views of those concerned. Quite recently, the Committee had been working on a new form of rail at the instance of Mr. Fell, but there had been great opposition to altering the existing standards for the 96 and 104-lb. rails, and these were going to remain. The new rail which was going to be called No. 8, was a heavy rail of about 114 lb. and 7 inches deep. It would have a depth of groove of 1 7/16 in. In the specification the chemical composition was set out separately for open-hearth and Bessemer rails, the open hearth having 0.6 to 0.7 carbon, which was much higher than had been used in this country. Many undertakings had been using American rails, which were higher than this, and he must say that the rails of the Lorain Steel Co. showed great resistance from the point of view of corrugation. There were objections to the use of Bessemer rails, but he believed there was a hope that we might get a harder rail in the future.

Mr. F. BLAND agreed with the use of deep grooved rails. As a member of the British Engineering Standards Committee dealing with tramway rails, he regretted that a long time was taken in preparing the specifications, and he believed if the manufacturers had been left to do it, the standard specification would have been issued long ago. He imagined the author was advocating shorter points because of the cost, and it should be remembered that the cost of tramway rails did not increase *pro rata* to all other commodities of life, and there was not now a sufficient demand to cause a wholesale fall

in price. With regard to special track work, he thought there was need for simplification of the fittings.

MAJOR CALDWELL said, in connection with the arc welding process, that there was too much metal shown in the illustrations in the paper, and that better results would be obtained with a single run weld instead of what appeared to be more or less of a mould. Tests had been carried out on the Manchester system by the Woods Gilbert people, using light welds instead of the heavy welds, the advantage of the light weld being that the strength of the weld was really obtained by fusion in the first place. If fusion was not perfect in the first layer, then it did not matter how much metal was added afterwards. Such a weld on the Manchester rails withstood 56.5 tons before it broke, and then the fracture was at a distance from the weld.

Mr. C. BURNET (of the Rail Welding Co.) exhibited some samples of rails treated by his company's process, which had been in operation since 1914, and said he did not know that Manchester had any claim to have originated the type of weld which the previous speaker had referred to.

Mr. W. T. ROSSON said that not very much carbon was passed through the arc, and the hardness was obtained by adding a hardening powder as the work was being done. With regard to special track work, when the author wrote his book on permanent way work, electric welding was hardly known, but since then it had enabled tramway engineers to build their own points and crossings, and he expected it was entirely a question of economy which had induced the author to raise this point.

Mr. HOLZ, briefly replying to the discussion, said he had never done any electric welding with manganese steel rods. As to the length of the arc, he had heard experts say that more carbon was liable to be carried over the shorter arc. With regard to the greater wearing properties of rails made years ago, those were made with more regular heats than was now the case; but if tramway authorities were prepared to pay the price, they could have a better article. The whole trouble was one of first cost. Similarly, since he wrote his book conditions had changed very materially. There were tramways now without any money at all, and if the makers hoped to sell points and crossings they must be made very much cheaper; unless these things were made cheaper tramways would go out altogether. He believed a satisfactory 10 ft. point could be made to take fish plates. He knew of important tramway undertakings which were building important junctions, and by the aid of welding were able to make a very much cheaper job than formerly. Therefore, unless Sheffield turned out cheaper stuff it would find someone else taking the business from it. If a softer metal was used, it would not be possible to harden it by any exothermic method afterwards. A deeper groove was necessary, and if the Standards Association did not take this matter in hand, tramway engineers would find a way of settling it themselves.

(To be concluded.)

THE "EDISWAN" HOUSE-WIRING SYSTEM.

THE subject of house wiring is of so much importance that every means by which the work of installation can be cheapened calls for careful scrutiny, and we were pleased to have the opportunity, last week, of inspecting a new system devised by Mr. F. C. Raphael, manager of the cable and wiring department of the Edison Swan Electric Co., Ltd. The essence of this system is simplicity, which is attained without loss of other desirable qualities, and it is claimed that its use will result in economy of time and labour, that it can be



FIG. 1. BONDING RING.

installed satisfactorily by workmen who are not highly skilled, and that it offers little scope for bad workmanship.

The cable used presents no special features of novelty, being of the 600-megohm class, rubber insulated, and sheathed with metal alloy, flexible enough to allow of sharp bends, but stiff enough to be fixed with clips without sagging; it is supplied single or twin, the conductors in the latter case

having tapes of different shades and the sheathing being of flattened section.

The standard sizes range from 0.041 in. diameter to 3.2 S.W.G., and the cable is dispatched on small drums, each containing 110 yards.

The characteristic feature of the system is the bonding ring (fig. 1), for the purpose of connecting together the metal sheathings of the cables—set screws, staples, and other fittings. It consists of a ring of soft tinned brass in which there are four slots, the sides of which are formed so as to allow the metal-covered cable to pass through. The outer and

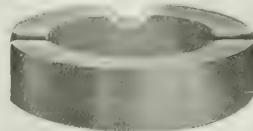


FIG. 2.—THREE-WAY WOOD BLOCK.

inner diameters of the bonding ring are the same as the outer and inner diameters of the wood block (fig. 2) and the blocks are provided with grooves to fit the bonding ring and cable. When the block is screwed down in the ordinary manner, the cable is gripped on both sides by the bonding ring, and perfect electrical contact is made. No small screws and nuts are required, the necessary bonding is obtained simply by screwing down the wood block by means of the usual wood

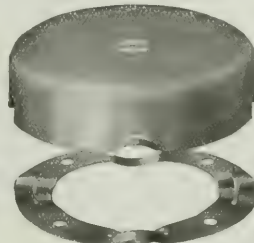


FIG. 3.—BLOCK AND RING.

screw through its centre (fig. 3). It is always possible, when inspecting the completed work, to see whether the bonding ring has been properly inserted, as the edge and the turned-up portion are visible at the sides of the block.

In the case of back entry, a wing of lead is turned back from the cable and inserted in the slit in the bonding ring from the inside, a plain block being then used, which presses the lead and the ring into intimate contact when screwed



FIG. 4. JUNCTION BOX.

home. Both side and back entry cables can be hooked under the same block. The bonding ring is "universal," any ways not utilised being pressed flat when the block is screwed home.

The wood blocks, for which patent rights are being obtained, are supplied ready grooved for the cable, in imitation walnut and white enamel finishes, $3\frac{1}{4}$ in. in diameter outside, $2\frac{1}{4}$ in. inside, and 1 in. thick. As the bonding ring occupies no space inside the block, the whole of the interior is available for slack cable. A "universal" 4-way block alone need be stocked, as all the ways need not be occupied, but blocks with one, two, or three ways are also supplied. To prevent any

possible damage to the slack cable by the centre screw, an insulating bush may be slipped over it—but this is not really necessary.

The "Ediswan" distribution box is made in the form of a universal 4-way box (fig. 4); it consists of a heavy iron backplate, a bonding ring, a porcelain connector, and a stout stamped iron cover, painted grey. The backplate is screwed to the wall by a screw through the centre; the cables are then passed through the bonding ring and connected as desired with a porcelain connector, and the cover is fixed on with



FIG. 5.—BONDING STRIP.

four screws. The parts can also be used in other combinations.

Where cables enter a distribution box, they are clamped between a thick iron backplate and a thin tinned brass strip, which ensures perfect contact (fig. 5). The earthing wire can be clamped under the brass strip, but is preferably soldered thereto. Bonding strips for 2, 3, and 6 ways are available.

One of the neatest features of the "Ediswan" system is the method of supporting the cable. The "cable fixer" is of

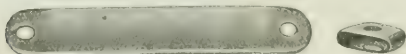


FIG. 6.—CABLE FIXER AND CAP.

lead strip, which is bent round the cable; the punched ends are fitted into a bronzed cap (fig. 6), and the clip thus formed is nailed or screwed to the wall or ceiling (fig. 7). The cable is thus securely held without risk of injury, there are no projecting ends of metal, and the time expended is a minimum. The standard fixers will take two single cables or one twin cable. Where a larger number of cables is to be dealt with, lead strips can be cut to a suitable length.

Special attention has been given to the packing of the components in boxes containing convenient numbers, saving

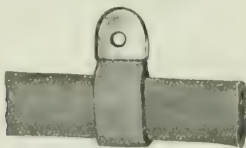


FIG. 7.—CABLE FIXED.

space and preventing damage to the parts. For example, a box of cable fixers contains 144 caps, 100 straps, and 10 ft. of lead strip.

Every detail of the "Ediswan" wiring system, it is claimed, conforms with the I.E.E. Wiring Rules. It is certainly very neat and effective, with the minimum of special parts, and requires no special tools at all. Hence the claim that the system is characterised by extreme simplicity is justified. The whole of the parts described are made by the company, and a great deal of ingenuity and foresight has obviously been expended upon their design.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Competition in the South American Market.

I have read your leader in the current issue of your paper re "Competition in the South American Market" with considerable interest, and generally the writer can, after 12 years' experience of South America, confirm your remarks. The reasons why the German trade is so successful in the South American Republics are:

(1) Because, whilst individual firms and industries are apparently separately represented, actually they are (unofficially perhaps) under the control of a guiding representative of a central authority, who controls large groups of industries.

(2) They conform to the business customs of the countries. With regard to the first point, the remedy is for groups of British manufacturers to come together and, whilst not necessarily altering the personnel of their present repre-

sentatives, they must appoint a strong reliable man to act as their united representative, who must be *persona grata* with the Government and Municipal powers of the country. The present local representatives must keep in close touch with him and discuss any business, at any rate, of an important nature with him, before tendering.

Details as to the wisdom and reasons of such an appointment can only be given at an interview, but matters such as guarantees, obtaining payments and especially final payments, are points that would come within the ambit of the duties.

At any rate, with a representative of such a nature, and with adequate powers, there is no reason why the majority of any business going should not be obtained for Great Britain, especially when it is borne in mind that British goods and workmanship have a reputation for good quality as an asset to start with.

Under the second point, the objection often made as to British weights and measures and money values causing a loss of trade is of little importance; actually it may be and, no doubt, often is, given as the official reason for turning down a proposition, but it carries little weight. The writer can give a very much more pertinent cause for such rejections. Don't forget that the £1 sterling is known throughout these countries and its value thoroughly well known, and it is value that talks in the long run. For instance, with sovereigns in one's pocket one can travel throughout most South American countries and receive nominal exchange for them at almost any shop at which he may make a purchase. The writer has done it on more than one occasion just to prove this contention; no other country's gold can be so used. It is not meant that catalogues, letters, &c., should not be made out in the language and weights and measures of the countries under review; the writer considers this to be of great importance, but still is of opinion that it is of more importance to transact business in accordance with the customs of the countries as this carries the most weight. Obviously, details cannot be discussed in an open letter of this nature.

To illustrate the point, a group of companies could be made for, say, railway work, comprising firms making in a large way—Structural steel shapes; corrugated iron sheets; water tanks; artesian well pipes and tools; windmills and pumps; hydraulic cement; rails; points, crossings and special work; bolts, nuts, tie bars, &c.; signalling apparatus, mechanical, electrical and automatic; carriages and wagons; locomotives; workshop tools, both for iron-working and wood-working; and some less important but necessary trades.

When considering the above, do not conclude that because a lot of the railways are financed by British capital and managed by British men and because business with such railways can be negotiated in London, the above combination is not necessary. It must not be overlooked that there are a lot of Government railways, as well as other railways, financed by other countries, principally France, as well as a considerable mileage of railway of a semi-private nature.

Again, with regard to the electric supply industry, a combination should be formed between makers of boilers and superheaters, economisers, steel chimneys, reciprocating engines, turbines, generators, condensers, economisers, pipes, switch and controlling gearing, transformers, rotaries, motor generators and motors, instruments, meters, cables, earthenware ducts, feed and circulating water pumps, workshop and machine tools, other necessary details from other groups, such as structural steel shapes, and so on.

The above list does not pretend to be complete, but is only indicative of the idea advanced.

The percentage each section should bear of the expenses of running the type of representation suggested could readily be arrived at by a round table conference.

Hanley,
July 12th, 1921.

J. E. Stewart, M.Inst.C.E.

Charges for Service Mains.

Your correspondent, July 8th issue, who writes about "holding up wiring contracts, to the benefit of gas companies," would do well to first find out what the latter would charge.

I have recently negotiated two contracts for running service mains for electric power and gas for furnace heating, and under similar conditions the cost of the gas connection is certainly the heavier of the two.

Your correspondent who signs himself "Disgusted" must realise that owing to the difference in money values and the consequent difficulty in obtaining capital, it is only reasonable that public utility companies should demand the cost of these connections.

London,
July 14th, 1921.

F. S. Paterson,
Consulting Engineer.

Armature Core Bands.

With reference to "Armature's" letter in THE ELECTRICAL REVIEW of July 1st, I had similar trouble with an armature of a motor direct coupled to a centrifugal pump, running at 2,000 r.p.m. The "core bands" kept spreading after a run of 6 or 7 hours, while the heavy end bands remained perfectly intact.

The spreading and bursting of the core bands obviously allowed coils to rise and strike the pole shoes, causing a serious "shut down."

The windings were speedily repaired and new bands put on; this time I put on double bands. The five single core bands of No. 13 S.W.G. wire were first put on and sweated up; then second bands of No. 22 S.W.G. were wound between the turns of the first—both bands were clipped at every fifth tooth, and sweated up solid. This gave a more solid band—the contact area for solder being considerably increased. The new arrangement proved O.K.

J. J. P. C.

July 14th, 1921.

Correspondence re the E.P.E.A.

I, too, am not a member of the E.P.E.A., but I should be obliged for a little space in your columns in order to reply to Mr. Dorey's letter in last week's REVIEW.

In the first instance, I should like to point out to Mr. Dorey that the very principle he is opposing is the ideal at which employer and union alike are aiming, namely, arbitration, in place of direct-action methods. He also points out that the "Grouzers" letters tire him—which is indeed a great shame—but he, perhaps, forgets that his recent continual stream of arguments with regard to the measurement of kVA greatly tired myself and many of my confederates in the supply industry.

Mr. Dorey's contemptuous letter is undoubtedly an insult to the long and hard efforts of the E.P.E.A., whose well-fought battles have brought about such splendid results on behalf of the previously ill-paid electricity supply operatives.

With great pleasure I give both my name and address for publication.

L. T. C. Russell.

Spring-wire Power Station,
Dudley, Worcestershire.

July 12th, 1921.

Village Electricity Supply.

I beg to enclose cuttings with reference to a proposed village electricity supply which is under consideration at Kingussie, in the Highlands. This scheme is to be burdened with the expense of getting a Provisional Order. Why is this necessary? The local Council is to carry through the installation. Many villages in this part of Scotland, possessing water power at present doing nothing, are likely to have paraffin as an illuminant for many years yet, through obstacles of one kind or another. As for electricity supply from these much-talked-of super-hydro stations for the whole of the Highlands, it is very doubtful whether this would be a paying proposition, as anyone who has a knowledge of this part of the country knows that there would be a considerable amount of overhead mains passing through miles and miles of rough, rockbound country, where there would not be a single consumer of the current. The very severe winters in this district would involve costly maintenance of aerial cables.

W. Winterburn,
Engineer.

Aviemore, Inverness-shire.
July 18th, 1921.

[The Act of 1919 substituted "Special Orders" for "Provisional Orders," and was intended to facilitate the grant of such powers as are sought by the Kingussie Council; we think the difficulties suggested in the cuttings forwarded by our correspondent have been exaggerated somewhat.]

An alternative course, which presents no difficulties, is to form a small company locally to supply electricity without statutory powers. Such a company would have a large measure of freedom, as explained in our issue of April 22nd, 1921, p. 611. Many installations of this kind are in existence in this country. — EDS. *ELEC. REV.*]

The Review of "Armature Winding."

I have just noticed your review of my book "Armature Winding," and I must say that it is not favourable to me at all. The only conclusion I can come to, since my work has generally been appreciated by readers of the ELECTRICAL REVIEW and other journals of the technical Press, is that you must have received a copy of the book which does not contain an errata slip.

In explanation of this, I desire to point out that the last proofs were checked on the eve of my departure for the West Indies, so that I did not really have an opportunity of checking final proofs. When I received a copy of the book at Kingston, British West Indies, some weeks after its publication, I detected a number of errors, and I at once informed Mr. Rentell, who had slips printed and inserted in the book. I, personally, had a slip typed and sent to the secretary of the Institution of Electrical Engineers, to whom I knew a copy had been sent, because I had already received an acknowledgment of it.

The first edition of this book is almost sold out, and I am now engaged upon its revision. I desire to assure you that all errors will be entirely eliminated in the second edition. Moreover, I am adding several new features to the book which will make it a much more valuable asset to the armature winder. Thanking you for drawing my attention to some of the mistakes.

Cyril Sylvester, A.M.I.E.E., A.M.I.Mech.E.

Douglas, I.O.M.

July 14th, 1921.

Coal Shortage and Oil Fuel.

In reply to Mr. S. H. Fowles's letter, I stated that at least three times as much oil would be used under boilers; I had in my mind the results which were being obtained with boilers at the moment I wrote the letter, and the results I had obtained with a modern all-Diesel power house, containing engines of various makes. I could easily have said four times as much per kWh and still have been within the figures. My actual record for getting a boiler on the range, which had been properly banked with coal and with several oil burners fitted, is 22 minutes; this was only done because of necessity and not because it improved the condition of the boiler. I don't think Mr. Fowles will beat 20 minutes by a big margin. The actual time to get a Diesel on load depends to a great extent on the number of cylinders and the weight of the flywheel; I had a special low-speed traction set once which took about a minute, but an emergency set in the same station would run up in a very few seconds, although it had fewer cylinders.

With regard to Indian native crews of ships, many of them can drive Diesels and they can be satisfactorily trained in this work in a very short space of time, seeming to have a natural liking for it, as there is no coal trimming or other work distasteful to them. So far as English-made Diesels are concerned, I have noticed that they vibrate more than they should, and I have seen quite a number of them giving trouble, mainly due to vibration and sluggish running. I own up to having ill-treated one Diesel engine, continuously for four years or so during the war, and although at the time about 18 years of age, and suffering from permanent defects, due to a premature birth, it was running better at the end of the time, and capable of taking a bigger overload than when it was first overloaded. If there are any points of practical value in connection with Diesel engines I should be glad at any time to discuss them; the scientific aspect of the problems seems to be well established, and the advantage of exhaust boilers and feed heaters is now recognised, as is the fact that the hot circulating water may also be of value. The trouble seems to be an operation difficulty, which I myself have yet to discover, but which has set the "powers that be" quite against this type of prime mover.

July 18th, 1921.

Junior Charge Engineer.

A Mysterious Occurrence.

With reference to the mysterious earth lamp trouble which is puzzling "A. H.," I think if he looks a little closer into the matter he will find it not so mysterious after all.

The most probable cause of it is in a faulty field coil of a motor which is flashing a large back voltage to earth.

It may arise from insulation faults in coils such as a solenoid or a lifting magnet, but at any rate I think he will be certain to find it is an induced current of high voltage.

It frequently happens in steelworks practice, and as a cure for the damage to the earth sets I would suggest putting another lamp of the same voltage (220) in the earth wire, which will give the necessary result. The difference is that during a dead earth, instead of one full light showing, the earth lamp will show a half and one of the mains a half. In the case of the excess voltage I have mentioned, the two lamps have a better chance of standing up to it until the cause of the trouble is located and removed.

I should be pleased to know if "A. H." finds my surmise to be correct in his case, or, if not, where he found the cause.

Arthur Coates.

Stockton-on-Tees.

July 15th, 1921.

Short-range Sea Horizons for Cable Ships.

With reference to the letter of Capt. Campos, I would suggest that a range finder greatly facilitates the use of a short-range sea horizon.

A M. telegraphship that is fitted with a 9 ft. Barr & Stroud range finder. By utilising the astigmatic lens the distance of a flare or light can be obtained at night with great accuracy at the moment of observation, whether the ship be stopped or moving.

In the North Sea, where good horizons are rarely obtained, excellent results have been obtained by using the lighted mark buoy in conjunction with the range finder.

Walter H. Leech.

Third Officer.

H.M.T.S. Alert.

July 15th, 1921.

NOT YET PUBLISHED

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18458. "Electric storage cases." Crompton Electrical Storage Co., Ltd.
and H. D. S. July 7th.
18461. "W. S. for holding electric lamp holders in position." D. J. K. Ltd.
and W. S. July 7th.
18466. "Motor control." United-Hammer Manufacturing Co., Ltd.
and L. Ltd. July 7th.
18467. "Apparatus for sampling steam." Curtis-Hammer Manufacturing
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18474. "Electric storage cases." H. H. Berry, July 7th.
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July 8th, 1920.
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JULY 29, 1921.

No. 2,279.

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SOME AFTER-WAR TRADE CONSIDERATIONS.

WHATEVER may be considered right, and whatever wrong from the point of view of the economists, of the bankers, and even of our Government advisers, we find it extremely difficult to "forgive and forget" and to "kiss and be friends" where temptation is dangled before us to buy electrical manufactured goods from those who precipitated the world war.

We have listened to and read the arguments of many a public speaker who tells us that the world can only be brought back to financial stability by our engaging in interchange of trade with our late enemies, but these speeches do not smother in our minds the strong views and determinations that we felt it our bounden duty to express in these columns week after week while the Continental slaughter was robbing us of, or maiming, those who were near and dear to us. The cry of the widow, of the mother bereft of her sons, and of the hundreds of thousands of orphaned ones is still heard, and the manifold effects of the war which made men curse German militarism and all its works prevent us from "forgetting," and in such a case if it be impossible to forget can it be easy to "forgive"?

We said many a time here during the war that one of the greatest evil consequences for our enemies would be the ill-repute into which their war actions would bring them as they endeavoured to regain foreign trade connections. We saw too, plainly enough, that the high cost of living here would eventually be one of the influences which would tell against British manufacturing and trading, because it would sway much public feeling over towards cheap foreign goods—the difficulty of living would make the private purchaser over-rule his sentimental prejudices and buy in what would prove to be the cheapest market, thus hindering the employment of British workpeople. To-day while Parliament is discussing the safeguarding of Key industries, German electrical and other machinery and apparatus is finding its way into the country, and German and Allied tenderers are, aided by the rate of exchange, putting in knock-out-blow estimates.

And all the while the wounds of the war are still smarting as with salt rubbed in. Is it to be wondered at that one hears of men in authority who cannot "forgive and forget" sufficiently to bring themselves to recommend the placing of contracts in Germany, even though it be between two and three years since the armistice was signed? If such transactions were not favoured in pre-war days they are certainly less so to-day, when our whole nature revolts at the thought that we shall ever feel disposed to advocate the placing of electrical contracts across the North Sea merely because prices quoted are lower than British tenderers can put in. It may be a temporary repugnance that leads us to give expression to feelings that are indiscreet in the estimation of the economists, but we think we are only saying in print what a large number of our readers are saying to each other as they read evidences of the lack of repentance which marks the proceedings that take place to-day in Germany in connection with certain trials.

So much for sentiment and prejudice; justifiable up to a certain point, and human—very human. Having

said these things, however, we are not so foolish as to imagine that the end of the matter has been reached.

We are up against severe German and other Continental competition which is due to a number of causes. We have got to meet it. Are we downhearted? No! How are we going to meet it, assuming that our prejudices run counter to Government policy?

We hold that the circumstances of the hour are such that there is reason to believe that British manufacturers are now able to compete far more satisfactorily than they have done for some recent Home, Colonial and foreign contracts. Reasonable competition between our manufacturers will do no harm, indeed, it will be all to the good in the matter of efficiency, which is bound to tell in the long run. It may be that the percentage of profit will be lower—well so be it if it must be so, for the maintenance of our trade at a lower rate of profit than of late is better than the loss of the trade and the profit too. Equally will it be the case that wages will fall. So be it, if it must be so, for lower wages, especially with the cost of living reduced, with plenty of work, are better than an increasing rate of unemployment. Yet neither need the profit be less nor the wages substantially lower if we all get our hearts into the work, and produce more per man and per machine, per hour, than we have been doing in these wasteful post-war years, with their deplorable idleness and irritating disputation over matters which vitally affect the earning of our daily bread.

Our present hopefulness that we are now nearer to definite industrial stability than at any moment since the conclusion of the war, is founded upon the better industrial atmosphere of the moment, due may we say, more to the teaching of practical experience than to the vapourings of public speakers or the writings of pamphleteers. Experience is a hard teacher; in its school have been learned some of the great inevitabilities. All industrial and trading peoples must learn them at some time or other or fail in the competition. We believe that in this country the remorseless nemesis of starvation which will overtake those who will not work, and the calamitous loss for those who decline to produce, or who place wrong limits on the volume that they are willing to produce, are consequences which have been learned better than in some other lands. The voice of the extremist is listened to now with less eagerness as the general mass of industrial employes recognise that there is not open any easy royal road to immediate prosperity. Unless we are greatly mistaken some of our competitors across the seas have to travel along more wearying roads than yet have been their lot. Others have learned their lessons through an experience more bitter than ours has been, and they are accepting their lot with a determination to rise above adversity by hard work, longer hours, and less disputation.

The result of the engineers' ballot in this country indicates that the tide has turned, that manufacturers can give surer and firmer tenders, while the outlook with regard to both labour and material will enable them to quote prices which need not take into account so wide a range of risk and they will also be able to give prompter delivery.

A Sound Investment. It is a trait of human nature that a very large proportion of investors turns to schemes which promise an immediate, substantial and tangible return. This is one handicap with which electrical appliances have to contend. Their first cost is generally high and their advantages, although enormous, are not always obvious, and for this reason remain unappreciated. It has been said, and we see no reason to contradict the statement, that the domestic load is the load of the future, and whatever can be done by suppliers of electricity to bring that future nearer should not be left undone. As it seems rather hopeless to expect consumers to bring about this consummation of them-

selves, the necessary action must be taken by the supply authorities. Little has hitherto been done in this respect, and it may be too early as yet to expect the powers conferred by Clause 23 of the Electricity (Supply) Act, 1919, to be fully exercised. Perhaps suppliers think that the hiring-out of domestic electrical appliances involves bold experimental work? Of course, circumstances differ in various districts, but we can point to an example which proves that the system can be successfully employed. The Westminster E.S. Corporation (whose exhibition was mentioned in our "Business Notes" last week) does not look for a direct refund of the money spent on appliances for its hire system; the load curve is a sufficient indication of success. This is not a recent innovation, having been in operation for a considerable time, and a commercial company does not continue unremunerative business.

Local agents for domestic appliances need not fear that their interests will be prejudiced, for there is ample scope for them also; the first essential is to enable the cautious consumer to satisfy himself, at a minimum outlay, regarding the advantages claimed for electrical methods, and this can only be accomplished by means of the hiring system. Once the consumer's confidence is established, he will be prepared to buy appliances outright, and the dealer will then share in the harvest for which the supply authority has sown the seed.

The gas industry stands as a striking example of what can be achieved by this means; and the electricity supply industry would be well advised in following its methods in, at least, this one direction.

The German Electrical Industry.

The Prussian Chambers of Commerce have recently undertaken the issue of a monthly report respecting the situation of trade in various industries. In the report for June it is stated that business in small electric motors experienced a slight improvement in that month owing to the requirements of agriculture in motors for driving thrashing machinery. On the other hand, the demand for large motors, generators, and transformers further declined. The effects of the world crisis are also reflected in business in measuring instruments. The telegraph and telephone branches, as the authorities concerned are refraining from placing orders, have been working for stock for some months past in order to avoid discharges of men. It is added that the export trade suffered from the uncertainty arising from the world market crisis and the customs and anti-dumping legislation.

Protection in Spain.

A Royal decree has been issued in Spain reserving to Spanish subjects the use of water powers forming the subject of concessions and providing for the use of Spanish machinery as far as possible. The first article suspends the Water Law of 1879 referring to perpetual concessions for the use of water powers for motive power and industrial purposes. In future, concessions will only be granted to Spaniards and to companies formed and domiciled in Spain, and in the latter case the chairman, directors and managers must be Spaniards, while only one-third of the other positions can be filled by foreigners. Concessions can only be transferred or leased to those who fulfil the preceding conditions. The maximum period of a concession will be 65 years, at the end of which all the works, machinery, transmission lines, etc., will revert to the State. All the machinery and materials used in connection with concessions are to be of Spanish production and manufacture, unless it is proved to the satisfaction of the Commission for the Protection of National Industry that it is absolutely impossible to obtain or produce them in Spain. The rights of existing holders of water-power concessions will be respected, but native materials and machinery will have to be used for any modifications or extensions of the works. A similar decree has been published in relation to mining concessions.

"SUPER-SCALE" MEASURING INSTRUMENTS.

SOME EVERETT, EDGUMBE DESIGNS.

SWITCHBOARD instruments giving deflections up to as much as 300° have long been in use, either in the form of power-factor meters and the like (which theoretically have an infinite scale length), or of the induction type which, whilst lending themselves admirably to such scales, are inherently subject to so many electrical errors that the mechanical errors introduced by a long scale are relatively unimportant. The 300° moving-coil instrument has been adopted in certain cases where it is essential that an approximate reading should be taken from an abnormal distance or where it is desirable, on

spect the instruments are unique. The moving-iron instruments of the super-scale pattern will be of special interest. Fig. 2 shows the "movement" of a 100-amp. ammeter, with the working parts slightly withdrawn from the coil for the sake of clearness. The deflection is caused by the repulsion of a moving iron A by a fixed iron G so shaped as to give the desired form of scale (see fig. 3). The exact shape of the scale is susceptible of further adjustment by means of the regulating lever B, which is then securely clamped in position by means of the locking nut shown. The winding itself consists

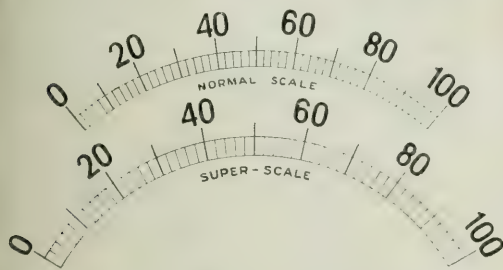


FIG. 1.

grounds of appearance, to have long disk scales entirely throughout a Scott Bow. In none of the cases cited, however, can increased accuracy be urged as a reason. In the production of "Super-Scale" instruments by Messrs. Everett, Edgumbe & Co., on the other hand, the procedure was, first, to determine experimentally what was the widest angle which could be adopted without any sacrifice of inherent efficiency, and it soon became evident that the angle of about 85° hitherto adopted could, by careful design, be increased by nearly 50 per cent. Next, the problem was to design a movement which would give the same degree of accuracy and be in advance of what had hitherto been found possible. Lastly, ques-

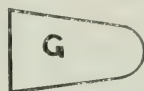


FIG. 3.

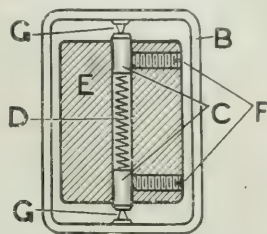


FIG. 4.

tion of a spiral of high-conductivity wrought-copper strip wound on edge and connected to heavy blocks c, c, into which the back connecting stems are secured.

The deflection is controlled either by gravity or by a spiral spring D, one end of which is attached to the zero adjusting lever E, and it may be added that double insulation is provided, so that an earth inside the instrument is a practical impossibility. The movement is rendered "deadbeat" by means of an aluminium vane attached to the spindle and working in the damping box

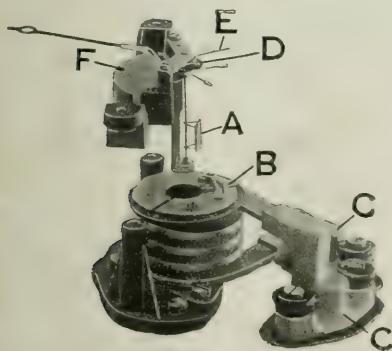


FIG. 2.

tions of damping, insulation, and overload capacity had to be considered, as well as the design of suitable cases, so as to take full advantage of the extra scale length now available. All the Everett-Edgumbe super-scale instruments have a scale length equal to the nominal diameter of the dial; for example, a 9-in. instrument has a 9 in. scale, a 6-in. one a 6-in. scale, and so forth.

Fig. 1 shows a typical super-scale and a normal scale, both from a 6-in. moving-coil instrument. The superiority of the former will be apparent, and this gain is not in the smallest degree off-set by any loss of accuracy, whether electrical or mechanical. In this re-

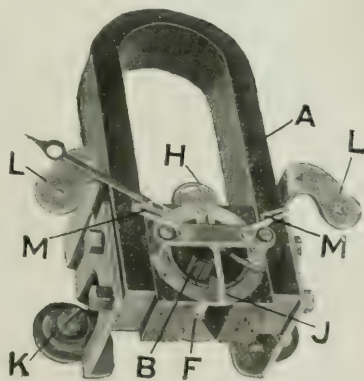


FIG. 5.

f, and the damping is extraordinarily efficient, being far superior, in fact, to that called for by the B.E.S.A. specification.

In the moving iron instruments described, the weight of the moving parts is no more than 1.7 grammes, and the ratio of torque to weight is 0.11, an exceptionally high figure even when compared with an 85° scale instrument of this pattern. The power consumption is only from 1 to 1.5 watts. After subjecting the instruments to overloads of more than 50 times the full-scale reading, they were found to be as accurate as before going through this ordeal; they had not even suffered any observable shifting of the zero, which represents far more severe conditions than could occur in practice,

and is probably unique. The tests were made with 30 and 50 times the full scale current respectively, and not merely with so many times full load current, which is the figure usually quoted in connection with such tests. On the latter basis the instruments under consideration withstood 100 times full load without sustaining any damage whatever. The scale divisions over the working range have been made as even as possible, whilst the upper (or overload) divisions are appropriately constricted, so that an overload of 30 per cent. can be read with certainty. If thought desirable, larger overloads than this could be arranged for by a further constriction of the upper portion of the scale.

The designers gave considerable attention to the elimination of hysteresis and other errors, and as a result one of these instruments can be used indiscriminately for alternating currents of 50 or 100 cycles or for direct current with an error of well under 1 per cent. of the full scale reading, even under the most adverse conditions. Again, the effect of changes of frequency is so small that the error at a frequency of 500 cycles per second is less than 1 per cent., and the effect of a change of wave-form is in all cases quite negligible. The same care has been devoted to the moving coil super-scale instruments and with equally satisfactory results. Fig. 5 shows the working parts of the moving-coil instrument; the permanent magnet *a* produces a strong field in the narrow circular air gap in which swings the moving coil *b*, consisting of a coil of wire wound upon an aluminium frame, swinging in pivots. The method of pivoting represents an innovation worthy of mention. In place of the usual external pivots, they are internal, the jewels being fixed in the core itself. Fig. 4 shows the core *b* in section. The coil *b* has two hardened-steel pivots, *a* & *c*, fixed on its inner side and working in sapphires mounted in the jewel holders *c*, *c*. These are pressed lightly outwards by the spiral spring *d*, and can be fixed rigidly in position by the two grub screws *e* (shown also in fig. 5), and by this means are clamped in such a position as to allow the necessary amount of "play" between pivots and jewels. The advantages of this arrangement are, first, that the greatest pressure which can be brought to bear upon the pivots is that due to the spiral spring *d*, which is so small as to preclude the possibility of damage, whereas with the usual arrangement of external pivots working in jewels mounted in screws, it is an all too common occurrence for the latter to be screwed down so hard that the pivots are badly damaged. Moreover, the fixing of the pivots is a much more mechanical business, since they are attached directly to the metal former instead of being held by means of silk, shellac, &c., to the outer side of the winding. The jewels are, in this way, held absolutely rigidly in a metal block (the core *b*) instead of being carried, as in the usual construction, by bridges which are necessarily mounted on insulating pillars or collets, and are therefore liable to deformation. Incidentally, should the instrument be subjected to great heat, the expansion of the former merely increases the "play" of the pivots, instead of forcing them against the bottom of the jewels, thereby turning their points, as is the case with the ordinary arrangement. Another useful feature in these instruments is the magnetic shunt (seen at *h* in fig. 5), which is readily adjustable and allows of the sensibility being varied; external zero adjustment is provided for by means of the lever *j*.

The special pointer stops, seen in fig. 5, consist of resilient flat springs *m*, fixed to the bridge, and carrying at their ends the flat insulating pieces which serve as a second line of defence in case the insulation of the coil should break down. The whole movement is likewise insulated from the case by means of the heavy insulating washings of mica-ite seen at *k*. The scale is carried on the brackets *l*, which form part of the movement and are thus an integral part of it. Instead of being mounted on separate pillars liable to displacement as in the usual construction. The damping—which is due to eddies set up by the motion of the aluminium former in the magnetic field—is exceptionally effective, and the weight of the moving parts has been reduced to about 2.5 grams,

the torque-weight ratio reaching the high figure of 0.18.

To satisfy themselves that the super-scale instruments would withstand the very worst of treatment, a number of moving-iron and moving-coil ammeters and voltmeters were taken from stock at random, and subjected to a severe test by means of a mechanical arrangement whereby the instrument was lifted some 2 in. from a wooden floor and allowed to fall thereon by its own weight at the rate of 300 falls per minute for two hours, in the case of each instrument, *i.e.*, it was repeated 36,000 times. After this, each one was carefully examined for mechanical defects and tested for electrical accuracy. In no single case could any defect be found.

Beside the round switchboard instruments and the open-dial pattern, the super-scale feature is applied to portable instruments of both the moving-coil and moving-iron types, and to a very useful set of double and triple-range portable super-scale instruments for use on a.c. circuits. When it is added that the super-scale instruments, although giving a scale nearly half as long again as the ordinary type, have a correspondingly increased accuracy of reading, it is safe to predict a great future for them.

JOINT ELECTRICITY AUTHORITIES.

London and Home Counties Inquiry.

(Continued from page 113.)

On Tuesday, July 19th, Mr. C. H. MERZ, on behalf of the County of London Electric Supply Co., gave evidence as to the relative policies of constructing new power stations and extending existing stations. The proposals put before the Commissioners were fundamentally different from the views put before the Commissioners in October. The County Co. proposed to erect a station of 170,000 kW capacity, and it was necessary to build the station if the County Co.'s area was to be developed adequately. This area was equivalent in importance to many large cities. He regarded it as a want of policy to propose any delay in the erection of modern plant to deal with this important area, and particularly the large undeveloped area north of the Thames. The erection of modern plant at once he did not think could be challenged. His own policy was to anticipate the load and not to wait for the load before attempting to deal with it. Plant nowadays did not cost more than it did before the war, especially having regard to improvements. Present prices were quite comparable with pre-war prices, and he had actually let contracts in the past few months at prices lower than pre-war prices. These contracts included turbine plant and steel buildings. The promoters of these schemes had been estimating in a falling market, and the estimates were out of date before they were completed. Another matter to be borne in mind was the improvement in the thermal efficiency. He did not believe that a technical Commission such as this would merely judge on what had actually been done, but would have some regard to the possibilities of the future. To-day was the proper time to begin to make preparations for capital stations, the thermal results from which would be such as to so reduce the coal consumption that the advantage of building capital stations at once would be far and away better than by extending existing stations. Dealing with the railway load, Mr. Merz expressed himself emphatically against the possibility of greater economy for the railways being obtained if the supply was given from a separate station. Handing in a table of comparison of thermal efficiencies, Mr. Merz pointed out that the average in London to-day, taking coal at 10.500 B.th.u. per lb. was 43,000 B.th.u. per kWh; the average for the County Co.'s station using coal at 11,000 B.th.u. per lb. was 30,800 B.th.u., whilst the estimated figure for the proposed Barking station of the County Co. was 17,000 B.th.u. per kWh. As a matter of fact, the County Co.'s estimated figure was actually being reached to-day, whilst its present figure was higher than the average of the L.C.C. scheme in the first stage, and therefore the County Co., whose area was largely a power area, could not do business on such a basis. The whole point was whether they wanted to develop electricity supply or meet an existing demand. The foundation of electricity supply was a low charge, and that really meant low coal consumption. The promoters spoke of putting down plant when the load came, and even of requiring a signed contract from the railway companies before thinking of putting down plant. He could not understand that point of view at all, and his experience was that they must be prepared to lay trunk mains 10, 15, or 20 miles, and take the electricity to the people's doors. In Chicago, Mr. Insull had secured the railway load by being ready to supply it. Again, it was on the North-East Coast, where the supply was available, that the most comprehensive railway electrification development

was in hand. Even in London, he imagined that the London Electric Supply Corporation got the L.B. & S.C. Railway contract because it was ready to give the supply. He failed to see how the Joint Electricity Authority could be in a position to supply railway companies without capital stations. With all respect, he regarded the Commissioners' powers under the Act of 1919 to refuse consent to a railway company erecting its own power station was rather illusory in the circumstances likely to arise under the L.C.C. scheme for extending existing stations. Another aspect was that the absence of such a progressive policy was seriously handicapping their manufacturers, because experience with working large plant at home must be obtained before they could be supplied abroad. Recently a large Melbourne order went to America because England could not supply owing to lack of experience with the larger plant. Progress would not be made if there were such obstructive opposition as had been given to the County of London Co.'s scheme. The Commissioners had sanctioned 250,000 kW of plant in small uneconomical stations without opposition, yet the only people who had come forward and were prepared to erect a modern station at their own cost, had met with obstructive opposition, and the scheme had been held up. His view was that the County Co. had vision and the others had none.

Discussing railway electrification in some detail, Mr. Merz said that, relieved of the capital expenditure on power stations, there would be every inducement for the railway companies to go ahead with rolling stock. The Romford area of the County Co. was an exceedingly important one. He had been concerned with the removal of works from London to the North-East Coast, which would not have taken place had an electricity supply been available. He was so convinced of the possibilities of the Romford area of the County Co. as to say that if the company was allowed to go ahead, the 100,000-kW station proposed would be 200,000 kW in a comparatively few years. On the question of voltages, Mr. Merz said that his experience was that British cables were ahead of any other country, yet English makers had no opportunity of supplying them. By increasing the pressure to 60,000 or 70,000 volts, the cost of transmission would be very materially reduced below the £1 per kVA-mile which had been spoken of.

Asked by the chairman as to the savings in operation at Barking, compared with the two existing stations of the County Co. at Wandsworth and City Road, if they were extended, Mr. Merz put the saving at £50,000 per annum for dealing with the load in the London area. The amount put down for the operation of the Barking station with a 54,000-kW load was £55,760 for superintendence, wages, rates, taxes, and insurance. For repairs and maintenance £14,400 had been allocated, and for boilers and stores, £5,400.

Mr. CRAIG HENDERSON cross-examined at length for the L.C.C. Mr. Merz said if he were one of the Commissioners he would say that the only commercial policy to adopt was to get some good modern plant erected so as to have an alternative when proposals were made to extend the existing uneconomical stations. He had not looked at the matter apart from the supply for the County of London Co.'s area. The County of London Co.'s Barking power station could be at work in three years, and meanwhile there was a temporary supply from the City Co. at Bankside. He doubted whether any advantage could come to the County of London Co. from a general linking up before the Barking station was built, and he knew of no better site than Barking.

The purport of this part of the cross-examination was that the County Co. might, if consent was given for the erection of the Barking station, be able to supply the whole area delimited, and that would be detrimental to a comprehensive scheme on the lines of that of the L.C.C. In answer to questions as to the need for new power stations, Mr. Merz said he saw no need for the Beckton station, nor for the one proposed on the site of the Thames Ironworks, nor that proposed at Deptford, although it might be possible to make out a case for a "peak" station at Chiswick.

Answering questions by Mr. TURNER and Mr. KENNEDY, Mr. Merz said the question of London supply had been discussed for so long that he did not believe the railway companies would go seriously into the matter of electrification and taking supply from outside until they at least saw the foundations of a power station in being and plant ordered.

Mr. KENNEDY put some questions about present prices of plant, and said that in July, 1921, a figure of £7.81 per kW for a 10,000-kW turbine alone, without condenser, had been quoted. Mr. Merz replied that he had placed orders for British plant within the past three months at £3 per kW, for a 15,000-kW turbine.

Later Mr. Merz said that the 17,000 thermal units per kWh of electricity sent out was being obtained at the Dunston power station, with a power factor of 50 per cent.

At the resumption on Wednesday Sir HERBERT FIELD interposed a witness on behalf of the Surrey County Council, which had lodged an objection.

Mr. C. B. EDGAR, M.P., Chairman of the Surrey County Council, said that at a conference of the local authorities in the county, opinions were expressed in favour of the inclusion of the whole of the county in the area delimited by the Commissioners. Another conference had been held last week, at which a resolution was passed asking that those parts of the

county which would not benefit during the first stage of the scheme should not be included without their consent. Speaking of the proposed constitution of the Joint Authority under the L.C.C. scheme, witness said he had appointed a sub-committee, consisting of such a large number of representatives of the L.C.C., and he held the view that there should be direct representation of the Surrey County Council if the whole of the county was included in the area of supply.

Cross-examined by Mr. HENDERSON, for the L.C.C., witness said that by splitting up the county, the Joint Electricity Authority would be taking over the best parts of the county from the point of view of electricity supply. What he wanted was for an interval to be allowed in which the various local authorities in Surrey should make up their minds to come in or not. Meanwhile, the whole county should be left out.

Mr. TURNER, for the Conference scheme, ascertained from the witness that Surrey would prefer to come into the Conference scheme on the same terms as those asked for by Middlesex.

Mr. MERZ was then further cross-examined by Mr. KENNEDY for the nine companies' scheme, who offered to place before the Commissioners, confidentially, full details of recent contracts awarded by the Companies if Mr. Merz would do the same, and it was arranged that the Commissioners should have access to the documents in both cases.

Mr. DONALD, on the question of prices of plant, suggested that British manufacturers were quoting lower prices for delivery abroad than they were for home orders, and that that accounted for the lower price mentioned by Mr. Merz for the 15,000-kW turbine.

Mr. Merz said the case he had in mind was an f.o.b. order, but whether British manufacturers were supplying more cheaply abroad than in this country, he referred Mr. Donald to the manufacturers. On the economical size of generating plant, Mr. Merz said that 25,000 kW was not the best sized unit. At present from 15,000 to 20,000 kW gave the best advantage, and anything above that should be in the neighbourhood of 30,000 or 35,000 kW.

Re-examined by Mr. MORSE, Mr. MERZ said his view was that coal consumption was the dominating factor in the electric power problem, and not finance. Coal consumption had not received the attention it merited.

The question of extension of tenure of the London Companies was touched upon, but Mr. MERZ said the opinion of the County Company was that it had an area in which it could get many times the business which it now had, and it attached more importance to getting this than to the question of extension of tenure in the London districts. Finally, Mr. Merz said it would be a calamity if other railway companies were compelled to put up power stations. The power stations of the L. & N.W. Railway and the L. & S.W. Railway Companies were not on the best of sites, and an attempt should be made at once to erect a really modern plant.

In the afternoon Mr. MERZ answered questions put to him by the Commissioners. In reply to Mr. PAGE, he said that the provision of modern plant was the best solution of the London problem to-day. At the same time, he was always anxious to secure unity, but if it were a question of choosing between modern plant and unity, he was quite confident that the question of modern plant was the more important. He referred to the Coal Conservation Committee's Report, which strongly emphasised the necessity for the provision of modern plant. As to the financial risk involved by the prosecution of the County Company's scheme, this, of course, applied to any undertaking pursuing a progressive policy. With regard to the carbonisation of coal, his view was that if coke was to be used under the boilers of generating stations, that coke would be better produced by the authority controlling the generating station than bought from outside.

In answer to Mr. LACKIE, who considered that the figure for maintenance at the proposed Barking station, given as £14,400, was very low, Mr. MERZ said that meant day to day maintenance of plant, apart from actual renewals. The figures were based on those obtained from other stations, and were the estimated maintenance charges for the first commercial year of the operation of the scheme.

Mr. C. P. SPARKS, late Engineer-in-Chief to the County Company, handed in charts showing the actual growth of the demand on the Company's generating stations from 1900 to 1919, and the estimated demand up to 1924. The figures were given at the previous inquiry held in October last year. At the end of 1919 the demand was 26,000 kW, and the estimated demand at the end of 1924 was 42,000 kW. Mr. Sparks referred to the impediment of the development of the County Company's area due to lack of plant. The actual load last winter was 27,000 kW, which could have been greatly exceeded, but in order to keep down to that figure it had been found necessary to restrict supplies. He had stated at the October inquiry that double the figure of 7,000 kW per annum would have been a moderate estimate in respect of new connections, and he put in a diagram showing additional demands on the Company's stations if sufficient plant were available. He estimated that if the Company had sufficient plant, it would be supplying 54,000 kW in 1924, instead of 42,000 kW. With regard to the Romford area, there was a considerable amount of private plant installed there, and there was a very considerable potential demand.

As an instance of a supply which had actually existed in the Company's area, and had been lost to it, he mentioned that the electro-chemical industry actually existed there, but had

now been transferred to another area altogether because of inability to obtain power.

Dealing with the cost of plant, Mr. Sparks said there was a very substantial reduction in present prices as compared with those ruling last year, and he agreed substantially with the figures given by Mr. Merz in this connection. His opinion was that a modern generating station should be put up at once, he knew of no better site for that purpose than that at Barking.

Mr. CRAIG HENDERSON cross-examined, first, with regard to the inability of the County Company to meet the demand in its area owing to lack of plant, his point being that the war had had the same effect upon other electricity undertakings during the past six years. He did not see why the County Company should be put in the position of supplying other authorities any more than that a joint authority should be put in this position.

Mr. HENDERSON then dealt with the figure of £8,600 in respect of rates, taxes, and insurance in the company's estimate of running costs. Mr. Sparks explained that this represented additional expenditure which would be incurred in respect of those charges if the power were supplied from the Barking station as against extended existing stations, but counsel submitted that it would be helpful to have fuller information with regard to this figure.

The CHAIRMAN said that the Commissioners regarded the incidence of rates, &c., upon costs as a very material point.

Mr. KENNEDY had commenced his cross-examination on behalf of the nine companies when the inquiry adjourned.

Evidence was given on Thursday morning in support of statements handed to the Commissioners earlier by the Electrical Power Engineers' Association and the Electrical Trades Union. Mr. W. A. Jones, General Secretary of the E.P.E.A., represented that body as well as the Chief Technical Assistants' Association, and did not make any statement beyond that already handed in. He was not cross-examined by counsel.

In reply to Sir HARRY HAWARD, Mr. JONES said they were asking for representation which would enable the views of technical assistants to be put before the authority. Sir Harry pointed out that there would be a chief engineer to the Joint Authority, who would be responsible for carrying out the requirements of that body, and asked witness whether a committee of an advisory nature to assist the chief engineer would meet the wishes of the Association. To this Mr. Jones replied that the members would prefer direct representation, but further questions by Sir Harry failed to elicit any real reason why the latter was considered desirable.

Mr. PAGE and Mr. LACKIE also put a few questions, the latter referring to the problem of the interests represented contributing capital to the authority. The contention of the Association was, said Mr. Jones, that it would be a help to the Joint Authority.

The CHAIRMAN also raised this point, and said that the responsibility entailed by representation on the joint board should carry with it financial support. As he understood it, the two reasons for the Association desiring representation were that it should be able to give technical assistance, and to improve the status of the technical assistants. A difficulty he foresaw was that there would be an assistant engineer actually on the board, and he would thus be in a position of authority over the chief engineer. Mr. Jones replied, however, that the representative of the Association on the joint board would not necessarily be an employé, but a member of the Association.

Mr. WEBB (London District Secretary of the Electrical Trades Union) supported the statement previously forwarded to the Commissioners by that body with a view to representation.

Mr. CRAIG HENDERSON (counsel for the L.C.C.) said that in the Union's statement the L.C.C. scheme was referred to, which made provision for two seats on the joint authority in the labour interest, and it was said that this number was totally inadequate. He asked, therefore, what was adequate representation in the opinion of the E.T.U.

Mr. WEBB said at least half (laughter)—and added that he had been modest in making that request.

The question of financial support was again raised by counsel, in the course of which Mr. Webb said that the question of financial support was one for the Executive Council, and not for him to deal with, but he said that the Union could not consider the shouldering of half the financial burden "at the present moment."

Mr. PAGE said that the fundamental purpose of the inquiry was to find the best means of securing a cheap and abundant supply of electricity in London, and that if better wages and better conditions were to be the main object of the workers' representatives, this might react on other industries which used electric power, inasmuch as the price would be increased. Mr. Webb said that this would not necessarily be the case, because wages represented a very small part of the cost of electricity, and also, increased efficiency might result. Mr. Page, however, maintained that the wages bill in most undertakings was considerable.

Mr. SPARKS then re-entered the witness-box. He dealt first with the item of £8,600 for rates, taxes, and insurance, raised by Mr. Henderson on Wednesday, and again explained how that figure was arrived at. It represented what would have to be paid by the Company in 1925 if the Barking station were

erected and power supplied from there, minus the sum which would have to be paid if the same business had been dealt with at the Wandsworth and City Road stations. He pointed out that the figures presented to the Commissioners at the October inquiry were in respect of a hypothetical case, and these had been revised by Mr. Merz and presented again at the present inquiry.

Mr. HENDERSON contended that this did not carry them much further as to how the £8,600 was arrived at. After some discussion, in which the Chairman joined, the latter finally reiterated his statement made on the previous day, that the Commissioners fully appreciated the importance of the point.

Mr. TURNER, on behalf of the Conference of Local Authorities, stated that Islington had now agreed to come in under the Conference scheme.

Mr. KENNEDY then continued his cross-examination of Mr. SPARKS. Dealing with the railway load, which the County Company hoped to get by the erection of the Barking station, he suggested that if the station were erected, and the Company canvassed for the railway load, stating that it had, say, a 20,000-kW plant to deal with it, which could not be used for other purposes, the Company would be more or less in the hands of the railway people, and would have to accept almost any price offered. Mr. Sparks replied that the plant could be used for other purposes. Another point raised by Mr. Kennedy was the difference in the figures estimated per kW installed by the engineers for the County Company's scheme and the scheme promoted by the nine companies and other bodies, this being £20 in the first case and £25 in the other. The Chairman pointed out that the figures produced by the two bodies of engineers were very much on a par in the first place, because they were estimated at about the same time, and the £20 in the case of the County Company was the revised figure based on reductions in price since the October inquiry. Mr. Kennedy's cross-examination then turned on the question of crossing the river to the south side from the Barking site, the greater part of the Company's load being on the south side. Mr. Sparks agreed this was not an easy matter. They felt that it would prejudice their position if they disclosed publicly how the river was to be crossed, but they would put their plans before the Commissioners if they desired them to do so.

Mr. TURNER then cross-examined, and suggested that the County Co. was anxious to secure the railway demand for itself. This led to a prolonged discussion on the proposals of the two schemes for dealing with the railway load.

In summing up the position, the CHAIRMAN said that the County Co. was willing to take the risk of erecting a modern station in the faith that it would secure the railway load, whereas the promoters of the joint scheme were not taking this risk, and it was not their intention to supply the railway load. The position with regard to the railway load had altered during the course of the inquiry, the railway companies having withdrawn their scheme.

Sir HARRY HAWARD said that the first stage of the scheme, which did not provide for the erection of the capital stations, would cost £1,050,000, so that if the first stage were shortened to provide for the erection of the stations earlier in order to meet the railway load, it would involve the re-arrangement of the whole of the financial provisions.

In further discussion on the point, the CHAIRMAN pointed out that the Joint Authority should be in a safer position with regard to preparing for the railway load, because if it were lost it would be able to dispose of the extra load more easily owing to the large area which it would supply, whereas the County Co. would be confined to its own particular area of supply. He also added, in reply to a question raised by Mr. Tyler, for the railway companies, that the question of whether they should erect their own generating stations was in the hands of the Commissioners.

Mr. SPARKS, in answer to questions by Mr. BAGGALAY, agreed that the Barking site was preferred partly because of its nearer proximity to the centre of gravity of the load, which was about Southwark, but in addition there were difficulties in connection with the foundations at Dagenham, and the shallowness of the water there as compared with Barking, which would necessitate the erection of a long pier for bringing in supplies of coal, &c., transported to the site by water.

In the course of his re-examination, Mr. MORSE reverted to the suggestion made by Mr. Kennedy that by the erection of a station to deal with the anticipated railway load, the County Company would place itself more or less in the hands of the railway companies. He pointed out in this connection that the railway companies would not be able to build a station themselves without the consent of the Commissioners, so that they would not be able to demand what price they liked.

This finished the evidence to be brought by the parties concerned, and all that remained was the hearing of the final speeches of counsel. Important consultations were going on in connection with the County of London's Bill, now before Parliament, in which most of those at the inquiry are interested, and in view of this it was decided to adjourn until Tuesday last. The chairman, however, said that the proceedings must really finish by to-day, July 29th, even if it were found necessary to sit a little later each day.

On Tuesday, July 28th, Sir JOHN SNELL said that Mr. Lackie, on behalf of the Commissioners, had seen a partner of the firm of Messrs. Kennedy & Donkin, and of Messrs. Merz and

McLellan, and had examined documents, specifications, and tenders in order to prove certain prices, and without disclosing from whom the tenders were received, the position was this: For large sets, say, from 15,000 to 20,000 kW., for a speed of 3,000 r.p.m. the following prices had held within the last two months: For export purposes and not including erection, £3 per kW. of maximum continuous rating for the turbo-alternator without surface condenser or pumps. For home tenders, add 10 per cent., making £3.3 per kW. Adding cost of erection, the price became £3.6 per kW. For smaller sets than 15,000 kW., add 15 per cent., bringing the figure to £4.14 per kW. of maximum continuous rating. If auxiliaries were added, a further 10 per cent. must be added, making £4.55 per kW. These prices were for a frequency of 50 cycles. For a frequency of 25, further 10 per cent. must be added, making £5 per kW. and if instead of 3,000-r.p.m. sets, 1,500-r.p.m. sets were built, another 15 per cent. must be added, making £5.75. These figures gave the range of prices of the tenders examined by Mr. Lackie, and it appeared clear that on a first-class specification that British manufacturers had quoted in competition and *bona-fide*, for 3,000 r.p.m. sets, something over 15,000 kW. continuous rating for export purposes, without cost of erection, a figure of £3 per kW. for the turbo-alternator, and the prices were firm.

Continuing, Sir JOHN SNELL said it was the intention of the Commissioners to see personally the various sites proposed for the capital power stations in the various schemes.

Speeches of counsel were then commenced.

Mr. BAKER, for the North Metropolitan Electric Power Supply Co., said that at least he had not embarrassed the Commissioners by shifting his ground during the inquiry. His case had always been, and still was, that the North Metropolitan Co.'s area and its Willesden power station should be excluded from the area of any Joint Electricity Authority. His contention was that the onus was upon the promoters of the L.C.C. and Conference schemes to show that a Joint Electricity Authority was necessary, and not for him to show that one was not necessary, and if the promoters had not satisfied the Commissioners that it was advantageous to include the North Metropolitan Co.'s area within the jurisdiction of a Joint Electrical Authority, then it was not for him to have to show that no advantage would accrue to it. As to the area, the one delimited by the Commissioners was merely provisional, and was not intended to be the actual area. Mr. Rider and his brother engineers did not appreciate that position, and he believed it was for that reason, and that reason only, that the North Metropolitan Co. had been obliged to fight this case. He was certain that had the engineers dealt with the area purely on engineering grounds without any previously suggested area, the North Metropolitan Co.'s area would not have been included. Moreover, Mr. Rider had admitted in his evidence that he could not give any date when the North Metropolitan Co.'s area would receive any benefit, by reducing the cost of supply, for the larger scheme; but Mr. Rider would not agree to exclude the Power Co.'s area because it would create a precedent for other objectors to ask for exclusion. The evidence was a little contradictory, but no evidence had been given as to the benefit which would accrue to the North Metropolitan Co.'s area by this scheme within the immediate future. It would not do for the promoters merely to say it would not do the Power Co. any harm. He submitted that neither the L.C.C. nor the Conference had given the Power Co.'s position any serious consideration apart from that given to the companies which were purchasable under the Electric Lighting Acts, and from counsel's speech for the Conference scheme it was clear that he had not been made aware of the difference in the circumstances. Speaking quite frankly, counsel said the Power Co. had no confidence in any Joint Electricity Authority that might be formed, and preferred to be left in the hands of the Commissioners. The whole problem was an engineering one, and he did not think the engineers for the schemes would contend for a moment that it was essential to the engineering scheme that the Power Co.'s area should be included. Throughout the whole inquiry they had not heard why it would be to the advantage of the Power Co. The scheme of the nine companies did not include any part of the Power Co.'s area; although at first this scheme did include a part of its area, the whole of it had now been cut out.

Sir JOHN SNELL said the Commissioners wished to look at the matter from a rather different angle to that put forward by Mr. Baker, namely, from that of the benefit to the whole area.

Mr. BAKER: Even at the risk of detriment to us?

Sir JOHN SNELL: No. I do not say that.

Continuing, Mr. BAKER said he believed that if the engineers were left alone they would leave the Power Co. out of the scheme altogether.

Mr. SYDNEY MORSE followed for his numerous clients. So far as the East London scheme was concerned, the City of London Electric Lighting Co., Ltd., had elected to remain outside, in acceptance of the offer of the promoters of that scheme. The L.C.C. scheme had been so modified that the financial result was doubtful, and the City of London Co. was not prepared to be held responsible for any part of the finance. Concerning the West Kent Electric Power Co. and the South Metropolitan Electric Light & Power Co., nothing that had been said during the inquiry had changed their views against being included in the area. With regard to the County of London Electric Supply Co., too much had been made of the

suggested intention of that company to extend the proposed Barking station to 600,000 kW. Nothing was in contemplation beyond an installed capacity of 100,000 kW.

Mr. HENDERSON, for the L.C.C., said that in his sworn evidence to the Parliamentary Committee on the County Co.'s Bill, Mr. Merz had referred to 600,000 kW.

Mr. MORSE referred to a report of the L.C.C. this week with regard to the Barking scheme, and said that the wording of the report rather suggested that the L.C.C. feared a good scheme. His case was that a large power station should be built at once. The County Co. was willing to erect a capital station at once and, among other things, to be ready to deal with the railway load when it came along. The erection of the Barking station would not in any way prejudice any solution of the London electricity supply problem which might be decided upon. So great had been the demand upon the company that its sales branch had had to be closed, and the demand was such that the erection of the Barking station would not only enable the company to extend the uses of electricity, but to generate at a very much lower figure than at present. The company had agreed that if the Barking station was authorised an option should be given to the Joint Authority to take it over, upon terms to be fixed by the Commissioners, within seven years.

Sir JOHN SNELL asked, supposing the Commissioners at the end of the inquiry came to the conclusion that the County Co. had made out its case for the Barking station to be constructed immediately, was Mr. Morse instructed to assist the Commissioners now publicly by defining the attitude of the County Co. towards inclusion in a scheme for a Joint Authority which would carry with it an extension of tenure to the company undertakings?

Mr. MORSE said the County Co. was quite prepared to co-operate entirely, but the consent to the station should not be withheld until the Joint Authority or the complete scheme was finally passed.

Sir JOHN SNELL next asked whether the County Co. would agree to the leasing proposal of the nine companies as regarded the power stations of the companies?

Mr. MORSE said the position with regard to that was not very clear, but in principle his clients would not object to the leasing proposal.

Sir JOHN SNELL said the Commissioners would like to feel before the inquiry was closed that all the possibilities had been explored, in order to bring about a solution of the problem, so that the Commissioners could make a selection of the proposals put forward without prejudice to any undertaker, company or municipal, so that the whole could be brought together.

Mr. MORSE said his clients' view was that any settlement should be for a long period, and that there should not be recurring periods of, say, ten years when purchase of the companies could take place, or a similar recurring period with regard to the lease.

Sir JOHN SNELL: You want stability?

Mr. MORSE: Yes!

Mr. HENDERSON, for the L.C.C., protested that as the County of London Co. had refused to give evidence on the schemes, he had not cross-examined its witnesses on the point. Therefore, the suggestions now made by Mr. Morse might be prejudicial to the L.C.C. as the purchasing authority over the companies, and he protested now in order to protect his clients.

Mr. MOSELEY, for the Metropolitan Electric Supply Co., then addressed the Commissioners on very similar grounds to those put forward by Mr. Baker for the North Metropolitan Electric Power Co. The former company asks for its bulk area and its Willesden power house to be left out of any scheme.

Mr. TYLOR, for the ten railway companies in the area, began his speech during the last few minutes of the afternoon. He said that the position of the railway companies as consumers must be considered apart from the point of view of traction, because most of them had other uses for electricity at the present time. At the same time, the railway companies had no predilection to spend money on generating stations, and if the inquiry showed that they could buy energy more cheaply, no one would be more pleased than the railway companies.

(To be continued.)

North-East Midlands Electricity District.

YORKSHIRE ELECTRIC POWER CO.'S REPRESENTATION.

With reference to the proposed formation of a Joint Electricity Authority for the above-mentioned area,* for which purpose a scheme was recently submitted by the City Corporation of Sheffield,† we have received a copy of a representation that has been made to the Electricity Commissioners on the matter by the Yorkshire Electric Power Co. (of which Mr. W. B. Woodhouse is the engineer and manager), which states *inter alia* that the company is of the opinion that no advantage is to be gained by the constitution of a Joint Electricity Authority for its district, and that the creation of a second organisation can only lead to unnecessary expense.

That portion of the proposed district which is to the south of the company's area is within the area of supply of the Derbyshire & Nottinghamshire Electric Power Co. with which the Yorkshire Co. is prepared to co-operate in the interests

* *Elec. Rev.*, Oct. 1st, 1920, p. 434.

† *Elec. Rev.*, July 15th, 1921, p. 103.

of the economical development of supply. If it can be shown that any economy would arise from the combination of electricity supplies in the district to the east of the company's area with that of the company, it is prepared to consider arrangements to this end. Proposals to this effect have been made by the company to the North Lincolnshire Homeowners in the past, and the company is prepared to discuss with these power users or others any scheme which can be shown to be beneficial.

The company's area of supply extends into three proposed electricity districts, for each of which the Commissioners require schemes to be submitted. The company must regard the interests of consumers in its area as a whole, and submits that no division should be made unless it be shown to be in the interests of consumers in all parts of the company's area.

The company submits that no necessity can be shown for the establishment of a Joint Electricity Authority in its area of supply. The Yorkshire Electric Power Co. was created by Act of Parliament substantially for the purposes for which a Joint Electricity Authority would be established, and Section 12 of the Electricity (Supply) Act, 1919, recognises the special position of the Power Co. by restricting the supply of electricity by a Joint Electricity Authority in the Power Co.'s area. The purchase by a Joint Electricity Authority of existing undertakings would require the provision of a large amount of capital, and the transaction would almost certainly result in an immediate increase in the cost of electricity to the consumer. The provision of capital for such a purpose would involve either financial assistance from the State or an obligation on the ratepayers of the various areas in the proposed district to defray losses out of the rates. This burden would largely fall on districts in which a supply of electricity from the company is now available without any risk to the ratepayers.

The capital of the company has to a very large extent been raised in Yorkshire, and many of the shareholders are power users who have preferred to co-operate through the agency of the company in the provision of a supply of electricity rather than to install their own power plant. In view of the existence of the Power Co., the creation of a Joint Electricity Authority would involve uneconomical duplication and unnecessary expense. Any function which such an authority could exercise with public advantage could equally well be exercised by the co-operation which has already been brought about by the company without the expense and delay occasioned by the establishment of a Joint Electricity Authority. The establishment of a Joint Electricity Authority and the creation of the necessary organisation would involve not only expense but further interference and delay in the development of electricity supply at a time when delay would have a most serious effect in restricting production and industrial development in the important area in which the company is authorised to supply.

The delay already occasioned by the restrictions imposed prior and subsequent to the passing of the Electricity (Supply) Act, 1919, has created a serious position of affairs such that new and extended demands for power cannot be met promptly, and as a consequence the extensions of supply, so much to be desired in the interests of national economy, have been delayed.

The company is empowered to co-operate with other undertakers in the supply of energy and the carrying out of works required by the company or other undertakers by either party, separately or jointly, the formation of Joint Boards, and for other purposes in connection with the supply of electricity. The interests of the public are fully protected by the legislative restrictions to which the company is subject.

The developments of the company's undertaking are subject to the supervision and approval of the Commissioners; the company is limited as to the maximum prices it may charge and the dividends which may be paid to shareholders, and it is under definite obligations to supply all those persons in its area who require a supply of electricity.

In the company's area of supply there are 62 electricity undertakings of authorised distributors, of which number the company is supplying or has entered into an agreement with, 40. Seven of the remainder have not commenced to supply electricity, leaving 15 of the working undertakings not yet associated with the company in the supply of electricity in its area. The company has intimated its willingness in all these cases to enter into agreements for supply. Of the above authorised distributors, four are at work in that part of the proposed electricity district which is within the company's area of supply, viz.: The Corporation of Doncaster, Rotherham, and Sheffield, and the Urban District Council of Mexborough. With three of these—Sheffield, Rotherham, and Mexborough—the company has already made agreements for joint working, interchange of supply, and avoidance of overlapping. The considerable developments in the unification of the area of electricity by the company in its area have been made by agreement with other undertakers, having regard to the special circumstances of each case. It is submitted that a continuation of development on these lines, subject to the control and guidance of the Commissioners, will produce the best result.

The company's area of supply includes the Yorkshire coal field, which extends continuously from north to south across the boundary of the proposed district. The company is supplying a large number of collieries with electricity, and the

extensive system of mains which the company has provided covers a large portion of the coal field. These mains are available not only for supply to collieries and to all classes of users, but for taking power from those collieries which may have a surplus derived from waste heat. The association thus established permits in the simplest and most economical way the utilisation of waste heat or surplus power for the general benefit. In view of possible developments in the use of low-grade fuel the co-operation of the Power Co. with the colliery owners is likely to have an important effect in reducing the cost of producing electricity in the future. Developments of this nature are necessarily intricate and difficult, and not only involve financial risk, but require the closest association between the two parties to achieve success. It is submitted that in such new developments a company undertaking will obtain the best results.

Whilst the company is of opinion that there is no present necessity for, or advantage to be gained from, the creation of a Joint Electricity Authority in its area of supply, it desires to emphasise its willingness to co-operate in the fullest degree with other bodies in any development which can be shown to be in the public interest.

The company is prepared to meet all demands in the area entrusted to it by Parliament by a continuance of the policy of development by agreement with other bodies which has already produced such substantial results in the unification and extension of supply of electricity throughout its area. The company requests that the restriction as to the supply of electricity for lighting in districts where there are no authorised distributors, imposed by Section 48 of the Yorkshire Electric Power Act, 1901, be removed, and that the company be permitted to supply such demands as may arise on equitable terms.

If so desired by the local authorities, it is suggested that powers might be granted to any local authority in the company's area to subscribe for securities, shares, or stock issued by the company, to lend money, to guarantee or join in guaranteeing the payment of interest on loans or securities of the company, and to give financial assistance in any other form, subject in each case to the approval of the Commissioners.

Electric Vehicles in Latin America.—A Reuter message from Buenos Ayres says that while hitherto the call for electrically driven vehicles in the States of South and Central America has been limited owing to the generally indifferent conditions of all but the principal highways, the expenditure of large sums by the Governments of the leading countries, such as Argentina, Brazil, and Chile, upon new roads and bridges will soon open a new and important market for these manufactures, especially motor-trucks and taxi-cabs.

General conditions are favourable for the use of electrically-propelled trucks. There are few cities where street distribution of supplies from retail stores is more generally carried out, purchasers as a rule declining to carry their parcels, no matter how small. Provisions, such as meat, are also transported over long distances, the slaughter-houses being outside the city, as are all of the market gardens, while, as all supplies have to be delivered before noon, expedition is a very essential consideration. The hauls usually are short, and there are frequent stoppages owing to the press of traffic. The grades are very moderate, and this applies to the capital and other cities alike.

It has been decided to establish a number of charging stations in Buenos Ayres, so that a system of public electrically operated automobiles may be commenced.

Brazil has lately imported some electrically-driven passenger cars, and it is proposed to extend the number if the experiment proves successful. The cities of Rio de Janeiro, Sao Paulo, Santos, and Bahia are well adapted to such vehicles. Owing to the large amount of water power available in Brazil, the price of electricity is moderate, while prospects of the development of the waterfalls under Government encouragement are exceptionally attractive.

Associated Municipal Electrical Engineers.—At the adjourned annual general meeting, held in London on July 22nd, the report of the Executive Committee for the year ended May 31st last was adopted. The report states that the total membership of the Association is now 188. It is announced that the I.M.E.A. Chairmen's Committee has definitely accepted the minimum salaries scale, and it is hoped that the Standing Joint Committee of chairmen and engineer members to deal with conditions of engagement will be of material benefit. During the year the bye-laws of the Association were revised in order to secure a certificate under Section 2 (3) of the Trade Union Act, 1913. The report regrets that no amendment has been made in the compensation clause contained in the Electricity (Supply) (No. 2) Bill, but should the Bill be proceeded with every endeavour will be made to secure adequate protection in the case of loss of office.

The statement of accounts issued with the report shows increases in income and expenditure, the balance in hand at the end of the year being £38, making with the balance from the previous year a total of £99.

MAGNET HOUSE.

Mr. Hugo Hirst, the chairman of the General Electric Co., Ltd., spoke to the shareholders with justifiable pride of the building in which the annual general meeting was held on July 21st. It is 32 years since the G.E. Co. came into existence, and the rapid advance of its business has compelled it to seek more commodious premises to house the offices, to store the manifold products of the company, and to provide showrooms where goods may be displayed to the best advantage. The result is Magnet House.

With admirable prevision the company secured the splendid site in Kingsway nine years ago, but the war intervening delayed the completion of the building. Mr. Hirst, in his speech, told his audience that the design of the building possessed three prominent features—utility had been a deter-



FIG. 1.—MAGNET HOUSE, KINGSWAY.

mining factor in the part devoted to offices, warehouses, showrooms, &c.; dignity played a part in the design of the offices of the leading officials; and sentiment was shown in the design of the entrance hall, which they had dedicated to the memory of 252 of those noble men who laid down their lives to save their country.

A visit of inspection to Magnet House will be amply repaid, for it may be said that in few other buildings has more care been taken to cater for the convenience and comfort of customers during their personal visits and to ensure the prompt and accurate execution of their orders. Every modern labour-saving device has been adopted, the installation being carried out on a scale commensurate with the size of the organisation it has to serve, and being in every instance specially designed to meet its particular needs. Every detail of the electrical equipment of the building is a product of one or other of the works of the General Electric Co., Ltd., or of its associated companies.

As an architectural achievement, Magnet House is excellent in conception and harmonious in design, as the main facade (by Mr. R. Frank Atkinson, F.R.I.B.A.), a photograph of which is reproduced in fig. 1, testifies.

The building covers a ground area of 25,722 sq. ft. and has eight floors, including the basement. Each floor is divided into eight sections by brick walls, fitted with double iron fire-proof doors. These doors, of which there are 130, were made by the company at the Fraser & Chalmers Engineering Works, Erith. They are of several types, some consisting of a single panel and others of three or four panels with hinged folding sections, allowing room for people to pass through without having to open the whole door.

There are five staircases giving access to the various floors, which are also served by seven passenger and eight goods lifts, made and erected by the Express Lift Co., Ltd. The Express Lift Co. was also responsible for the complete system of hoists and runways for loading and unloading vans and lorries, and for handling bulky goods. This lift equipment, comprising a total of 23 machines of various types, forms an epitome of modern practice in lift design and construction.

All inter-departmental correspondence is distributed by means of pneumatic tubes. A central exchange is situated near the entrance hall for dealing with this service, and is also used as a sorting office for incoming mail, letters being afterwards sent to the various departments by the tubes. Ventilation is secured by a network of ducts connected to a large air-washing plant and vacuum tubes are also installed for cleaning.

The main entrance hall, shown in fig. 2, is of stately proportions, the stone walls and marble floor forming an excellent background for the massive bronze gates and ornaments. A wide marble staircase, in the well of which run two high-speed passenger lifts, leads from the basement to the sixth floor, and at each floor opens out to a spacious vestibule.

In the basement are the showrooms, which offer practically the largest and most comprehensive selection of electrical goods in the United Kingdom.

On the left of the vestibule is a handsomely decorated suite of rooms devoted to the exhibition of electric light fittings and domestic electrical appliances. With a full appreciation of the value of display and demonstration, the company has devoted much thought and care to this important section, with the result that the comfort and convenience of the visitor are catered for in the most complete manner.

The various showrooms have been laid out with the object of facilitating the selection of fixtures to harmonise with any existing scheme of colour or decoration, and serve to make this an easy and pleasant undertaking. The central apartment, which is decorated in Georgian style, comprises a large display of Georgian and modern fixtures of all types. In the French room (fig. 3), which is tastefully decorated in white and vieux rose, is to be found a choice selection of Louis XIV and Louis XVI electroliers and brackets, together with French statuettes, bronze figures, and table standards. The Adam section, carried out in tints of Wedgewood green, contains many excellent examples of brackets, pendants, and electroliers in this style. Another period room is arranged as a Jacobean dining room, displaying chandeliers, lanterns, and table candlesticks of Tudor and Jacobean design, many of which are faithful reproductions of antique originals. The section devoted to a display of ware holds an excellent assortment of inverted fittings, vases and pedestals. Unique and artistic silk shades in great variety are arranged in an adjoining room, and the remaining apartment (fig. 4) is devoted to an exhibition of domestic electrical appliances. Here are demonstrated heating and cooking appliances, electric irons and fans, vacuum cleaners, washing machines, and practically every conceivable electrical requisite for domestic purposes.

On the opposite side of the vestibule is a large industrial showroom containing comprehensive displays of lanterns and



FIG. 2. THE ENTRANCE HALL.

fittings for factory and street lighting, ships' fittings, and other items of electrical equipment for ships, switchgear, telephones, electric light supplies, cables and wiring materials, and other products of the company. One interesting feature of the display in this section is a board demonstrating the company's new surface 'Kingsway' wiring system. A considerable amount of the wiring in the industrial showroom is also carried out on this system.

The greater portion of the ground floor is taken up by the sales counters, which form a continuous line 140 ft. long. Considerable storage accommodation is arranged above the counters, and the bins can be quickly replenished from the main stockrooms on the upper floors by means of electric service lifts operated by a system of push buttons. The salesmen are in telephonic communication with their departmental

stockrooms, so that in the event of any required article not being available at the counter, instructions can immediately be given for it to be sent down by these lifts. Under the counter runs a silent belt conveyor which carries customers' purchases to separate packing benches at one end; the salesmen are thus relieved of the task of tying up parcels, and are consequently enabled to attend to the requirements of customers in the most expeditious manner. This belt conveyor—another product of the Fraser & Chalmers Engineering Works—consists of a rubber-covered duck belt running over idlers mounted on a substantial steel frame. It is driven at a speed of 120 feet per minute by a 2 h.p. Witton motor through one of the EXPRESS LIFT Co.'s silent worm gears. The motor is controlled by a "Salford" ironclad double-pole switch and fuse and a standard G.E.C. face-plate starter. The goods to

despatch department by goods or service lifts, and the completed packages are lowered in special containers by combined cranes and runways into waiting lorries in the van dock below.

The stock-rooms on the fourth and fifth floors are equipped with some 12,000 steel bins, and are arranged on a deplete plan to facilitate the work of looking out goods for the execution of orders.

The telephone exchange, which has 50 incoming lines and 308 internal extensions, is situated on the fifth floor. The whole of the equipment was manufactured at the Peel-Conner Telephone Works.

The offices of the illuminating engineering department, a large and well-lighted fixtures design office, and a meter test room and workshop, are located on the sixth floor. Near by is a large staff canteen fitted with a complete equipment of the company's "Magnet" cooking apparatus, including urns, hot-water calorifiers, and hotplates. Here the staff can enjoy a light luncheon at mid-day and a cup of tea during the afternoon. A large lecture hall is also situated on this floor. It has a seating capacity for 350 people, and is used for the social recreation of the staff, as well as for lectures on technical and commercial subjects.

The motor rooms for the various passenger and goods lifts are on the roof, which is reached by four emergency staircases. These motor rooms have been designed to afford every facility for inspection of the different drives and controls.



FIG. 3.—FRENCH PERIOD SHOW-ROOM.

be packed are placed in wire baskets fitted with wooden runners, and, during the busy hours, follow each other in endless succession to the delivery end, where they pass over ball-bearing rollers to the packing benches.

In the van dock at the rear of the building are three cranes and runways for handling incoming goods. Cases are lifted from the lorries and lowered to the receiving department in the basement. Here the goods are unpacked and distributed by lifts to the stockrooms on the fourth and fifth floors.

The first and second floors are principally devoted to administrative departments, among which the spacious counting house on the first floor, the board room, and the catalogue



FIG. 4. DOMESTIC APPLIANCES SHOW-ROOM.

and information bureau on the second floor deserve special note. The offices of the departmental managers and the large despatch and general office are also situated on the second floor. A plentiful provision of signs in prominent positions direct the inquirer to the various departments.

On the third floor is the commodious and well-arranged despatch department, with its rows of bins and packing benches. To each despatch clerk is allotted a definite section of the alphabet, so that he always deals with all the orders of every customer in his section. Adjoining the despatch department is the packing room. Goods are delivered to the

LEGAL.

BULLERS, LTD. v. J. BREEDEN & CO., LTD.

IN the Mayor's and City of London Court, on July 21st, plaintiffs claimed £14 11s. 7d. against defendants, lamp manufacturers, of Birmingham, for the balance of account for porcelain heat dispersers supplied. Mr. Page appeared for the plaintiffs and Mr. Graham Davis for the defendants.

MR. PAGE stated that on March 20th, 1919, a contract was made by which plaintiffs were to supply the defendants with 10,000 dispersers. They were used in electric light bulbs and cost about 2½d. each. Delivery was to be made in eight weeks. There was considerable delay in making delivery owing to the trade congestion and various other causes. On July 25th, 1919, before plaintiffs made any deliveries at all under the contract, they received a letter from the defendants in which they said there was to be a slight alteration. That was done and certain alterations in the plant had to be made. At least a month of their time was used in which the alteration had to be made. No delivery was made by the plaintiffs until October. On August 28th defendants wrote a letter which plaintiffs said was a waiver. On October 24th they wrote and said what they would like to be assured about was the quantity which the plaintiffs could definitely promise delivery of per week, especially in view of the fact that the plaintiffs had further orders in all probability. Time might or might not have been the essence of the contract, and the defendants might have been entitled to repudiate the contract, but the letter which they wrote was a pure waiver. Deliveries commenced in October and continued for 15 months at intervals of about 11 days. Every delivery was accepted and paid for until November 27th, 1919, when defendants wrote and said: "We are again anxiously waiting for the dispersers." That showed their attitude. It was simply that of a person who had been disappointed. They were glad of deliveries when they could get them. On September 15th, 1920, they wrote and asked what their price would be for another 10,000 or 20,000. On November 2nd, 1920, plaintiffs wrote and said the balance of the first 10,000 would be completed so far as the manufacture was concerned in 14 days, and if they wished plaintiffs to continue manufacturing they would be glad of instructions. Defendants went on accepting deliveries until December 8th, 1920, when they wrote and said they had to request plaintiffs not to deliver any more goods until they advised them further as they were having to accept large cancellations of orders because of the non-supply of plaintiffs' goods. Before that was received one of the consignments was on the road. Defendants subsequently said that they looked upon the whole contract as cancelled.

MR. DAVIS said he agreed that the contract was for delivery in eight weeks. They took delivery until all sorts of excuses were made, such as were received during the war. There was not a new contract and not a waiver of the defendants' rights. It was a postponement of their rights. They had to complain bitterly of the great delay up to November, 1920, and then plaintiffs wrote on November 2nd and said the rate of delivery would be considerably increased, and that the balance of the order would be completed in 14 days. Up to that time they had practically postponed their rights of cancellation. When the 14 days expired and they got sick of the delays they said "cancel." Plaintiffs could not go back on their promise to deliver in 14 days.

Judge JACKSON said he had come to the conclusion that there was a waiver of the contract, and he found for the plaintiffs with costs.

BROKEN INSULATORS.

At Doncaster Borough Police Court, last week, seven pit youths, of Adwick-le-Street, were fined 20s. each for trespass, and 20s. each for damage to telegraph insulators on the railway between Carcroft and Castle Hill. It was stated that very many insulators had been broken during the past three months, and foreman John Sawsby had just completed the replacement of broken ones by new ones when the defendants were seen on the railway line throwing stones, and when the foreman went back to the spot he found more of the insulators broken.

WHITEGATE BRICK CO., LTD., v. O'BRIEN & CO.

At the Manchester Assizes on July 20th, the Whitegate Brick Co., Ltd., sued Messrs. O'Brien & Co., electrical contractors, for damages for an alleged breach of contract. It was stated for plaintiffs that the defendants were asked to supply a 10-h.p. motor suitable for d.c. power at 500 volts. A motor was delivered, but after three or four days' running was burned out, and the plaintiffs stated that it was totally unfit for the supply employed. They accordingly returned it, and asked for the refund of the sum of £136 paid for it. This was refused, and the damages now claimed amounted to £539, including reparation for loss of work, &c. The defendants said that thousands of similar motors were being supplied for direct current, and the failure must have been due to improper handling. It was decided to submit the case to a technical referee.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New Continuity Fitting.

A simple but effective device for ensuring the continuity of electrical conduit systems has recently been patented by MESSRS. RYELAND & Co., 44, Weston Street, St. Thomas's Street, London Bridge, S.E.1. The fitting is made in two types, both of which are illustrated in fig. 1. The first type is intended for "straight-through" joints only; it consists of a strip of steel (or other metal) at each end of which is a clip which is an integral part of the fitting. The clips are provided with nuts and screws for fixing the device on to the ends of conduit. The flat part of the fitting can be passed behind a connector box, fuse board, or any other component of an electrical circuit, providing an unobtrusive and continuous conductor, safer than the methods usually employed for this

nary arc. Another important feature is that, with the exception of striking the arc, the operation is automatic. In place of five hand adjustments as on the ordinary lamp, this lamp has only two. No adjustment of the carbons should, therefore, be necessary during normal operation. The only movement to set the arc at the focus is a longitudinal one which, once determined for any particular lens, does not have to be readjusted.

The positive carbon is horizontal, projecting through the positive nose, while the negative carbon is at an angle of 60 deg. to the horizontal, and so located that its tip is never between the crater on the positive carbon and the lens; 90 per cent. of the whole illumination given by the arc comes from the deep crater in the positive carbon, which is held tightly by a clamp to the feed screw which, with the carriage, is rotated by a bevel gear and pinion connected to the motor through a worm-gear train. A star-wheel fastened to the feed screw with the feed screw and clamp around the axis of the carbon, and feeds the latter forward by engaging with a detent.

The negative carbon is not rotated but is fed by means of a clamp on the feed screw, which is rotated by bevel gears. These gears are driven by the motor through a worm-gear train and clutch. Automatic regulation of the arc length, and consequently of the rate at which the carbons are fed, is secured by connecting the motor across the arc. Thus the speed of the motor is unaffected by any fluctuations in the power supply, being dependent on the arc voltage.

Little time is required for changing carbons. As the current is carried through the carbons for only a short distance from the arc end, the remainder of the carbon does not become so hot as it would if the current passed through its whole length. Furthermore, when new carbons are inserted, no vertical or horizontal adjustments are necessary to get the crater at the focus of the lens, because the holding mechanism cannot be moved out of position. The entire device is designed with a view to compactness. It is for use in theatres requiring a more intense light source, having "daylight" colour values, that the "high intensity" projection arc lamp has been produced.

Toy Transformers.

A device for giving a safe and constant supply of electricity for the operation of electrical toys and models is supplied by the BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, E.C.4. This is a small transformer equipped with six feet of flexible cord and a lampholder adapter. Unlike a battery, it is always ready for use, never requires renewal, and, above all, is perfectly clean. B.T.H. toy transformers are made in four patterns, all of which, with the exception of the smallest, are provided with control switches on the secondary windings and alternative primary tappings. These two adjustments permit of a wide variation of secondary voltages ranging, in 2-volt steps, from 4 to 22 or 28 volts. The smallest size is finished in green, and may be used for working small motors, &c. Two are finished in red and black, and are suitable for the operation of medium-sized toys; while the largest (also finished in red and black) is intended for the operation of big toys and models.

At present B.T.H. toy transformers are only supplied for 110 volt circuits; three of them having a frequency range of from 25 to 49 cycles. Transformers for 200-volt circuits are, however, in course of design, and will shortly be available.

The "Duros" Accumulator.

A novel type of accumulator (fig. 2) has been introduced into this country by MESSRS. E. G. LINT & Co., of 150, Buckingham Palace Road, S.W.1. It is designed especially for use on signalling installations, for telegraph, telephone, and railway

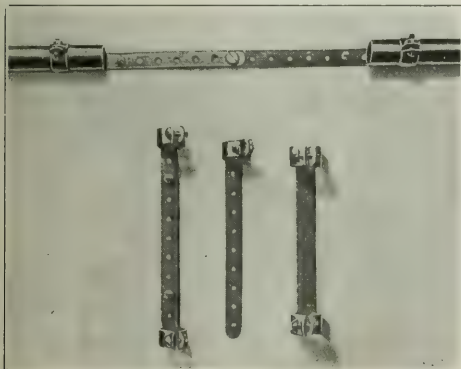


FIG. 1.—The "Multi-way" Earthing Clip.

purpose. A development of this type of fitting has a wider application. In this form the device consists of a perforated strip with a clip at one end. By means of a bolt and nut a similar piece can be closely connected to give a continuous path at tees, angles, or other combinations of several ways. The range of sizes manufactured enables the system to be used with distribution boards of any length. The fitting is aptly called the "Multi-way" earthing clip.

A New Kinema Projection Lamp.

Recent experiments by the GENERAL ELECTRIC CO., LTD., of Schenectady, New York, U.S.A., have resulted in the development of a new high-intensity projection lamp which promises to revolutionise the projection of motion pictures, says the *American Electrical Review*. The lamp gives, it is said, twice the illumination on the screen that can be obtained by the use of the older type of low-intensity lamps, with no increase in current consumption, and the quality of light, obtained by a special type of carbon, tends to eliminate eye strain.

Light from this lamp, as shown by spectrum analysis, is a close approximation to daylight, which means that a much clearer definition is given the pictures and that, in the projection of coloured films, the full value of the colours is brought out. This is especially true in the case of blues and greens, which often look muddy in the light of the ordi-

purposes, to take the place of primary cells, and therefore to work for long periods without attention or recharging. It consists of a strong glass box, with grooves in the sides, in which two heavy plates (one positive and one negative) are firmly held; the box is sealed to prevent evaporation of the electrolyte. The terminals are of large size, and extend well above the cell; they are made of a special acid-resisting material to prevent corrosion, and the terminal screws, the polarity of which is marked on them, have threads of different sizes, so that they cannot be interchanged. The cells are made in three sizes, of 20, 45, and 90 Ah capacity respectively (with intermittent discharge), the smaller ones being suitable for use in place of Leclanché cells for all purposes, and the large one for signalling installations. It is claimed that the "Duros" cell does not suffer from bucking or internal short circuits, and



FIGS. 2 AND 3.—"Duros" CELLS.

will retain its charge for very long periods, being safely kept in service for 12 months or more without recharging or topping-up—subject, of course, to the demands made upon it. The most striking feature claimed for it, however, is that it can be sent out dry, and on being filled with dilute acid it can be put on load at once, without charging, giving out 80 per cent. of its normal capacity, after which it can be recharged in the ordinary way. Thus the tedious prolonged "first charge" is dispensed with. A life of from 12 to 15 years is claimed for this cell, if completely discharged three or four times a year.

"Genii" Electric Distillers.

We have received particulars of two types of electric distillers made by Messrs. George Noms, Ltd., 89, Cleveland Street, Fitzroy Square, W. 1. The first and smaller distiller, illustrated in fig. 4, consists of three rectangular-shaped compartments measuring 12 in. by 5 in. by 15 in. high overall. These are of copper lined inside and polished on the exterior. The lowest compartment contains the liquid to be distilled, and in this is fitted a 2-kW immersion heater. Above this compartment is a division in which the distillate is caught and a $\frac{1}{2}$ -in. spout is fitted into this. The top com-

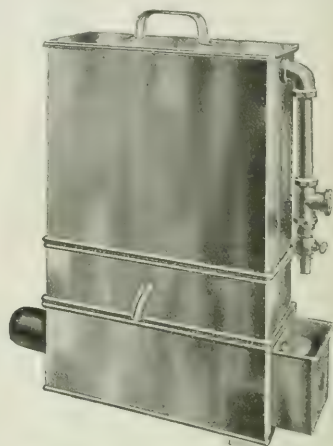


FIG. 4. THE "GENII" 2 kW DISTILLER.

partment is a condensing chamber with a cooling water jacket. It is fitted with a screwed boss as a cold water inlet at the bottom and excess cooling water is discharged through a larger boss at the top. The latter has a regulating valve and nozzle. The excess cooling water may either form a hot-water supply or be stored for use again. This distiller is capable of dealing with $\frac{1}{2}$ gal. of water per hour.

The principles embodied in the larger distiller are the same, but this is cylindrical in shape, and is fitted with eight immersion heaters—a total loading of 16 kW. The larger distiller has a capacity for 4 gal. of water per hour.

BUSINESS NOTES.

Bankruptcy Proceedings.—W. H. S. WARD, electrical engineer, 56, High Street, Acton.—Last day for proofs for dividend, August 6th. Trustee: Mr. T. Gourlay, 29, Russell Square, W.C. 1.

J. H. Taylor, electrical engineer and contractor, 99, Blackhorse Street, Bolton.—First meeting, August 3rd, at the Official Receiver's Offices, Byrom Street, Manchester. Public examination, September 21st, at the Court House, Bolton.

J. Harrison (Harrison & Son), electrical engineer, 93, Princes Street, Southend-on-Sea.—Last day for proofs for dividend, August 10th. Trustee: Mr. T. Gourlay, 29, Russell Square, W.C. 1.

Company Liquidations.—We are asked to state, in order to avoid misunderstanding, that the notice in our issue of July 8th of the winding-up of Engineering & Arc Lamps, Ltd., does not refer to the Engineering & Lighting Equipment Co., Ltd., of St. Albans. It relates to the completion of the winding-up of Engineering & Arc Lamps, Ltd., whose business was taken over in February, 1920, by the Engineering & Lighting Equipment Co., Ltd.

WIDGESIDE ELECTRICAL CO., LTD.—Winding up voluntarily. A meeting of creditors is called for August 5th at the Institute of Chartered Accountants, Great Swan Alley, E.C. Particulars of claims should be sent by September 30th to Mr. E. H. Hawkins (one of the liquidators), 4, Charterhouse Square, E.C.

RAILLESS ELECTRIC TRACTION CO., LTD.—Particulars of claims should be sent by July 31st to the liquidator, Mr. A. Page, 28, King Street, E.C.

Lithanode, Ltd.—A meeting of members is called for August 26th at 2, Billiter Avenue, E.C., to hear an account of the winding-up from the liquidator, Mr. F. A. Bell.

Dissolutions of Partnership.—Taber & Fryer, incandescent electric lamp and hardware merchants, 41, Merriam Street, Leeds.—Mr. W. H. Taber and Mr. W. O. Fryer have dissolved partnership. Mr. W. H. Taber will attend to debts.

The Heath Electrical and Mechanical Engineering Co., electrical and mechanical engineers, 1, Pembroke Street, Cardiff.—Messrs. L. Massimo, S. C. Crocker and E. W. Bartlett have dissolved partnership. Debts will be attended to by Messrs. Crocker and Bartlett, who will continue the business.

Trade Announcements.—THE BRITISH THOMSON-HOUSTON CO., LTD., has recently opened additional premises at National Buildings, St. Mary's Parsonage, Manchester, to deal with increasing business in the district in Mazda lamps, fittings, and accessories, and to provide greater storage accommodation. Part of the extension is furnished as a fittings showroom for effective display of lighting appliances. Members of the industry in Manchester and neighbourhood are invited to visit the showroom.

MESSRS. W. GEIPEL & Co. have acquired the business of Quead Electric Fires (stock, plant, patents, and goodwill) as a going concern. They have made special provision for the manufacture and sale of these fires at their St. Thomas Street Works where they will produce the whole range of apparatus listed in the Quead catalogue. Correspondence should be addressed to the firm, Quead Department, 72a, St. Thomas Street, London, S.E. 1.

MESSRS. WILLIAMS, PELL & FAYING, at their new address, mentioned here last week, will hold a stock of the Electrical Alloy Co.'s nickel-chromium wires and ribbons, and also of three-phase motors, starting gear, switchgear, &c., manufactured by the Hemaf Co., of Hengelo, Holland.

MESSRS. JONES & PORDES state that their new telephone number is Holborn 4774.

MESSRS. E. SHUTTLES & Co. have removed to 10, King Street, Covent Garden, W.C. 2. Their telephone number is unaltered: "Gerrard 374."

Catalogues and Lists.—MESSRS. COWLES-HAW, WALKER AND CO. (1920), LTD., P. & O. House, 14-16, Cockspur Street, S.W. 1.—A well-illustrated and fully-descriptive catalogue of "Out put" bar coal cutters showing methods of employment, &c.

MR. ALBERT MORGAN, A.M.I.E.E., 138, Gower Street, W.C. 1.—Illustrated leaflets dealing with lift and crane controllers and brakes, wall cranes, wrought-steel split belt pulleys, friction hoists, "Osman" lamps, and "Freezer" fans.

MESSRS. DINA & LUCAS, 329, High Holborn, W.C. 1.—An illustrated leaflet showing a number of applications of "Ad-hex" belting to various kinds of machinery.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C. 2.—Catalogue Section F (5)—Electrical Plant, giving illustrations and descriptive details of generator sets, Diesel and gas engine sets, suction gas plants, water wheels, boilers, feed pumps, haulage gears, lifts, and lifting magnets. Leaflet S.2541, giving, in tabulated form, revised prices (including all advances to date) for all items in Section S (1) of the complete catalogue.

THE CABLE ACCESSORIES CO., LTD., Tivdale, Tipton.—Progress Sheet No. 5, bearing illustrations and descriptions of "Revo" mining and industrial lighting fittings and cable boxes. Priced.

CITY ELECTRICAL CO., LTD., 1, Emerald Street, W.C. 1.—An illustrated catalogue of "Mersey" motors and dynamos including drip-proof, pipe-ventilated, totally-enclosed, and other types. Full prices and dimensions are given.

MESSRS. E. & C. GATES, LTD., Arcade Street, Norwich.—An illustrated catalogue of silk lamp shades, with price list.

THE ASTER ENGINEERING CO., LTD., Wembley, Middlesex.—A show-card (15 in. by 11 in.) advertising the "Aster British Light." The plant itself is illustrated and a number of applications are depicted.

Holidays.—The offices and works of MESSRS. ALBERT LEE & Co., Ltd., will be closed from Saturday, July 30th, to Monday, August 8th.

The Works of MESSRS. J. H. TUCKER & Co., LTD., Birmingham, will be entirely closed from to-day (Friday) mid-day, until Monday morning, August 8th, for the summer holidays. A small staff will be in attendance at the offices to deal with urgent matters.

The works of the London Electric Firm, Croydon, will be closed for the annual holiday from this (Friday) evening until the morning of Monday, August 8th, but a small staff will be kept in attendance to deal with urgent business.

Parliamentary Bills.—Mr. Chamberlain announced in the House of Commons on Tuesday last that it was proposed for the remainder of the session that Government business might be proceeded with after eleven o'clock. The outstanding feature of the present session was the Railway Bill, which it was necessary to pass before Parliament was prorogued. Accordingly, it would be taken July 27th to August 9th, on which days it would complete its stages and go to the House of Lords. On the completion of that Bill they would take the three remaining days allotted for the Safeguarding of Industries Bill, which would, he hoped, reach the House of Lords not later than August 15th. Amongst the other Bills it was necessary to pass into law was the Public Works, Telegraphs (Money) Bill. "It was not intended to proceed further" with the Electricity Supply Bill and the Summer Time Bill, amongst others. The House would rise between August 19th and 26th.

Inventors' Competition at Lyons.—The Société Lyonnaise des Inventions is organising, in connection with the Autumn fair in that city, an international inventions competition and exhibition. Exhibits forwarded may include electric accumulators, textile apparatus, and machines, motor cars and cycles and apparatus, agricultural machinery, household heating appliances, and workers' protection devices.

Salaries at Karachi.—The Karachi Electric Supply Corporation held its annual meeting on June 14th, and according to a report appearing in the *Times of India* just to hand, an attempt was made to extract information regarding the individual and total salaries paid to Indians as compared with those paid to Anglo-Indians and to Europeans. The chairman Sir Montagu Webb, replied, "I am not prepared to answer these questions. We keep no such information ready tabulated in this office, and I do not propose to commence drawing up such information. I want to point out most emphatically that this business is not carried on for the benefit of Europeans or Anglo-Indians or Indians as such. The capital has been subscribed by all classes. Our energy is distributed to all classes without thought of colour, race, or religion. So, too, our employees are engaged not because they are English or Europeans or Parsi or Hindu or Mahomedan, but solely because they are the men most competent to undertake the job. Our staff is appointed entirely on merit, and on no other consideration. I am sure you will agree with me that no good end will be served by digging out figures and making comparisons calculated to arouse colour, race, or religious prejudices. Our business is to give to Karachi a good permanent supply of electrical energy at the lowest safe cost, and we have no ulterior motives. I decline, therefore, to give information as to the individual or total pay of the different races or religions of the men whom we employ."

The shareholders supported the chair. A dividend of 8 per cent., free of income tax, was declared for the year.

Book Notices.—"The Engineer Directory and Buyers' Guide" (No. 21) (176 pp.). London: The Engineer, Ltd.

Gratis. The usual arrangement is retained in the latest issue of this extremely useful directory. A vocabulary of engineering terms in French, Spanish, Italian, and German is included, and the names of manufacturers are classified under their principal products and also alphabetically.

The *Journal of the Institution of Electrical Engineers*, Vol. 59, No. 301, May, 1921. London: E. & F. N. Spon. Price 10s. 6d. Containing the following papers: "Magnets for Ignition Purposes in Internal Combustion Engines," by E. A. Watson; "Harmonic Analysis by Selected Ordinates," by A. E. Clayton, B.Sc.(Eng.); "Some Developments in Multi-speed Cascade Induction Motors," by F. Creedy; and "Electric Driving in the Paper Mill, on Heat Economy Lines," by A. B. Mallinson.

"Instructions for Working Edison Accumulators" (43 pp.). London: Edison Accumulators, Ltd., 15, Upper George Street, W. 1. Price 2s. 6d. net. This is an important manual which should be in the possession of all concerned with the operation and upkeep of Edison accumulators. Such points as charging, cleaning, renewal, and inspection are fully covered, and reference is facilitated by a thumb index provided. The company will supply a copy to anyone interested in the subject.

"The Post Office Electrical Engineers' Journal," Vol. 14, Part 2, July, 1921 (72 pp.). London: ELECTRICAL REVIEW, Ltd. Price 2s. net.—This issue includes articles and notes on "Telegraph Keyboard Perforators" and "Morse Quadruplex," by A. C. Booth; "Paper Core Telephone Cables," by S. Hansford, B.Sc., and a description of the Imperial wireless station at Leafield, Oxfordshire, by E. H. Shaughnessy, O.B.E.

Engineering Abstracts from current periodical literature. New series, No. 8, July, 1921 (249 pp.). London: The Institution of Civil Engineers.

The Spanish Tariff.—The Board of Trade was to issue yesterday as a supplement to the *Board of Trade Journal* the draft of the proposed new Spanish tariff. It is published for general information, and, up to September 8th, the Spanish Customs Board will be prepared to receive representations and petitions on the subject of the tariff proposals, which may be submitted in writing by industrial or commercial bodies, or private individuals, who may consider their interests to be affected by the proposals. At the end of the period the draft tariff, together with all representations received, will be reviewed by the Customs Board, who will, as soon as possible thereafter, submit to the Spanish Government the definitive draft of a new tariff. The Board of Trade proposes to invite Chambers of Commerce and Trade Associations in the United Kingdom to submit to it any representations which those bodies may desire to make in the interests of the trade of their members, with a view to such representations as may appear to be necessary being made officially to the Spanish Government with regard to the proposed new tariff in relation to the trade of this country with Spain.

Lead.—In their market report dated July 23rd, Messrs. JAMES FORSTER & Co. state that the feature of the market was the increased premium for July shipment lead over forward, due principally to "shorts" for this month attempting to cover in their sales on a market which is at the moment bare of supplies.

"As is usual at this time of the year, the demand from consumers for metal is very moderate, and business for export is practically at a standstill. It is rumoured that considerable quantities of lead have recently been shipped from Spain to Germany, and if this is the case it may quite well mean that supplies from that quarter to this country will be proportionately reduced. This, coupled with the reduced stocks, would be a very serious matter, as we are still dependent on Spain for the bulk of our supplies."

The Dover Dispute.—As briefly stated in our last issue, a strike of the Dover Corporation's technical staff was narrowly averted by the Electricity Committee's concession of certain terms. These terms, which were ratified by the Corporation at its meeting on July 19th, provided for the retention of three charge engineers in Grade 8 and the payment to them of the appropriate salaries of this grade; the difficulty in connection with the salaries of two other officials was overcome by placing them in lower grades which were stated to be the correct positions for a works of that size.

Electrical Supplies in South Africa.—The *South African Mining and Engineering Journal* for July 2nd says: "Things are exceedingly slow in the electrical trade just now everywhere, with very few inquiries. Prices are unaltered, but the tendency is for them to harden in consonance with ruling quotations in Britain. Lower prices are expected to rule at home now that the coal dispute has been settled, but these cannot be reflected here for some little time. Electrical wares are continuing to arrive steadily from the Continent; a consignment this week showed a decline of 10 per cent. on previous prices and a very large difference as compared with British quotations."

New Italian Tariff.—A supplement to the *Board of Trade Journal* of the 21st inst. contains a translation of the new general Customs tariff for Italy. A statement is included of "the conventional" rates still operative under existing commercial treaties and the goods to which they apply, and in formation as to tare regulations, &c.

Patent Application.—The Peckham Truck & Engineering Co., Ltd., has made application for the restoration of Patent 182,773 of 1945 granted to Sidney Thomas and Frank Hartigan for "Improvements in or relating to trucks for railway or tramway vehicles."

Scottish Technical Staffs' Wages.—At a meeting of the Greenock Corporation on July 19th it was decided to reduce the wages of the technical staff of the Electricity Department by 25 per cent., half of the reduction to take effect in August and the balance in September.

British Industries Fair, 1922.—We have received from the General Manager of the Birmingham section of the next British Industries Fair, which is being held from February 27th to March 10th, 1922, a copy of the prospectus, which includes a space-application form. We are told that new groups, including mining, agriculture and building construction, are to be added, while existing sections, such as engineering, metals, power, lighting and heating, are to be considerably enlarged. The Birmingham Fair was acknowledged by the Board of Trade Committee appointed to report on the Fairs to be the most representative and productive of good results, and the members were unanimously agreed as to the necessity for its continuance. The general manager's address is 73, New Street, Birmingham.

Applications for British Trade-marks.—Appended is a summary of the recent applications for British trade-marks in respect of goods and productions connected with the electrical trades and industries:—

Electromersible (lettering and design). No. 414,729. Class 6. Electrical motors and pumps. Thomas Lancelot R. Cooper, 11, Tothill Street, Westminster, S.W. April 29th, 1921.

Gas-filled Osram (lettering and design). No. 414,415. Class 13. Electric lamps (ordinary). The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C. April 18th, 1921. Infinite. No. 405,157. Class 13. Sparking plugs. Brewster Goldsmith Corporation, 33, Gold Street, New York, U.S.A. June 14th, 1920.

Wattalite (lettering and design). No. 415,285. Class 13. Dynamo lighting sets. Watts, Williams & Co., Leysfield Road Works, Goldhawk Road, Shepherd's Bush, London, W. May 18th, 1921.

Triangle and circle design. No. 415,074. Class 6. Electrical machines and other parts. Delta-Star Electric Co., 2433, Fulton Street, Chicago, U.S.A. May 16th, 1921.

Pendulum design. No. 412,939. Class 8. Electrical instruments and apparatus and parts thereof. Aron Electricity Meter, Ltd., 60, Salisbury Road, London, N.W. February 2nd, 1921.

Bellerocks. No. 414,411. Class 11. A compound giving protection against X-rays. Barrett & Elers, Ltd., 127-9, Wallis Road, Hackney Wick, London, E. April 18th, 1921.

Bedesco. No. 415,852. Class 16. Electrical lighting sets for cycles, motor cycles and motor cars. Bedesco Ltd., 20, Bucklersbury, London, E.C. June 2/21.

A Swedish Extension.—It is announced that the Elektriska Aktiebolag Chr. Bergh & Co., of Malmö, have acquired the majority of the shares in the Elektriska Aktiebolag Delta of the same city.

New French Companies.—A Société Anonyme styled Les Entreprises Lorraines d'Electricité et de Mécanique has been formed at Longwy (7, Rue du Tramway), with a capital of 350,000 fr.

At Montrouge (53, Rue d'Orléans) has been established the Etablissements Autowatt, with a capital of 2,000,000 fr., to carry out all works concerned with metal working, mechanical engineering, and electricity.

La Compagnie Franco-Argentine de Télégraphie Sans Fil is the name of a new company which has lately been formed in Paris (79, Boulevard Haussmann), with a capital of 1,500,000 fr.

The Position of Chilean Trade.—No developments of importance occurred in the Chilean commercial situation during June. Trade generally was quiet in all sections of the country, but despite the depression which exists, a gradual increase of confidence was noticeable, and the leading business men express their conviction that the bottom has been reached and that trade will soon begin to improve. Their opinion is based upon the fact that the world is said to be in need of Chilean nitrate, and that when the exports of this valuable product increase in volume, as they are bound to do very shortly, the return of prosperity to the country will be assured. The foreign exchange situation shows little improvement. The value of the Chilean peso continues disappointingly low, which is due, in part, to the manipulations of speculators. The Government, however, is watching the situation very closely, and is taking steps to restore the financial equilibrium of the country. Some time ago the Government invited tenders for the supply of battery material for submarines. The British prices were about 10 per cent. under the American quotations. Foreign interests are exceptionally busy in Chile just now, the Germans being especially active. In Concepcion a woollen mill, owned by a Teuton firm, is installing German machinery, and will soon be prepared to produce 250,000 metres of cloth a year. Other German firms, it is reported, are about to erect flour and woollen mills in Valdivia. *—Reuter's Trade Service, (Santiago).*

The Lyons Fair.—The Fair which is to be held at Lyons in October will be more particularly devoted to metallurgical products. In order that the wide scope and importance of the Fair may be realised, the Mayor of Lyons and M. Herriot, the Honorary President of the Fair Committee, will shortly undertake a tour through Great Britain and Scandinavia for the purpose of bringing it to the attention of the trading communities of those countries. Although the Fair will not be opened for another two months and a half, most of the exhibitors who had stands at the last Fair have again applied for places. *—Reuter.*

The Utrecht Fair.—The fifth of a series of fairs promoted under the auspices of the Dutch Government is to be held at Utrecht from September 6th to 16th this year. While the main body of the Fair will be devoted to Dutch industries, there will be ample scope for the display of goods of other nationalities, and one section will be devoted to machinery and applications of electricity.

A Complete Guide.—A booklet recently published by the General Electric Co., Ltd., contains a great amount of information regarding omnibuses, trams and tube routes which pass near to the new headquarters of the company. The booklet should attract many customers to Magnet House, Kingsway.

Hendon Aerial Derby.—We are informed that B.T.H. magnetos were fitted to the "Banel" machine, Mars I, piloted by Mr. H. J. James, the S.E. 5a machine flown by Flight-Lieut. W. H. Longton, and M. A. S. Butler's Bristol "Tourer," which secured respectively first, second and third places in the Aerial Derby on July 16th. Mr. James and Mr. Butler also gained first and second handicap prizes respectively. The machines gaining first and second places in 1919 and 1920 were also equipped with B.T.H. magnetos.

Riga Exhibition Concession.—The Board of Trade Journal states that bona-fide British exhibitors at the Riga Industrial Exhibition (July 31st to August 28th) may have their passports *visa* by the Latvian Consulate at a fee of 8s., which is one-fifth of the ordinary cost.

Lantern Slides.—The Hoffmann Manufacturing Co., of Chelmsford, is prepared to loan a considerable selection of lantern slides illustrating the application of ball and roller bearings to various classes of machinery to any engineer lecturer on anti-friction bearings.

LIGHTING AND POWER NOTES.

Australia.—MELBOURNE.—The report upon the working of the City electricity supply undertaking for the year ended December 31, 1920, records a total revenue of £203,589, as compared with £240,081 in 1919. Working expenses totalled £187,339, as against £134,854 in the preceding year, leaving a gross profit of £116,250 (£105,227). This was distributed as follows:—Interest, etc., £24,907 (£23,885); sinking fund, £7,120 (£7,120); depreciation and renewals, £40,811 (£37,999); Town Fund, £38,977 (£30,492); sundry other appropriations, £4,435 (£5,731). The total number of units sold rose from 33,113,841 to 41,954,531, an increase of 26.7 per cent. The capital expenditure for the year amounted to £82,398, machinery costing £28,824 and new mains, £30,152.

Labour troubles affected the working during the year. A strike of marine engineers caused a shortage of coal and resulted in a loss of £3,000 to the department. In June there was a strike of engine drivers and firemen, but the technical and clerical staff were able to keep up a sufficient supply for essential services. The loss due to this dispute, which lasted a week, is calculated at £4,300.

ALUMINIUM CONDUCTORS.—The *Industrial Australian and Mining Standard* says that the Victorian Electricity Commissioners have accepted the tender of the American Aluminium Company at £91,416, for the supply of conductors for the main transmission line from Morwell to Newport. The line will comprise six separate wires, making the total length of the conductors about 700 miles. The alternative materials open for consideration were copper and aluminium-coated steel. The tenders received showed a heavy advantage in favour of steel, which has the further advantage of greater strength than copper, thus permitting of the employment of longer spans, and, therefore, of fewer steel towers, insulators, and appurtenances. It is estimated that by the employment of steel-aluminium instead of copper conductors a total saving upon the whole outlay on the transmission line of about £100,000 will be effected. The landed cost of the steel-aluminium conductors in Melbourne, duty paid, will be more than £30,000 less than the lowest tender received for copper. The successful tenderer has entered into a guarantee that the whole equipment will be manufactured in and shipped from Canada.

A £1,000,000 SCHEME.—The support of the Acting Premier of New South Wales (Mr. Dooley) has been gained for a combined water and hydro-electric scheme estimated to cost £1,000,000. The *Sydney Daily Telegraph* says that the Burinjuck Reservoir on the Murrumbidgee River is to be utilised to supply water and power to about twenty towns.

SYDNEY (N.S.W.).—The City Council recently applied for permission to increase its charges for electricity, and a Royal Commission was appointed to investigate the necessity for this increase. It was stated by the Council that, since 1915, production costs had risen by .6d. per unit and an equivalent increase on the existing rates (4½d. for lighting and 1½d. for power) was asked for. The case was contested by about 20 municipalities and other parties taking bulk supplies. The City Council considered that a profit of 6 per cent. should be made in order that the undertaking could contribute to rate-relief. An increase of .6d. per unit would bring in £240,000 a year.

Bath.—**PRICE INCREASE.**—The Electricity Committee has decided to increase the charge for electricity for private lighting by 1d. per unit as from the September meter readings.

Blackrock (Dublin).—**PEAT FUEL.**—The Urban Council is considering a proposal to produce electricity for the township, using peat fuel.

Bradford.—**LOAN SANCTIONED.**—The Electricity Commissioners have given formal sanction to a loan of £7,000 for sub-station buildings.

NEW OFFICES, &c.—The Electricity Committee has decided to acquire new offices and showrooms at a cost, including alterations and improvements, of £42,250, and sanction is being sought to a loan of this amount. The committee has also applied for permission to borrow £25,000 for house services.

Brownhills.—**"HARD ON GAS."**—When it was suggested at a meeting of the Urban Council that the Walsall Corporation should be asked to supply electricity to the Sheffield housing site, a member thought it rather "hard on" the gas company if it had to meet electricity as a competitor. The proposal was, however, carried, and endeavours are to be made to extend the supply to Brownhills and Walsall Wood.

Carlisle.—**EXTENSIONS.**—The Electricity Committee recently considered the report of Mr. Arthur Ellis, of Cardiff, upon the present position of the electricity undertaking. As a result, it has decided to defer the proposed erection of a new station at a cost of £200,000 and to proceed with extension of the existing plant, including a new turbo-alternator which is estimated to cost about £40,000.

Continental.—**GREECE.**—The *Bulletin* of the F.B.I. states that, according to the Greek Press, a law recently passed regarding the utilisation of the hydraulic power of the river Glavkos for the production of electricity for the lighting and industrial needs of the city of Patras, is about to be put into force. The necessary preliminary work for the execution of this project—the cost of which is estimated at 1,000,000 drachmas, to be raised by a loan by the Municipality of Patras—is now being carried out at the Ministry of Communications. It is understood that tenders will shortly be invited for the construction of this work.

FRANCE.—A message from Strasbourg states that the electrical workers there let the furnaces go out on July 22nd, as a protest against a reduction of 25 per cent. in wages decided on by the directors. At 10 o'clock on the morning in question the power failed and the tramways ceased running.—*Reuter's Trade Service* (Paris).

GERMANY.—The Badische Landes Electricitäts Versorgung Gesellschaft is the name of a new company which has lately been formed in Karlsruhe with a capital of 30 million marks and under the auspices of the Baden Government, with the object of establishing generating stations throughout the Grand Duchy for the supply of electricity for lighting and power purposes.

Clitheroe.—**EXTENSION OF SUPPLY.**—The R.D.C. has appointed a sub-committee to confer with the Blackburn Corporation Electricity Committee with respect to the extension of the electricity supply to Whalley and other villages.

Coleraine (Co. Londonderry).—**WATER POWER.**—Last week the Court of the Honourable Irish Society, London, visited Coleraine and discussed with the representatives of the Urban Council the water powers of the Cutts at the Salmon Leap of the Bann River. Mr. Christie, chairman of the Council, very ably put the case for using the water power of the Cutts for generating electricity for local uses. The Deputy Governor of the Society said that he would put the views of the Council before the Court on his return to London.

Colwyn Bay.—**LOAN SANCTIONED.**—The U.D.C. has received the sanction of the Electricity Commissioners to borrow £20,000 for the erection of overhead transmission lines from Dolgarrog to Colwyn Bay.

Edinburgh.—**PRICE INCREASE.**—In order to recoup the loss engendered by the coal dispute the Corporation has increased the price of electricity for lighting from 4½d. to 5½d. per unit, and that for power from 1½d. to 2½d. per unit.

Electricity District.—**SOUTH-EAST LANCASHIRE.**—The Electricity Commissioners give notice that the date by which objections and representations may be made or schemes submitted in connection with the above-named area has again been extended from the last day of this month to October 31st, 1921.

Flint.—**ELECTRICITY PROPOSALS.**—At a meeting of the Lighting Committee it was stated that the Electricity Commissioners are prepared to sanction the borrowing of money on being satisfied that the proposals are sound from engineering and financial standpoints, but that the Special Order must first be obtained. The Committee resolved to defer the matter for the time being.

Framlingham (Suffolk).—**PROPOSED ELECTRICITY SCHEME.**—At a public meeting of the inhabitants, Mr. Naper, President, of the East Anglian Electricity, Ltd., outlined the advantages of a supply of electricity, and the meeting, with only one dissident, decided to raise the necessary funds (£4,000) to carry out an electricity scheme.

Hove.—**TEMPORARY PRICE INCREASE.**—The T.C. has increased the price of electricity for power from 2½d. to 3d. per unit. This was necessitated by increased costs arising out of the coal dispute, but it hoped that it will only remain in force for about three months.

Liverpool.—**NEW TURBO-ALTERNATORS.**—On July 19th a new turbo-alternator was formally put into commission at the Lister Drive Station. This set, which is the first of a pair, has an output of 12,500 kW at 3,000 r.p.m.

Leyton.—**LOAN.**—The Council is seeking sanction to a loan of £15,000 for the provision of a new sub-station.

Luton.—**YEAR'S WORKING.**—The accounts of the borough electricity department for the year ended March 31st last show a total revenue of £107,376, as compared with £103,084 in the preceding year. Working expenses amounted to £77,431, as against £71,397, leaving a gross profit of £29,895 (£31,687). The payment of loan charges, &c., left a net profit of £8,110, a considerable decline from the previous year's figure (£15,391). The number of units sold fell from 11,010,326 to 10,607,708.

London.—**ST. PANCRAS.**—The B.C. is recommended to reduce the price of electricity for power and heating from 3d. to 2½d. per unit. The price was raised to its present level in June, 1920, to meet an expected deficit, but in view of the large profit made last year it is thought that no justification for the higher charge now exists.

The Electricity Commissioners have sanctioned the borrowing of £15,285 for the following purposes: Plant, £1,500; house services, £2,688; meters, £2,986; and mains and services, £8,111.

Melton Mowbray.—**PUBLIC LIGHTING.**—The U.D.C. has accepted the tender of the Electric Light Co. for public lighting at 6d. per unit, plus £200 per year for rental of standards. The Council undertaking renewals and labour. The Gas Co. tendered at 6s. 8d. per 1,000 cubic feet, plus £90 per year rental.

Newcastle (Co. Down).—**PRICES.**—Owing, it is stated, to the inadequacy of the energy supplied and the high price (1s. 2d. per unit) over 140 consumers have refused to pay meter rentals and a minimum charge of £2 per annum.

Oulton Broad.—**PURCHASE OF PLANT.**—The Lowestoft T.C. has received sanction to a loan of £1,247 in connection with the purchase of the undertaking of the Oulton Broad Electricity Co.

Oswaldtwistle.—**DELAYED ELECTRICITY SUPPLY.**—In reply to an inquiry as to why the Council had not taken further steps to secure an electricity supply for the town, the chairman of the Electricity Committee stated that both the Accrington and Blackburn Corporations had been approached with regard to the matter, but neither was at present in a position to supply electricity.

Preston.—**PROPOSED NEW STATION.**—The Electricity Supply Committee has recommended that Mr. J. A. Robertson should be asked by the Town Council to prepare plans for a new generating station for submission to the Electricity Commissioners.

Reigate.—**PRICE INCREASE.**—The T.C. has increased the prices for electricity for heating from 2½d. to 6d. per unit, and for commercial power from 2½d. to 4½d. per unit.

Watford.—**TIME EXTENSION.**—The R.D.C. has decided to raise no objection to an extension of time for the carrying out of the electric lighting order held by the Colne Valley Electric Supply Co.

West Ham.—**YEAR'S WORKING.**—The engineer's report upon the electricity undertaking for the year ended March 31st last records a total income of £156,305, as against a total of £380,613 in 1919-20. Working expenses amounted to £374,411, as compared with £310,777, leaving a gross profit of £82,064 (£499,236). After providing for interest and repayment of principal, the result was a net profit of £22,456, as against £14,350 in the preceding period. The total number of units sold rose from 41,628,476 to 45,095,734. Owing to labour disputes plant which should have been installed is expected to be twelve months overdue—it may be running in October. The total capital expenditure during the year was £61,490.

TRAMWAY AND RAILWAY NOTES.

Australia.—N.S.W. TRAMWAYS.—The accounts of the State Tramways for the financial year 1920-21 show a revenue of £2,225,000 against working expenses amounting to £2,591,152, a gross surplus of £366,151. Last year's surplus was £175,152.

Birmingham.—RAILLESS TRACTION.—At the last meeting of the City Council a resolution was passed instructing the General Purposes Committee to prepare a draft Bill authorising, amongst other things, the provision of railless electric traction on any tramway route now or hereafter to be authorised within the city.

Edinburgh.—TRAMWAY ELECTRIFICATION.—In connection with the electrification of the Pilrig-Nether Liberton tramway route the Tramway Committee recommends the erection of overhead trolley wires in Princes Street.

Grimsby.—TRAMWAY PURCHASE.—The Grimsby and Cleethorpes tramway system is to be purchased by the Grimsby Corporation. The price is to be fixed by arbitration.

Llandudno.—REFUSAL TO SUPPLY POWER.—The Council refuses to supply electricity to the company operating the Llandudno and Old Colwyn Electric Tramway for the purpose of running a Sunday service from Rhos to Llandudno.

Newcastle-on-Tyne.—EXTENSIONS.—An inquiry was held at Newcastle-on-Tyne on July 22nd into the application by the City Corporation to the Light Railway Commissioners for an order to enable the Corporation to run a line through High Gosforth Park, the object being to link up the extension to the Longbenton line, on the east of the park, with the line of the Tyneside Tramways Co., which terminates at the main entrance to the park on the Great North Road. The town clerk of Newcastle pointed out that if the city were to extend, it was essential that the extensions should be to the north. The total estimated cost of the light railway was £60,000. The tramways manager supported the application, and said at the last three race meetings the total number of passengers carried was 147,000, and the last meeting was held during the miners' strike. The town clerk said if the application were granted, the Corporation would like to get on with the work as soon as possible. The inquiry was then closed.

Nottingham.—YEAR'S WORKING.—The following are the results of working for the year ended March 31st last, the preceding year's figures being given in parenthesis: Total income, £16,111 (£578,917); working expenses, including income tax, £15,536 (£291,221); gross profit, £37,753 (£81,723); net profit, £665 (last year £21,000 was contributed to the rates). The number of passengers carried increased by 3,416,719, to 62,105,573.

West Ham.—YEAR'S WORKING.—The accounts of the tramway department for the year ended March 31st last show a total revenue of £305,833, as compared with £283,345 in 1919-20. Working expenses amounted to £299,332, as against £253,694, leaving a gross profit of £66,551 (£29,651). The payment of loan charges, &c., resulted in a net deficiency of £18,363; last year's deficiency was £44,777.

Wolverhampton.—YEAR'S WORKING.—The report of the Tramway Committee for the year ended March 31st last states that the total revenue was £126,294, and working expenses amounted to £107,458; the figures for the previous year were £111,663 and £89,835 respectively. Of the gross profit of £18,836, capital charges, &c., absorbed £16,858. Crediting bank interest, the net profit amounted to £2,934 less than the profit in 1919-20—£6,390. The number of passengers carried was 19,370,676, and total car-mileage run 1,269,139, an average of 15.25 passengers per car mile.

Walthamstow.—A CONCESSION FOR CHILDREN.—During the holidays in Walthamstow any adult travelling on the trams during the school holidays may be accompanied by two children, not over 12 years of age, for whom no charge will be made between 10 a.m. and 4 p.m. This concession means that thousands of children will be able to take free trips to Epping Forest under proper supervision.—*The Times*.

York.—MISADVENTURE.—One of the front wheels of a Corporation tramcar, passing over points near the Haxby Road terminus, last week, became detached, and the front portion of the car dropped on to the axle and springs. Fortunately the car was travelling slowly, and little damage was done beyond injury to the bogie.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—LONG-DISTANCE WIRELESS.—Messrs. W. E. Coxon and Co., of Perth, have constructed wireless telegraphic receiving apparatus to the order of the Perth Observatory, which will be capable of intercepting messages over a maximum distance of 12,500 miles.

France.—WIRELESS STATIONS TAXED.—Every private wireless station in France is to be taxed 10 fr. (4s. 6d.). Even receiving sets put together for a few shillings by schoolboys are included in the category of "stations," says *The Times*.

FRANCO-AMERICAN TELEPHONE RELATIONS. It is stated that the Compagnie Française Thomson-Houston has entered into an association of interests with the Western Electric Co. of New York, which will facilitate the development of the telephone system in France.

French Soudan.—WIRELESS STATION.—The wireless station at Bamako in the Soudan begun in 1918 is expected to be finished before the end of the present year. During its construction a temporary post of 10-kW capacity with musical spark was set up to maintain communication between Bamako and the coast stations. When completed the Bamako station will be the chief one in the French Soudan, and will have antennae with horizontal emission, supported by six 120-metre high towers. The other equipment will comprise two 275-h.p. Diesel engines to yield the motive power. Transmission will be made by quenched wave with a 100-kW alternator group. Later on a second group will be installed.

German-American Communications.—CONCESSION HUNTERS.—The *Lebendiger* learns that the negotiations between the Imperial postal authorities and the representatives of the Mackay Co. regarding the laying of a direct cable between Germany and the United States are still proceeding. Similar concessions are being requested by the Western Union Telegraph and Commercial Cable Companies, and negotiations are also proceeding with two American companies with a view to the establishment of an American wireless station in Germany.—*Reuter's Trade Service* (Berlin).

Italy.—GERMAN CABLES.—In the event of the reported allotment of one of the German cables between South America and the Azores to Italy being realised, the Italian Government intends to lay a complementary section between the Azores and Italy, and thus establish for the first time direct cable connection between Italy and the American continent. The cost of the complementary section has already been reckoned and is set at 20,000,000 gold lire. The scheme will have a further complement in that it will enable direct connection, eventually, to be made with Northern Europe. The saving upon the fees now paid to foreign cable companies for the carriage of messages will suffice to pay for the outlay on these several schemes, estimated to cost over 75,000,000 gold lire.

Naval Wireless Stations Closed.—The decision to dispense, on grounds of economy, with the wireless stations of the Royal Navy at Bathurst (Gambia), Mauritius, Port Nolloth (Cape Colony), and the Seychelles, as recently announced in this column, has taken effect. They were put out of commission on July 15th. The station at Demerara is being retained for the present. All the stations were built during the war. They will remain in the hands of caretakers until it is decided whether the Colonial Office or the Post Office will take them over, or whether it is possible for them to be run by private enterprise.—*The Times*.

Russia.—PROPOSED TELEGRAPH CONFERENCE.—An International Telegraph Conference proposed by Latvia and Russia is to be held during the current month to regulate telegraph communication between Russia, the Baltic, the Scandinavian States and Germany.—*Reuter's Trade Service* (Riga).

The Telephone Service.—INQUIRY INTO SWEDISH SYSTEM.—It is announced at Stockholm that the British Legation in Stockholm has been requested to obtain statistical information regarding the Swedish telephone system and organisation with the object of placing such information at the disposal of the committee recently appointed by the British Postmaster-General with a view to effecting cheaper running costs and lower subscription rates.—*Reuter's Trade Service* (Stockholm).

Wireless Telegraphy.—WATCHERS' EXAMINATIONS.—With reference to Notice No. 17, to Shipowners, Masters, Officers, and Seamen, under the Merchant Shipping (Wireless Telegraphy) Rules, 1920, relating, *inter alia*, to the examination of wireless telegraph watchers, it is notified that forms of application for examination may be obtained from the Wireless Telegraph Inspector, Codrington Road, Victoria Docks, London, E. 16, and not from the Wireless Section, General Post Office, London.—*Board of Trade Journal*.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the *ELECTRICAL REVIEW* in which the "Official Notice" appeared.)

OPEN.

Australia. TASMANIA.—August 15th. P.M.G.'s Department. Switchboard material. (July 8th.)

MELBOURNE.—September 28th. Victorian Government Railways. Lifting magnet and generating set with control apparatus and accessories. (Contract No. 34,241.)*

QUEENSLAND.—P.M.G.'s Department.—November 5th. Bronze wire, Schedule 536. (See this issue.)

Belfast, August 22nd. Electricity Department. One 12,500-kW turbo-alternator, with condensing plant and auxiliaries. Four water-tube boilers, with superheaters and forced-draught fans. Four fuel economisers. Two steel chimneys,

with four electrically-driven suction draught fans. One electrically-driven centrifugal pump, capacity 18,000 g.p.m. (July 22nd.)

Bristol.—August 15th. Corporation Electricity Department. One 3,000-kW, single-phase, 93-cycle, 2,200-V turbo-alternator and condensing plant and auxiliaries; one 6,000 kW, three phase, 50-cycle, 6,600 V ditto. (July 15th.)

Coventry.—September 1st. Electricity Department. Two 10,000-kW, 3-phase turbo alternators, complete with condensing plant; four water-tube boilers with chimneys, superheaters, mechanical stokers, economisers, and all accessories. (See this issue.)

Chile.—August 31st. Chilean State Railways. Emery and grind-stones, bolts, nuts, cotter pins, rivets, nails and screws, telegraph and telephone apparatus, chemicals, &c. (estimated value £44,000).*

France.—August 24th. French State Railway authorities, 88 Rue de Rome, Paris, for the supply of two batteries of accumulators for the sub-station at Argenteuil-Triage and for the maintenance of two batteries at that station during a period of fifteen years. Particulars may be obtained from the Service Electrique, 43 Rue de Rome, Paris.

Glasgow.—August 8th. Corporation. Electric lighting installation at Merklands Cattle Wharf, Partick. Burgh Electrical Engineer, 75, Waterloo Street, Glasgow.

Londonderry.—August 12th. County Council. Electric lighting installation in the County Council Offices in the Courthouse. Mr. T. B. Adams, Secretary to the County Council, County Courthouse, Londonderry.

Manchester.—August 3rd. City Education Committee. Electric lift, for 2½ cwt., at College of Domestic Economy, High Street, Chorlton-on-Medlock. Director of Education, Education Offices, Deansgate, Manchester.

New Zealand.—WELLINGTON.—November 1st. Public Works Tender Board. One 200/250-b.h.p. oil engine and one 3-phase, 50-cycle, 190-kW at .8 power factor, alternator, with exciter and switchgear.*

November 1st. Public Works Department. Fresh tenders for the supply and erection of steel pipe lines and fittings, required in connection with the Mangahao power plant, are now being called for. While the quantities, &c., of the material would appear to be substantially the same as those specified in the original call for tenders, it may be mentioned that some of the conditions applicable to the contract appear to have undergone modification.*

Rawcliffe, near Goole.—August 13th. West Riding Mental Deficiency Act Committee. Overhauling accumulators at Rawcliffe Hall Institution. West Riding Architect, County Hall, Wakefield.

South Africa.—Rand Water Board. September 28th. Contract No. 203. Tenders for supply, delivery, and erection at the Board's Intake Pumping Station, Transvaal Bank of Vaal River at Vereeniging of (1) Two vertical spindle centrifugal pumps, direct-coupled to electric motors, with all accessories, and (2) one 10-ton travelling crane. Also for main pumping station site, Vereeniging, two horizontal spindle centrifugal pumps, direct-coupled to electric motors, with all accessories.*

DURBAN. August 10th. Corporation. Supply and installation of superheaters and motor-driven mechanical stokers to three existing water-tube boilers at the Corporation Power Station, Alice Street, Durban.*

Warrington.—August 9th. Corporation Electricity Department. Circulating pumps. (July 15th.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—Victorian Electricity Commission. *Tenders* notifies the acceptance of the following:—

Seven transformers, Australian G. E. Co., £2,538.

Five transformers—Weymouths, Ltd., £4,044

Transformers, switching gear, synchronous condensers, frequency changer, &c.-
Australian G. E. Co. #1541-888.

700 miles aluminium steel reinforce.

\$365,663.

Two sets, condensing plant and pumps—Weymouth, Ltd.

Two sets condensing plant and pumps Weymouths, Conn. 240,000.

Belgium.—Thirteen concerns recently submitted tenders to the municipal authorities of Montignies-sur-Roo for the establishment of a primary and secondary electricity distribution system in the town. The tenders ranged from 84,377 fr. to 133,841 fr., the lowest being that of Messrs. Biske, Livron and Kalinowsky of Saint-Josse-ten-Noode, Brussels.

Chesterfield.—T.C.:—
Plowright Bros.—Coal conveyor and ash elevator for the Electricity Works. £2,570.

Edinburgh.—Tramways Committee. Accepted:—

Hurst, Nelson & Co.:—46 new electric car bodies, £19,520.

North British Rubber Co.—Tires for Corporation buses.

London.—**St. PANCRA.**—Electricity and Public Lighting Committee. Recommended.

The proposed 1,000 kW power rectifying plant will be necessary to supply the 1.5 MV d.c. for the proposed rail system. The estimated cost of the plant is £1,010, plus £1,082 for the 1000 kW transformer. As the Rectifier & Co. Ltd. has for 9.16% of the cost of the equipment, the cost of the plant will be £1,010 plus £1,082 plus £1,082, or £3,174.

L.C.C.—Highways Committee. Recommended:—

New plant, &c., at Greenwich power station and Holborn and Streatham sub-stations.

J. E. MANS		£
Western Electric Co., Ltd. (recommended)	...	38,486
Pirelli General Cable Works, Ltd.	...	38,211
W. F. Hentley's Teleng. & Works Co., Ltd.	...	37,255
British Insulated and Cold Water, Ltd.	...	33,255
Johnson and Phillips, Ltd.	...	40,365
W. F. Glynne & Co., Ltd.	...	40,811
Cableways Cable & Construction, Inc., Ltd.	...	41,290
Siemens Bros. & Co., Ltd.	...	41,912
STAIN, LINDROOS, READING, COOPER & CO.		
Dony and Lacroix on behalf of Soci. Anon. de Constructions Aléatoires	...	18,049
Do. (alternative)	...	1,434
Do. do.	...	4,668
English Electric Co., Ltd.	...	2,239
Metro. Vickers Electric Co., Ltd.	...	22,175
Do. (alternative)	...	33,425
Do. do.	...	4,567
Do. do.	...	5,617
Do. do.	...	36,756
Do. do.	...	38,000
General Electric Co., Ltd.	...	2,181
Do. (alternative)	...	2,464
Bruce, Bebbies & Co., Ltd.	...	39,924
Do. (alternative)	...	67,682
British Thomson-Houston Co., Ltd.	...	4,369
Do. (alternative)	...	4,382
British Thomson-Houston Co., Ltd. (recommended)	...	54,598
Arborel de Constructions Aléatoires	...	28,740
Arborel de Constructions Aléatoires	...	28,740

The Committee recommends that the tender of the British Thomson-Houston Co., Ltd., amounting to £54,598 should be accepted, as it is strictly in accordance with specification and taking into consideration the higher efficiency guaranteed, is in effect the lowest tender.

CONDENSING PLANT		
Escher Wyss & Co.	..	16,607
(alternative)	..	16,595
C. A. Parsons & Co., Ltd.	...	18,650
(alternative)	...	23,224
W. H. Allen, Sons & Co., Ltd.	recommended	18,835
Cole, Marchant & Morley, Ltd.	..	19,802
Marriles, Watson & Co., Ltd.	..	19,806
Worthington-Simpson, Ltd.	..	19,811
Hick, Hargreaves & Co., Ltd.	..	19,826
D. Adamson & Co., Ltd.	... ..	20,745
English Electric Co., Ltd.	..	21,268
Metro-Vickers, Electrical Ltd.	..	21,665
(alternative)	..	23,820
(alternative)	... ..	24,740
Belliss & Morcom, Ltd.	..	21,955
Richards, Westgate & Co., Ltd.	..	22,808
G. & J. Weir, Ltd.	... ..	24,857

As regards the condensing plant, the lowest tender, submitted by Escher, Wyss & Co., is for plant of Swiss make, but the company is uncertain whether it would accept a contract for condensing plant to be used in connection with some other make of turbine. The committee, therefore, recommends that the next lowest tender, amounting to £18,835 and subject to a reduction of 5 per cent., making the net amount £17,833, submitted by W. H. Allen, Sons & Co., Ltd., be accepted.

Meter Contracts.—Messrs. Chamberlain & Hookham, Ltd., have secured contracts for a twelve months' supply of electricity meters to the following municipalities:—Glasgow, Battersea, Belfast, Gloucester, Islington, Bath and Llandvther.

NOTES.

The Ramsay Memorial.—*The Times* states that a memorial tablet to the late Prof. Sir William Ramsay is to be placed in Westminster Abbey as part of the Ramsay Memorial.

Appointments Vacant.—Visiting teachers in electrical engineering for the L.C.C. School of Engineering and Navigation, Poplar, and the Hackney Institute, Dalston Lane. Also assistant in electrical engineering workshop and assistant in practical wiring, for the Hackney Institute.

Resident electrical engineer (Rs. 1,000 monthly+) and electrical engineer for power station (Rs. 540 per month+), for the Calcutta Electric Supply Corporation. Power station superintendent for St. Helens Corporation, salary according to E.P.E.A. schedule. (See our advertisement pages to-day.)

Service Note.—**ELECTRICAL ARTIFICERS' TESTS.**—As electrical artificers, from the nature of their employment before being examined in the torpedo schools, may be at a disadvantage when desiring to pass for chief electrical artificers, the Admiralty has ordered that men sent to the schools for this purpose are to be permitted to undergo a short course, lasting 20 working days, in order that they may be able to bring their knowledge up to date. No electrical artificer, or acting chief electrical artificer, is to be examined for chief electrical artificer in a torpedo school without being given this preliminary course, if he so desires.—*The Times*.

Hydro-electric Enterprises in Formosa.—H.M. Consul at Tainan, Formosa (Mr. C. H. Lippert), gives in the course of a despatch to the Department of Overseas Trade an account of hydroelectric developments in Formosa with some details of the Lake Candidius scheme, the main project in the electrical enterprise of the island.

The first hydro-electrical undertaking was in 1902, when a company was formed to utilise the falls of the Shinten river, in the Taihoku Province, to produce power for supplying light to the city of Taihoku. The Formosan Government, however, decided to place the supply of electricity under its own control and it accordingly took over the Shinten scheme. The first power station was opened in 1905 and a second followed in 1909, the two together having a total of 4,000 h.p. These were followed in the next few years by other power stations at Chikushinmon in 1909, 2,000 h.p., supplying Tainan and Takao; on the Daian river in 1911, 1,200 h.p., to supply Taichu and Shoka; and on the upper course of the Rono-kei in 1917, 4,000 h.p., to supply Tainan and Takao.

In order to facilitate the Dakusui river and Lake Candidius (the largest lake in Formosa which lies almost exactly in the centre of the island) scheme, the Formosan Government in 1919 floated a semi-official limited liability company to take over all the Government's electrical undertakings. This company received a franchise for the Lake Candidius scheme and commenced work in 1920. The date of completion is as yet somewhat vague; the year 1924 was at first spoken of, but it is likely that the actual date will be a year or two later. The estimated cost of the undertaking is Yen 48,000,000, apportioned as follows: Civil engineering constructional work, Yen 19,900,000; electrical constructional work, Yen 26,500,000; business expenses, Yen 1,600,000.

The scheme provides for leading water from the Dakusui-kei river from an intake in the Shimaigahara region into Lake Candidius (Japanese name: Jitsugetsutan), which will act as a reservoir. The power-station fall will be 1,100 ft. The volume of water at the intake on the Dakusui river will vary between a minimum of 300 cu. ft. per second and a maximum of 1,600 cu. ft., or an average of 954 cu. ft. This will allow a steady flow at the exit from the lake of 900 cu. ft. per second, by means of which it is expected to generate a maximum of 100,000 kW with a minimum of 65,000 kW.

It is hoped eventually to construct a second power station some four miles below the first, the water being again carried through tunnels to the point required. A fall will be obtained of 465 ft., and it is hoped to generate a maximum of 62,000 h.p. The two stations together would thus produce 292,000 h.p., giving a maximum of some 145,000 kW, or an average of 95,000 kW. The intention is, on completion of the first part of the scheme, to transmit electricity all over the island, and the entire electrification of the Government railway system is even spoken of.

At Suma-an, situated some 2 miles in a north-easterly direction from the lake, the offices of the construction department of the company were established in January last. A network of light railway lines will be constructed for the transport of plant and materials to the various points at which work is to be carried on, including 33 miles of light electric railways.

No electric power being at present available for running the electric lines and wireways and for working the rock-drills for piercing the tunnels, it has been necessary to construct a special power station for these purposes. The site is at Hoku-sanko, some 4 or 5 miles below the town of Herisha. A concrete dam has been constructed and the water will be led through tunnels one mile in length to the point lower down the course of the river where the power-station building is practically completed and the plant is now in course of erection. The latter comprises two turbines, each developing 1,200 h.p. The installation was expected to be completed early in the month of June.

Pending completion of the big scheme, steam power stations are to be constructed at Keelung and Shokwa to furnish additional power for the needs of those towns and vicinity. The Keelung station has already been begun, and work will soon be commenced on that at Shokwa. Keelung enjoys the advantage of cheap fuel, the principal coal fields in the island being situated in its immediate vicinity.

On a much smaller scale than the Lake Candidius project and requiring less time for completion is the installation now under construction in the Giran district of Taihoku Province on the East Coast. This was begun as a private enterprise of the Tainan Sugar Co., but the big Taiwan Electric Power Co. took a share. Owing to financial stringency it was decided to form an independent company under the name of the Taiwan Denki Kogyo (Formosa Electrical Enterprise) Co. with a capital of Yen 6,000,000 divided into 120,000 fifty-yen shares, of which some were taken up by the Tainan Sugar Co., some by the Taiwan Electric Power Co., some by individual promoters, and the remainder by the general public. The company may eventually be amalgamated with the Taiwan Electric Power Co.

The scheme provides for conducting water from the upper course of the Dakusui river (Giran), a distance of about five miles to Lake Kyukyute, on the bank of which a power station will be built. The cutting of a tunnel will soon be commenced; the foundations of the power station are already nearly completed and the site is said to be an ideal one. Work was begun in June, 1920, and it is hoped to have the first power station in operation by the end of 1921 at the

latest. A fall of 900 cu. ft. of water per second will be obtained, and the installation will generate 7,500 kW. A large proportion of the power will be transmitted to the city of Taihoku and taken over by the Taiwan Electric Power Co. The contract for the erection of the installation (other than the transmission wires mentioned above) has been let to the Okura Gumi, and work is progressing satisfactorily. Owing to the favourable nature of the locality, the cost of erection of the installation has been estimated at 471 yen per kW, as compared with 600 to 700 or even as high as 1,000 yen per kW in Japan. The Giran district is as yet undeveloped, but it is rich in coal, timber, sulphur, and marble, and it is hoped to use the power produced by the present scheme for the development of the natural resources of the district.

The promoters speak of starting work on a second power station in 1923 and of following that by a third.

Projects also exist for the utilisation of the water of the Daiko river, in the Taichu Province, and of the Dakko river in the Takao Province, and there is also a further scheme, in the Taito Prefecture on the east coast, projected by the Taito Sugar Co. All of these are somewhat nebulous and some have not even been fully surveyed.

Church Lighting.—We recently reproduced a view of a church in which electric lighting had been installed. The British Thomson-Houston Co. now sends us particulars of another instance in which electricity has replaced gas for this purpose. The accompanying illustration shows the interior of St. Marie's Roman Catholic Church, Rugby, in which the lighting has been carried out by means of "Mazda" lamps in "Mirolux" trough reflectors. The photograph reproduced was taken at night solely by means of the lights themselves and is untouched. Neither the lamps nor the reflectors are visible to



the congregation, and the light comes from the same level as the daylight, effectively illuminating every detail. There are 14 trough reflectors in the nave and six in the chancel. The wiring was carried out on the Henley system under the supervision of Mr. Shenton, electrical engineer to the Rugby Urban District Council.

Educational.—The 1921-22 session entrance examination of the Finsbury Technical College is to be held on September 20th, and applications for admission must be sent to the College not later than September 15th.

Institution Note.—THE ELECTRICAL POWER ENGINEERS' ASSOCIATION.—A lecture on the subject of "Boiler Design, Latest Developments," was given by Mr. J. Cauthery on July 22nd in the Central Hall, Westminster. The lecture had been arranged by the Southern Division of the Association. Mr. J. H. Parker, A.M.I.E.E., occupied the chair, and in introducing the lecturer said their object was to obtain information which was not given in books, and they recognised that in that way they would rapidly increase the prestige of the E.P.E.A. and advance the interests of the industry. Mr. Cauthery said that engineers of this generation were keener in the quest of efficiency than in the past, and in no part of an undertaking was efficiency more essential than in the boiler house. The lecturer then dealt with the various types of boilers, with special reference to the Sparring boiler which, in his opinion, was the final word in the development of water-tube boilers. He described the Sparring boiler in detail, and diagrams illustrating the various points were projected on the screen. At the conclusion of the lecture, an animated discussion ensued.

The American Association.—The American Association for the Advancement of Science, which has a membership of between twelve and fifteen thousand, will meet in Toronto in December next. Like the British Association, it is divided into a number of sections, each presided over by a vice-president. One of these sections is devoted to engineering in all its branches, and the officers of this section extend a hearty welcome to any engineers from the British Isles who can make it convenient to be in Canada at that time.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, about electric tramways and railway overhead, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Sir WILLIAM J. LARKE, K.B.E., M.I.E.E., M.I. and S.I., A.M.I.Mech.E., A.M.A.I.E.E., who was knighted by the King at Buckingham Palace on July 19th, was born in 1875. Sir William was a student at the London Polytechnic School of Engineering, while his engineering training was received at the works of Messrs. H. F. Joel & Co., Finsbury, and of Messrs. Siemens Bros. & Co., Woolwich. In 1898 he joined the British Thomson-Houston Co., Ltd., Rugby, becoming manager of its power and mining department. From 1912 to 1915 he was Executive Engineer and Assistant to the Engineering Director of the company. As a volunteer, Sir William

J. Larke, in July, 1915, entered the Ministry of Munitions to assist in its reorganisation. His first appointment was that of Director in the Controlled Establishments Section, and as such he was responsible for the selection of firms to be controlled and for the negotiations with such firms on the difficulties arising out of "control." His skill in organisation brought him a new task in March, 1916, when he devised and introduced the priority scheme for the control and regulation of munitions output. Without this scheme production could not have reached its ultimate capacity, as the rationing of skilled labour and materials, as well as the classification of munitions work in the order of its relative importance, were entirely dependent on it. In June, 1916, he reorganised, and became director of, the Badges and Exemptions Section of the Ministry of Munitions. In January, 1917, he reorganised and became director of the Dilution Section, in connection with the introduction of female labour into munitions industries, particularly those of an engineering character from which men had been withdrawn for the army. When he relinquished this appointment in December, 1917, there were 900,000 women employed in munitions industries. From October to December, 1917, he was also the Government representative on the Hill's (Skilled Day Workers' Rates) Committee. Early in 1918 he was appointed technical adviser to the Secretariat for Special Service in connection with demobilisation and reconstruction. He was also a member of the Council Committee on Demobilisation and Reconstruction. In January, 1919, he inaugurated and became chairman of the Committee on the Utilisation of Surplus War Material, and was also appointed chairman of the Advisory Committee on the Disposal of Mechanical Transport. During May, 1919, he organised, and acted as chairman of, an Engineering Commission which inspected German factories in the occupied territories with a view to ascertaining German methods of munition production and conditions of pre-war and post-war trade. The report embodied the results of the inspection of the works of 80 different German firms. Following his appointment as Director-General of Raw Materials (Metals), he became, in July, 1919, a member of the Disposal Board with responsibility for the disposal of all metals, ferrous and non-ferrous, chemicals and explosives. His further activities have included membership of the Co-ordinating (Supply and Demobilisation) Committee, membership of the Advisory Council (Section III, Labour and Industrial Organisation) of the Ministry of Reconstruction, and membership of the Standing Council on Post-war Priority during the whole period of its existence. Sir William received the O.B.E. in 1917 and the C.B.E. in 1920.

Mexborough U.D.C. does not know what salary is payable to its electrical engineer, Mr. FELTHAM. An offer made to him by the Council had been declined by him, and when the Council discussed the matter it transpired that the accountant had issued his cheque under a misapprehension, and then told Mr. Feltham not to present it! It was decided by seven votes to four, as there was so little certainty what the Council was liable to pay the engineer, to give him two months' notice



Photo by J. Turgill
SIR W. J. LARKE.

to terminate his present engagement. We move that the Council now ask the I.M.E.A. or the E.P.E.A. to keep it out of its middle.

Mr. WHITFIELD asks us to state that the personal announcement regarding himself appearing in the ELECTRICAL REVIEW for July 15th, page 94, is not correct. Correspondence for him should continue to be addressed to him at the generating station, Inverwood, and not to him.

Mr. T. R. WHITFIELD, the engineer and general manager of the Coventry Electric Tramways, recently had a presentation made to him by the staff and employees as a mark of esteem on his completing 25 years' service.

Mr. H. W. LAING, general manager of St. Annes Tramways, who has completed 15 years' service, has been presented by the staff with two silver entree dishes and a silver mullin dish to mark the occasion, and "as a mark of esteem and happy remembrance." Mr. J. Partington, rolling stock superintendent, presided, and Mr. G. W. Wood, traffic superintendent, made the presentation.

Mr. W. H. T. SWIRE, A.M.I.E.E., late chief electrical engineer of Bow Bridge Works, Dundee (Jute Industries, Ltd.), has been appointed chief electrical engineer for Jute Industries, Ltd., with charge of the electrical equipment at all the Associated works.

NEW COMPANIES REGISTERED.

Rubber Club of Great Britain, Ltd. (175,840).—Registered July 20th as a company limited by guarantee. Objects: To promote the use of the rubber and allied industries of Great Britain. The company is assisted in a Council, the first members of which are: A. B. Coote, Esq., St. Paul's Churchyard, E.C. managing director, Anderson, Anderson & Anderson, Ltd., J. H. C. Brooking, St. Helens Cable & Rubber Co., Ltd., Warrington (general manager), St. Helens Cable & Rubber Co., Ltd.; G. E. Watson, 10, Grove Road, Willesden, N.W. (rubber manufacturers' manager); T. B. Burrows, 13, Castle Street, Liverpool (director, William Somerville's Rubber Co., Ltd.), O. Latham, 21, Mincing Lane, E.C. (a rubber merchant), W. G. Mead, 2, Den Street, Loughborough, L. H. (managing director, Abbott, Roberts and Abbott); F. C. Jones, 212-213, Upper Thames Street, E.C. (director, Reliance Rubber Co., Ltd.; managing director, Peerless Pictures, Ltd.; chairman, East Sheen Cinema, Ltd.; and director, Cinema Combine, Ltd.); H. W. H. Standing, 43, Essex Street, W.C. (journalist); J. L. Lake, 19-21, Wilson Street, E.C. (rubber manufacturers' agent); W. H. Hutton, Bromley Street Rubber Works, Manchester (director, Philip's Patents, Ltd.; director, Premier Waterproof & Rubber Co., Ltd.); Secretary: H. W. H. Standing. Solicitor: Raeburn S. Smallman, 8, Queen Street, E.C.4.

Jeary Electrical Co., Ltd. (175,830).—Private company. Registered July 20th. Capital, £15,000 in 12,000 8 per cent. cum. participating preference and 3,000 ordinary shares of £1 each. To take over the business of manufacturers and exporters of electrical supplies, including iron and steel, Hill, Queen Victoria Street, E.C., as "George Beaulieu," and to adopt an agreement with W. C. Jeary. The subscribers (each with one share) are: F. O. Franks, Bradstone, Linden Gardens, Tunbridge Wells, gentleman; W. C. Jeary, 85, Erpingham Road, Putney, S.W.15, electrical engineer. The first directors are: F. O. Franks, (chairman) and others to be appointed by the subscribers. Solicitors: Francis & Johnson, 9, Great Winchester Street, E.C.

Hall Telephone Accessories.—Hall Telephone Accessories, Ltd. has been formed as a private company with a nominal capital of £30,000 in £1 shares. The objects are: To carry on the business of dealers in all kinds of telephone apparatus and telephone collecting boxes, marine and electrical engineers, brass founders and finishers, iron and non-ferrous metal founders, metal workers, &c. The first directors are: Major the Hon. Oscar Guest, 375, New Broad Street, E.C.; Captain the Hon. Fredk. Guest, 375, New Broad Street, E.C.; Maurice Rosenstern, 375, New Broad Street, E.C.; and F. W. Hall, Queen Anne's Chambers, Westminster. No qualification required for first directors; £30. Remuneration fixed by the subscribers. The registered office is at 375, Old Broad Street, E.C.2. The file number is 175,783.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

New Welding Co., Ltd.—Particulars of £700 debentures authorised June 6th, 1921. Whole amount issued, charged on the company's undertaking and property, present and future, including uncalled capital.

Hall Brothers (Manchester), Ltd.—Particulars of £3,000 debentures authorised June 15th, 1921. Present issue £2,850, charged on the company's undertaking and property, present and future, including uncalled capital.

Thermal Electric Works (Hackbridge), Ltd.—Debenture dated July 15th, 1921, to secure £300, charged on company's undertaking and property, present and future, including uncalled capital. Holder: A. Keen, 9, Farnmouth Road, Wandsworth Common, S.W.

Milford-on-Sea Electric Supply Co., Ltd.—Particulars of £2,000 debentures authorised June 28th, 1921. Present issue £1,150, charged on company's property, present and future.

Durel Co., Ltd.—Particulars of £65,000 debenture stock authorised June 24th, 1921, and covered by trust deed of even date: Whole amount issued, charged on shares and debentures, in various companies, and company's undertaking and property, present and future. Trustees: W. E. Thornton and J. Gardner.

Cryselco, Ltd.—Particulars of £50,000 debentures authorised June 24th, 1921, and covered by trust deed of even date: Whole amount issued, charged on factory, works and other buildings at Kempton, Beds., and company's undertaking and other assets, present and future. Trustees: W. E. Thornton and J. Gardner.

Duram, Ltd.—Particulars of £45,800 debentures authorised June 24th, 1921, and covered by trust deed of even date: Whole amount issued, charged on 10,000 shares in Cryselco, Ltd., factory, works and other buildings in Howell, and company's undertaking and other assets, present and future. Trustees: W. E. Thornton and J. Gardner.

CITY NOTES.

In the course of his interesting address delivered at the annual meeting of the company, held at the new offices, Magnet House, Kingsway, W.C., last week, Mr. H. Frost referred to the growth of the company since he assisted its foundation in 1889; he also referred to the completion of the new G.E.C. House in which they were meeting. He closed his reference to the building with the wish that good fortune might continue to favour them. In expressing that wish, he was somewhat influenced by the present unhappy condition of trade and industry. He believed in being frank and facing facts. They had every reason to be proud of the balance sheet before them, yet the four months of the new year that had just elapsed were casting a shadow over those results. Unrest in the labour world, the stoppage of the coal mines, the shutting down of most of the steel works of the country, the standstill of the shipbuilding industry and automobile industry, the condition of the textile industry, and so on, had all at once reduced their home market beyond recognition; the general fall in the values of securities had impaired the purchasing power of the public; simultaneously, the state of exchange in many of their foreign markets had interfered with export and had added to the present state of depression, becoming an paralysis. He sincerely hoped that the slight improvement noticeable during the last week or two might continue, that they might still create in the course of the remaining eight months a peak in the curve of business which would counteract the dents and depressions created during the first four months. That, however, was a matter beyond their control. For the moment they were effecting all possible economies to help them over a difficult period. He was satisfied that as soon as that period was passed, the future of the G.E.C. should be as happy and prosperous as in the past. Their progress had been so rapid that it was difficult to compare the results of the last few years. Passing on to the accounts, he said that the increase of the items sundry debtors and stock-in-hand was not out of proportion to the increased volume of business. As to trade investments, they represented sound assets, and wherever there was any doubt a reserve had been created. Almost the whole of revenue from investments was derived from trade investments in allied and subsidiary companies which were under their own control and management. A few of them, particularly the electricity supply companies, still suffered from the depression created by the war, and had yielded no return, but in many cases improvement was already noticeable. The item that would please shareholders most was the net results of profits from all sources, amounting to £46,148. He was preparing himself to hear comments on that result striking quite a different note. Year after year writers and speakers, who imagined they were doing a service to labour, pointed to the growth of their results as if it were wrong to progress or as if the results were extorted at the expense of the manual workers in their organisation. They either did not or would not understand that the results were due to joint efforts, that capital and the brain workers were doing their share as well. Labour would be told they had made £100,000 more profits, but no attention would be drawn to the increase of capital—£2,000,000—which was essential to obtain the increased yield. Out of the total profits only £539,000 had reached the pockets of the shareholders who, had they invested £5,600,000 (which represent their total debenture and share capital) in British and Colonial securities, would have had an income of at least £300,000, without risk of any kind. To secure to them the remaining £239,000, distributed in their case amongst 12,500 shareholders, they had been able to employ usefully 16,440 workpeople and staff. They had paid to them in wages and salaries £2,864,000. In addition, they had contributed another £2,000,000 of wages to workers in other industries, spent on transport and on the raw materials required for their manufactures, such as coal, steel, copper, rubber, &c. In this year in particular they had besides contributed at least another million to the wages in the building trade alone, but the main benefit to all was that capital and labour had jointly created new values and added to the much-needed wealth of the country some £8,000,000 or £9,000,000. The company was admittedly not self-supporting. To feed the people it was essential that they should import foodstuffs. They could only pay for those foodstuffs if capital and labour united in creating yearly more values than they consumed, but it should be borne in mind that the value of their finished product was not assessed by them, but by the foreign buyer. Capital and labour alike must realise that. They would have to be more modest in their demands in the future, or their country could not meet its obligations. The relative importance of industry and trade were misunderstood in many walks of life. The debates in the House of Commons in connection with the Key Industries and Anti-Dumping Bill showed that some legislators held equally hazy views on the subject. The name of the General Electric Co. was frequently mentioned in connection with the decision of the Government to include

electric light carbons in that Bill. "Why should a powerful company like the G.E.C. be protected?" "Look at the growth of the company," were some of the remarks that dropped. Some seemed to imagine all their results were due to electric light carbons. The Government had been accused of favouring the G.E.C. and assisting it to a monopoly. The real facts were that the total capital invested in the carbon enterprise up to the outbreak of war was £14,000,000, the total losses incurred up to 1911, through no fault of theirs, but through the deliberate attacks of foreign trusts, was £78,000. Year after year the directors considered the shutting down of those works; nothing but the fear of war, the knowledge that electric light carbons were as important for the defence of the country as shells or guns, and nothing but the feeling of duty in the interests of the safety of the country prevailed upon them to continue that unremunerative enterprise, so long as the company could afford it. At the outbreak of the war it became apparent that the Government had underestimated the probable requirements in the ratio of one to ten. Additional works had to be established at a cost of £50,000, towards which the Government contributed £30,000, which latter the company undertook to pay back out of future profits. At the same time they gave the Government an undertaking to continue the supply of carbons throughout the war at pre-war prices. That promise was kept with the modification that towards the very end of the war they received a small increase in price based on the increase of wages dictated by the Government. The result was that they made no profit out of those carbon works during the war, in spite of their monopoly, with which they were taunted, and the great service which they had rendered. Their total accumulated losses to March, 1920, amounted to £115,000. Every searchlight for coast defence or for anti-aircraft purposes throughout the country was fed from their carbon works. Since the war, owing to the arrival of the gasfilled lamp, the demand for carbons had dropped. Their works, he believed, could feed the whole of the demands of the country, and they presumed the Government, entirely for reasons of defence, were anxious that the country should make use of those works. Another industry with which they were connected—their Lemington glass works—proved almost of equal value as the carbon works, and they regretted that it had not received the protection from the Government which was promised at one time. The financial results of those works, owing to foreign competition, were always indifferent; foreign trusts tried to acquire them before the war, but they would not part with them, as they preferred independence from the foreigner to additional profits. Their policy was justified. Special bulbs for the safety of our warships, which had never before been made in this country, were all at once required; bulbs for bombs, for vacuum flasks and other war supplies were at one time only available from those works which, at the same time, kept alive at a critical period the lamp industry in this country. Without those works they could not have taken so prominent a part in the development of electric valves, which were used for a most effective defence against submarines, and which now, in peacetime, were beginning to revolutionise all systems of communication, bringing wireless to the service of telephony and other branches of electrical engineering. He could tell similar stories of nearly all their works. In the telephone works they had been busy throughout the war in making telephone material for the trenches, but since the war they had made such progress as to reduce the dependence of the British Post Office on foreign trusts to a minimum, and they hoped that with their new enlarged works they would succeed in making it entirely independent, though he was afraid they would always have their competition. His reason for referring to those matters was to bring home once more to the shareholders and the public at large the dual importance of production *versus* trading. The war had created a large number of new and small countries; their endeavours to be self-supporting would fail. It was only the producers in great countries who had a large secure home market who could, by producing cheaply and efficiently, supply the demands of the world. It was on those fundamental ideas that the greater programme of the G.E.C. had been conceived. Other countries had produced electrical concerns with large capital, a large number of works covering every branch of the electrical industry, assisted by the capital and the brain of the whole country. It was no use relying to those mammoth organisations by the disjointed efforts of 60 or 80 small specialist electrical concerns. In order that Britain should have its share in the electrical work of the world, bigger groups had to arise, and they for one had laid themselves out accordingly. Every one of their works had been enlarged or modernised. A great deal of money had been spent in improving the conditions under which work would be carried on in the future, welfare arrangements for the comfort and happiness of the workers playing an important part. Laboratories and development departments had been started, and results modest as they were so far—had already added to their prestige. Today he was as convinced as ever that throughout the world the demand for electric light and power was greater than ever. The whole world considered whenever possible large hydro-electric schemes to counteract the absence or the dear price of coal. The whole world was considering power stations of one kind or another. Railway electrification schemes in this and almost every country were pressing. Mines, steel works, and factories all the world over had to be modernised. As and when power

was cheaper, the opportunities for developing domestic electric business would be vastly increased. New fields would be opened for lamps, fittings, motors, heating apparatus, and the whole range of products for which the company had ever been famous. The demand of this and every other country for improved telephony was a well-known fact. They had prepared themselves to have their fair share of the world's work, and nothing but the financial or social collapse of this country could stop the G.E.C. from attaining their ideal, never mind what temporary hold-up or check it might experience. He had ever been an optimist, and he had never believed in such a collapse. He was satisfied that, with the continued support of the shareholders, with the help of his able colleagues and staff, and with the continued loyal support of their workers, and the goodwill of the public, which they were ever anxious to merit, it would be their good fortune to attain the aims they had set themselves. In conclusion, the chairman paid a tribute to the staff, especially mentioning the industry, energy, and ubiquity of the general manager, Mr. Railing, without whom, he said, the labours of the board would have been much heavier.

Sir John Hewett seconded the motion, which was adopted after a short discussion of a congratulatory nature.

Pernambuco Tramways and Power Co., Ltd.

Mr. Follett Holt presided at the annual meeting on the 19th inst. He said that the gross sterling receipts had increased, but, on account of a larger increase in working expenses, the net receipts from operating showed a decrease of £20,000 as compared with the previous year. The net earnings were sufficient to meet the debenture interest, interest on the notes, amortisation of capital, and also for renewals, but the balance was not sufficient to entitle the directors, particularly in view of the present rate of exchange and the completion works in hand, to make any payment of dividend on the preference or ordinary share capital. Unfortunately the company must suffer along with so many industrial undertakings, from the same cause—bad exchange and commercial conditions. They carried forward £18,373 to the credit of the revenue account. With the proceeds of the recently issued £500,000 8 per cent. prior lien debentures the company would be able within 12 months to extend its lighting and power supply, and, best of all, to complete the electrification of the steam tramway system and make the extension to Tipigio, and thus become entitled to a substantial increase in its tramway fares. With the completion of those works the earnings in milreis should show substantial progression, but exchange was the important factor. The present low rate of exchange was very disappointing, but nobody with any knowledge of the country believed that this rate could remain for any considerable period. A new 3,000-kW set had been added and was now at work as an earning factor. New light-truck customers were being added daily, and ten new double-truck passenger cars had arrived, which would considerably improve the tramway receipts.

Marconi International Marine Communication Co., Ltd.

The directors' report for 1920 states that the business continued to show expansion. The gross revenue was £933,568, as compared with £772,019 in the preceding year. The increase was due in substantial part to high remuneration paid to the telegraph operators, from which the company did not derive profit. The net result compared unfavourably with that of 1919. The profit is £117,370, as compared with £198,141 for 1919. The reduction is due very largely to exceptional circumstances. In common with all other businesses, there was a substantial increase during the past year in all working costs. Under normal conditions the increased cost of working would have been more than counterbalanced by the greater volume of business. The exceptional circumstances referred to consist of: (a) A loss of £15,301 occasioned by payment of operators' salaries in India and consequent upon fluctuations in the value of the rupee. (This loss will not recur.) (b) On December 31st, 1920, the quoted value of Government securities was very depressed and most foreign currencies were suffering from severe depreciation. Both securities and moneys, consistently with the company's custom, were taken into account on December 31st at the prices they would have produced had they been then realised. This showed a temporary loss amounting to £67,596. (c) The company conducts a large foreign business, and that business has shown expansion during the past year. The revenue from such business at the rate of exchange on December 31st, 1920, amounted to £21,385, notwithstanding the increased business, as compared with £51,109 in the preceding year. The money representing this profit has remained abroad, but is treated in the accounts as having been brought home on December 31st. On June 30th last the capital represented by Government securities and moneys abroad had appreciated, and the loss substantially diminished; a considerable amount was brought forward from the preceding year to the credit of profit and loss account and after making adequate allowance, as the directors are advised, for E.P.D. and corporation profits tax, a substantial balance remains. Taking all the circumstances into consideration, the directors feel justified in maintaining the rate of dividend, and recommend a final distribution of 10 per cent., which, together with the interim dividend of 5 per cent. paid in January last, will make a total of 15 per cent. for the year.

London Underground Railways.

Central London Railway Co.—Interim dividend for the half-year on the undivided ordinary stock of 2 per cent., comparing with 4 per cent. for the same period of 1920, and on the preferred ordinary stock of 2 per cent., comparing with 4 per cent.

City & South London Railway Co.—Interim dividend for the half-year on the consolidated ordinary stock of 2 per cent., against 4 per cent. for the same half of 1920.

London Electric Railway Co.—Interim dividend for the half-year on the ordinary shares of 1½ per cent., against 4 per cent. for the same half of 1920.

Underground Electric Railways Co.—Interest on the 6 per cent. cum. income debenture stock payable September 1st, less tax, at 3 per cent. Coupon No. 27 of the 6 per cent. income bonds will be paid on the same date at 2 per cent., free of tax, against no interim payment last year.

Metropolitan District Railway Co.—Interim dividend for the half-year on the 5 per cent. second preference stock, of 2½ per cent., against 1½ per cent. for the same half of 1920.

Fellows Magneto Co., Ltd.

In their report for 1920, the directors state that the year under review was a most troublesome one, and the difficulties which suddenly arose owing to the acute trade depression were such that it was impossible finally to deal with the accounts until the actual situation was ascertained. The net profit for the year, after allowing for depreciation, &c., on the same basis as in previous years, was £31,960, a considerable increase over 1919. Although during the first part of the year trade was brisk, towards the end of the year an unprecedented depression occurred which upset all ordinary calculations, and produced a situation of the utmost gravity. With very large contracts in hand, arrangements were made for further extensions in order to cope with the demands of the business. The factory was working to its utmost capacity, and would have continued to do so except for the above circumstances, which affected the motor industry more seriously than any other. The contracts were sufficient to keep the factory fully engaged until the middle of 1921. In such a crisis the manufacturer was in the unfortunate position of having had to secure himself on forward contracts for raw material, and these contracts were in most cases very binding and could not be suspended, whereas the board considered it expedient to extend leniency in the matter of contracts entered into for the sale of magnets, with a view to maintaining the goodwill of the company. The situation in the motor industry was such, that if these contracts had been rigidly enforced, the crisis would have been aggravated, and in many cases insolvency would have resulted; but the position was now much clearer and better. There was still a considerable amount of money outstanding, some of which could not be collected for some little time to come. A reserve was in existence to provide for any loss which might occur, but it was not anticipated that this would be required, as it was understood from responsible parties that the creditors would be paid in full. A much more confident spirit was now prevailing in the motor trade. The weekly output of magnets was steadily increasing, and it was hoped that very shortly the normal output of the factory would be reached. Interim dividends were paid on the 8 per cent. preferred and on the ordinary shares for the half-year ending June, 1920, which were warranted by the circumstances at the time, but in view of the tightness of money, and the necessity for keeping sufficient funds available to provide for immediate wants and for future development, the board did not recommend the distribution of any further dividends at present, although the profit earned was sufficient to maintain the usual dividends on both classes of shares. The balance standing at the credit of profit and loss account, £24,352, is to be carried forward to next year, when it is hoped that the financial position will be easier.

Anglo- Portuguese Telephone Co., Ltd.

The report for the year ended December, 1920, to which we made brief reference last week, states that the average rate of exchange for the year was 125½ per escudo, in comparison with 28 13/16d. for 1919. The rate prevailing at the close of the year was 6½d., as against 20d. at the end of 1919. The floating assets and liabilities in Portugal at the close of the year have been converted into sterling at the rate of 6½d. per escudo. The capital expenditure for the year amounted to £121,367, in comparison with £39,066 for 1919. The profit and loss account shows a gross income of £18,007 and expenses amounting to £12,023, leaving a gross profit of £6,984, as against £29,797 for 1919. After payment of income tax, £1,187, and providing for debenture interest and sinking fund, £5,100, the amount for disposal (including £8,328 brought forward) is £7,565. In November last the company paid an interim dividend of 3 per cent. less income tax, which absorbed a sum of £7,778, being £213 in excess of the amount now available. The amount of the corporation profits tax has not yet been ascertained. The directors have not thought it necessary to encroach upon the reserve to cover the small balance of £213, which is carried forward to the current year. The directors regret that the final result shown by the audited accounts does not admit of the payment of any further dividend. As stated in the last report, the company's profits had undergone serious contraction, a heavy increase in wages

having taken place in March, whilst the first substantial increase in the tariff only became effective in the latter half of the year. Throughout the year there was a persistent increase—corresponding to the fall in the value of the escudo in the cost of material sent out by the company and in imported material purchased locally. The year's revenue receipts and expenses had been converted into sterling at the monthly average of 123d per escudo. Expressed in currency the true measure of comparison the gross income from subscriptions, sales, &c., was Es. 797,832 (against Es. 491,908 in 1919), the expenses in Portugal were Es. 737,071 (against Es. 292,849), and the trading profits Es. 60,758 (against Es. 229,059). The report contains a table showing the extreme fluctuations in the sterling value of the escudo (nominally 53d.), in each of the last ten years; also the yearly average (taking the price on the last day of each month) and the rate prevailing on the last day of the year. We give the 1911, 1919, and 1920 figures:—

	1911.	1919.	1920.
Highest	50½	85½	194
Lowest	48½	19	5½
Average	49½	28½	12½
At December 31st	46½	30d.	6½

The highest price touched so far during the present year (1921) has been 94d., and the lowest 4½d.; latest price 81d.

Demands for another increase in wages were put forward in November and the Government, after hearing the men's case, refused to consider the company's petition for authority to increase the telephone rates until these demands had been conceded. Subsequently a scale of charges was authorised as from February 21st last which is expected to leave a satisfactory margin of profit.

In our last issue we quoted the statement of the general manager in which he showed that the fall in exchange combined with the ever-increasing value of imported material, high Customs duties (calculated on a gold basis), and sterling salaries, was disastrous in its effects on what would otherwise have been a profitable year to the company. He says:—

"From the beginning of the year up to June 15th the company was working under the tariffs fixed in 1918 and 1919, which, had the exchange remained at the average of 1919, would have made a successful year, but the fall of exchange and the further demands of the employees were seriously affecting the company's financial position, and we were compelled to apply to the Government for a further increase in our rates. This was granted on June 15th, 1920, the new tariff being based on an exchange rate of 17d., but by this time the exchange was already down to 12d., and therefore even the new rates did not put the company on a profitable basis. After many efforts the strike was settled by granting an increase of pay, but, unfortunately, the corresponding negotiations for an increase of tariffs to meet the heavy loss resulted only in an increase of tariffs three months after the increased pay had started. This delay was a source of serious loss to the company. The part taken by the telephonists in organising the strike was practically negligible, being confined to a few malcontents, but for whom it is believed that the great body of the men would have remained at their posts. Upon conclusion of the strike negotiations the manner in which the operating staff threw themselves into the work of reopening the service left no doubt as to their generally good disposition towards the company."

In spite of the many changes in the Government—there having been no less than seven Cabinets during the year—the company's relations with the various Ministerial departments were throughout quite cordial. In July Mr. Eustace Cuthbert Quilter joined the London board. Owing to the resignations of Senhor Hugo O'Neill, Mr. C. H. Bleck and Mr. R. W. Frazer from the Lisbon board, Mr. W. G. T. Pope, Mr. F. Frick, and Dr. B. Carqueja were elected as directors in their places.

The annual meeting was held on Tuesday.

Submersible Motors, Ltd.

Mr. B. T. Rumble, presiding at the annual meeting at Southall, last Friday, referred to the adverse effect of the fire in November, 1919, as being the chief cause of the falling off in profit. As they did not obtain a settlement from the insurance companies until October, 1920, they were unable to commence reconstruction until that date. The delay kept them without the use of their main machine shop during the whole of the year covered by the accounts, and this fact necessarily caused a considerable falling off in the company's output during that period. In common with all other firms in the engineering industry, they had been suffering from the recent severe depression in trade. The whole of the destroyed premises had now been rebuilt and equipped with modern machine tools. They had a fair amount of work in hand, and were hopeful, now the coal dispute was settled, that they would be successful in obtaining orders for submersible motor pumps for dewatering the mines and as permanent installations. They had some large sets going through the shops for a coal mine in China. In view of the figures shown by the accounts the directors did not recommend any distribution of dividend.

Ward and Goldstone, Ltd.

In their report for the year ended March, 1921, the directors state that the net profit, after providing for bad and doubtful debts, depreciation on machinery, plant and stock, salaries, commissions, directors' fees, advertising, and all other charges excepting income tax, E.P.D., and corporation profits tax, amounts to £25,190, of which it is estimated, E.P.D., income tax, and corporation profits tax will absorb £14,698, leaving £10,492, plus £6,041 brought forward, making £16,533. The interim dividends at the rate of 7 per cent. per annum, already paid, absorbed—preference, £3,920, ordinary £2,696. It is now proposed to pay 2 per cent. on the ordinary shares,

making 9 per cent. for the year (£770), a participating dividend of 4 per cent. on the preference shares (payable with the September interim dividend), making 7½ per cent. for the year (£280), £2,000 is put to reduction of preliminary expenses, and £6,530 is to be carried forward. During the first nine months of the period under review, records were established in output and turnover; the concluding three months witnessed a collapse in values of most of the stocks handled, and a paralysis in the home and export trade. Stocks have been written down irrespective of cost price to the reduced values ruling at March 31st last; were it not for this necessity the results for the past year would have been much more favourable. The removal to new works was completed in January of this year, and the favourable results from the increased plant and better conditions of working should be confirmed when the industrial conditions improve.

Mr. Miller Lash presided at the annual meeting, held in Toronto on July 20th. According to a report in the financial Press, he dealt particularly with the financial position of the company and its inability to resume the payment of dividends.

Although the earnings in Brazilian currency continued to increase rapidly, the increase was more than offset by the fall in exchange, and as a result the estimated available net earnings for the first half of the year 1921, when converted into dollars at the present rate of exchange, would show a very small surplus after providing for the fixed charges, sinking funds, and preference dividend. All construction work had, where possible, been postponed, but a certain amount was essential in order to comply with the terms of the company's concessions. The board hoped that in due course the markets for securities would so improve as to make possible a public issue to provide funds for extensions, and that exchange would gradually rise to a point where the earnings when converted into Canadian currency would justify the resumption of dividends. Meanwhile, the duty of the directors was obviously to proceed with caution.

Paris Supply Companies.

The *Société de l'Union d'Electricité*, which aims at the consolidation of the producing interests in the environs of Paris as distinct from those which are vested in the Compagnie Parisienne de Distribution d'Electricité for the whole of the City of Paris, reports that as a result of the successive increases in share and loan capital, it was possible actively to continue in 1920 the great programme of works. The progress made at the Gennesvilliers generating station was satisfactory. The various works which had been incorporated in the company by the absorption of the local companies (Secteurs) had been left in the hands of the latter for a period which would in principle extend to February, 1922. During the period the Secteurs were operating the works on their own account, they were paying to the Union an annual rental equal to the interest of 6 per cent. on the amounts which had been paid to them for the acquisition of their works. Under the circumstances the operations of the Union in 1920 were limited to the works of Vitry, Billancourt, Nanterre, and Issy-les-Moulineaux, where important works of reinstatement were carried out. The negotiations with a considerable number of consumers, aiming at the bringing of pre-war contracts into harmony with existing economic conditions, had been concluded. On the other hand, the company had entered into new agreements with the Orleans Railway Co., and had participated with the latter in the formation of the Union Hydro-Electrique. After making provision for depreciation, the accounts show net profits of 3,990,000 fr., permitting of the payment of a dividend at the rate of 5 per cent. on the share capital.

Addressing the shareholders at the annual meeting of the *Compagnie Parisienne de Distribution d'Electricité*, M. Benac, vice-chairman, referred to the understanding which had been reached with the Paris Municipal Council, and which would now allow the company to make the extensions necessary for meeting the requirements of consumers. He stated that the company had already secured municipal sanction to an increase in the tariff which had permitted the undertaking to bear the large advance in the prices of coal, and a supplementary agreement had been concluded with the city which revised the relations between the latter and the company. Without waiting for the vote of the Municipal Council, the directors had undertaken the works necessary for doubling the capacity of the generating stations, which had been estimated too low at the original total of 75,000 kW. The supplementary agreement had also modified the financial relations with the city. It had removed a clause which placed at the charge of the city the increases in wages and salaries which the company's staff and workmen could claim because they had been assimilated with the staff and workmen in the employ of the city—a charge which was about 17,000,000 fr. On the other hand, the tariffs instead of being definitely fixed, would be automatically raised or lowered by taking into account both the prices of coal and of raw materials and the wages and salaries of the workmen and staff. Though the results, which could be expected, could not be as satisfactory as was hoped for under the old convention, the important advantage of having security for the capital invested in the undertaking had been gained. In addition, a further important result had been obtained—namely, that the city now at last regarded the company as a real partner, and relations

of mutual confidence were established between the municipal services and those of the company. The vice-chairman added that the extensions in progress were being executed for the account of the city, for which the company was working; the works being built were the property of the city, and if the city did not find it convenient to pay for them at present—out of the loan which was being raised, the company would have to advance the funds and issue a loan for the purpose.

Kalgoorlie Electric Tramways Co., Ltd.—Net profit for 1920, before charging depreciation, was £8,742. In January, 1921, demand was made for further increase in wages, which the company, having regard to its financial position, was unable to agree to, and an application to the Arbitration Court was made on behalf of the men for variation of existing award. Negotiations which followed were broken off on February 1st, when without waiting for the decision of the Court the men went on strike and the service was entirely suspended until February 25th. It was then agreed to refer the dispute to the local tribunal, the men resuming work meantime under the old conditions. The award of the local tribunal gave the men a considerable increase in wages, but this award was given subject to confirmation or variation by the Federal Arbitration Court—*Financial Times*.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Madras Electric Supply Corporation.—3,469 ordinary shares of £1 each, fully paid, Nos. 186,001 to 189,469.

Dealings in the following securities have been specially allowed by the Committee under Rule 148a:—

Madras Electric Supply Corporation.—3,469 ordinary shares of £1 each, fully paid, Nos. 186,001 to 189,469.

Shropshire, Worcestershire & Staffordshire Electric Power Co.—£300,000 7½ per cent. 10-year guaranteed convertible debenture stock, issued at 97 per cent., £30 paid and fully paid, after issue of allotment letters.

The Swiss Brown, Boveri Co.—The directors of the A.G. Brown, Boveri & Cie. of Baden, have decided to abstain from making any distribution for the year ended March 31st, 1921, whereas 8 per cent. was paid for the preceding year. They state in explanation that the wholly satisfactory results in 1920-21 had been absorbed by the extraordinary depreciation of raw materials, semi-finished products and manufactures which had taken place since the New Year, as well as through the further writing down of securities and participations which had become necessary, which burdened the accounts with over 10,000,000 fr. The directors state that in reaching the decision they were guided specially by the present critical industrial situation and the large decline in orders.

Chili Telephone Co., Ltd.—The gross revenue for the year ended March 31st, 1921, was £238,784, less gross expenditure in Chili and London £195,137, leaving a profit of £43,647, plus £19,843 brought in, making £63,490. The directors recommend a final dividend of 3s. per share, free of tax, making 6 per cent., free of tax, placing £17,285 to general reserve, carrying forward £16,504. The difference on converting liquid assets and liabilities in Chili at lower rate of exchange was £12,785, and this amount has been debited to general reserve.

Thos. Bolton & Sons, Ltd.—According to the *Financial Times*, the accounts for the year ended March, 1921, show that after deducting £17,500 for interim dividend and putting £15,000 to reserve for depreciation, and £500 to debenture redemption premium reserve, £130,920 stands at the credit of the profit and loss account.

Charing Cross, West End & City Electricity Supply Co., Ltd.—Interim dividend on the ordinary shares of the West End undertakings for the half-year ended June 30th, 1921, at the rate of 3s. per share.

Kensington & Knightsbridge Electric Lighting Co., Ltd.—Dividend of 4 per cent. on the ordinary shares for the half-year.

Metropolitan Electric Supply Co., Ltd.—Dividend at 4 per cent. per annum, less tax, on ordinary shares for the half-year.

South American Light & Power Co., Ltd.—Dividend of 6 per cent. less tax, for the year £10,000 has been written off plant and machinery, and £4,737 carried forward.

Barnsley & District Traction Co., Ltd.—Dividend at the rate of 11 per cent. per annum; £23,166 carried forward.

Chelsea Electricity Supply Co., Ltd.—Dividend at 5 per cent. per annum, less tax, on ordinary shares for half-year.

Hadfields, Ltd.—Interim dividend 6d. per share, free of tax, on the ordinary shares.

National Gas Engine Co., Ltd.—Dividend at 7½ per cent. per annum, less tax, on the ordinary shares for the half-year.

Mather & Platt, Ltd.—Interim dividend of 3 per cent., free of tax.

Bristol Tramways & Carriage Co., Ltd.—Interim dividend for the June half-year at the rate of 3 per cent. (free of income tax) on the ordinary shares.

Westminster Electric Supply Corporation, Ltd.—Interim dividend at the rate of 8 per cent. per annum, less tax, for the half-year.

City of Buenos Aires Tramways (1904), Ltd.—Dividend of 1s. 3d. per share, less tax, for the quarter ended June.

STOCKS AND SHARES.

TUESDAY EVENING.

The course of the Stock Exchange markets is governed by the fall in the Bank Rate. Investment securities are better, and there has been a little increase in business amongst such stocks as those that are being bought by people who, having money on deposit at the banks, wish to invest it in the Stock Exchange markets when they realise that the banks are paying no more than 4½ per cent. on such deposits. There has been, however, no particular rush to the Stock Exchange for investment, and while this has caused some little disappointment, it is attributed to the holiday season being close at hand, and to other such seasonal causes. Even the hot weather is claimed as one explanation for the unwillingness, on the part of people generally, to bestir their minds in the transfer of money from deposit into channels that will afford them better rates of interest.

There is some talk of the possibility that the Bank Rate may come down to 5 per cent., though, on the other hand, this is met by the argument that the autumn is usually a time in which money stiffens, owing to the movements of American crops. So there is plenty of room for speculation, either way, in Bank Rate prospects.

The interim-dividend season of the Home Railway companies has produced several announcements pleasant to holders of Underground stocks, although the Underground Electric Railways Company, in declaring a dividend of 2 per cent. net on its Income Bonds, has disappointed those who were looking for the full 3 per cent. A month ago, the latter rate was regarded as practically certain to be declared, but since then, the rate of exchange with America has gone so much against this country that the Underground Company, whose coupons are payable in New York as well as in London, may have been swayed by this consideration in deciding to reduce the dividend. The £2 net is worth about 54s. 6d. if the coupons are sold through a broker for payment in America, and, as they are cashed free of tax, the return is not a bad one at the present price, having regard to the prospect of the company's being able to meet its full 6 per cent. in the future. The interest on the bonds is not cumulative, being dependent, as the name of the security implies, upon the income for each half year. The bonds fell 3 points to 79½, and the £10 shares dropped to 115½, the 1s. shares receding to 5s. 9d. On the decline, however, buyers came forward for the shares, and the quotations have recovered to 2½ and 6s. respectively.

The Metropolitan District declares a dividend of 2½ per cent. on its 5 per cent. second Preference, which is double that of a year ago. The London Electric is paying 1½ per cent. on the Ordinary against ½ per cent. in 1920, the City & South London's 2 per cent. on the Ordinary compares with ½ per cent. and the Central London's 2 per cent. on the undivided Ordinary and Preferred stocks goes against ½ per cent. and ½ per cent. respectively.

The Central London announcement has had a sharp effect upon the prices of the non-assented stocks. The Ordinary has risen 2 to 36½, the Preferred 2½ to 40½ and the Deferred is 3 higher at 32½. The District Second Preference is all held by the Underground Electric Railways Co. Metropolitan Ordinary is better at 27½; the dividend announcement is expected to be made on Friday of this week. Districts are up 30s., to the accompaniment of further talk as to the chance of the stock receiving a dividend next year.

The Shropshire, Worcestershire & Staffordshire Electric Power Co. offered £300,000 7½ per cent. 10 year Convertible Debenture stock at 97, the principal and interest being guaranteed by the British Electric Traction Company. Such was the demand for the stock that the subscription-lists closed several days in advance of the date to which they could have remained open. Applicants are hoping that their allotments will be posted towards the end of this week, and in the market it is expected that there will be a premium of about a couple of points at the opening of business. The General Electric new Debenture is 1½ premium. North Metropolitan Electric Debenture, after dipping to 3½ premium, stiffened to 4, and the Metropolitan Extension Debenture remains steady at 6 premium. Chiswick Electric Debenture has hardened to 63½. British Electric Traction Ordinary stock is quoted at 32½, the 6 per cent. Participating Preference at 57½ and the two Debenture stocks at 68 and 51 for the 5 per cent. and 4½ per cent. issues respectively.

In the Cable group, the Eastern stocks are all maintaining their prices, with Globes ordinary better at 16½. Great North-ems. are easier at 25½. Telephone shares are better, Chili Telephones unmoved to 51½ and United River Plates to 5½. Marconis have eased off to 2½. The report of the Marconi International Marine Communication Company shows a fall

in the profit of £80,500 at £117,000, but the dividend is maintained at 10 per cent., making 15 per cent. for the year, and the price of the shares remains at 15 1/2. To pay the 15 per cent. dividend, the carry-forward has to be drawn upon, but the Directors point out in the report that the company encountered a loss on rupee exchange through paying operators' salaries in India, and that this will not recur. Canadian Marconi are a little lower at 7s. 9d.

Engineering and kindred shares, including those of the armament companies, have been inclined to give way owing to the way in which works are being closed down in the North of England as a result to trade depression and labour conditions. Babcock & Wilcox keep steady at 23, but Vickers and Armstrongs have both fallen for the reasons mentioned, and the list is generally heavy. Rubber shares have weakened after their extremely brief spurt, the dullness being due to reaction in the price of the raw stuff to 8 1/2d. per lb., which serves to underline the arguments put forward in our leading article last week (E.R. page 105) to show that time will be required to rehabilitate the industry upon a profitable basis.

In the list of Home Electricity Supply shares, there are no changes to record. Melbourne First preference have improved to 5 1/2. The manufacturing market is quietly hard. British Aluminiums at 17s., and General Electric Preferences, of both classes, are all 6d. better. Siemens Ordinary and Preference both keep about 23s. 3d. Many of the Canadian-American dollar stocks are up by several points. Mexicans have moved irregularly; Mexican Light & Power First Mortgage are 2 higher, while the company's shares show losses. A drop of a couple of points in Brazilian Tractions is due to the Rio exchange. A year ago, the milreis was worth nearly 1s. 3d., whereas at the present time it stands at a very small fraction above 7d.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price July 26, 1921.	Rise or Fall	Yield.
	1919, 1920.			per cent.
Brompton Ordinary ..	12 12	6	—	410 0 0
Charing Cross Ordinary ..	7 8	34	—	10 6 3
do. do. 4 1/2 Pref. ..	4 1/2	4 1/2	—	7 4 0
Chelsea ..	4 4	7 1/2	—	9 4 8
City of London ..	13 14	11	—	11 4 0
do. do. 5 per cent. Pref. ..	8 8	17 1/2	—	7 1 2
County of London ..	8 8	8 1/2	—	9 17 0
do. do. 6 per cent. Pref. ..	6 6	6 1/2	—	9 13 3
Kensington Ordinary ..	7 9	4 1/2	—	10 19 2
London Electric ..	2 1/2	2 1/2	—	7 10 0
do. do. 6 per cent. Pref. ..	6 6	6 1/2	—	10 18 4
Metropolitan ..	6 6	7 1/2	—	9 13 3
do. 4 1/2 per cent. Pref. ..	4 1/2	4 1/2	—	7 16 6
St. James and Pall Mall ..	12 13	6	—	10 0 0
South London ..	6 7	7 1/2	—	10 13 4
South Metropolitan Pref. ..	7 7	16 1/2	—	8 12 4
Westminster Ordinary ..	10 10	10 1/2	—	9 6 0

TELEGRAPHS AND TELEPHONES.

	Dividend	Price July 26, 1921.	Rise or Fall	Yield.
	1919, 1920.			per cent.
Anglo-Am. Tel. Pref. ..	6 6	8 1/2	—	7 2 9
do. Def. ..	1 1 1/2	1 1/2	—	8 19 0
Chile Telephone ..	6 6	5 1/2	—	5 18 5
Cuba Sub. Ord. ..	7 7	7 1/2	—	9 8 8
Eastern Extension ..	10 10	10 1/2	—	6 8 0
Eastern Tel. Ord. ..	10 10	10 1/2	—	6 8 0
Globe Tel. and T. Ord. ..	10 10	10 1/2	—	5 19 5
Great Northern Tel. ..	6 6	8 1/2	—	8 11 6
Indo-European ..	2 1/2	2 1/2	—	8 10 3
Marconi ..	10 10	80	—	8 6 8
Oriental Telephone Ord. ..	12 12	2 1/2	—	16 16 8
United R. Plate Tel. ..	8 8	8 1/2	—	16 16 8
West India and Panama ..	Nil Nil	6 1/2	—	Nil
Western Telegraph ..	10 10	10 1/2	—	16 16 8

HOME RAILWAYS.

	Dividend	Price July 26, 1921.	Rise or Fall	Yield.
	1919, 1920.			per cent.
Central London Ord. Assented ..	4 4	4 1/2	—	8 1 8
Metropolitan ..	1 1 1/2	1 1/2	—	5 9 1
do. Districts ..	Nil Nil	1 1/2	—	5 9 1
Underground Electric Ordinary ..	Nil Nil	2 1/2	—	5 9 1
do. Pref. ..	Nil Nil	6 1/2	—	5 9 1
do. do. Income ..	4 4	7 1/2	—	5 0 8

FOREIGN TRAMS, &c.

	Dividend	Price July 26, 1921.	Rise or Fall	Yield.
	1919, 1920.			per cent.
Anglo-Arg. Trams, First Pref. ..	5 12 1/2	2 1/2	—	10 0 0
do. do. 2nd Pref. ..	Nil 5 1/2	2 1/2	—	9 11 4
do. do. 5th Deb. ..	6 6	6 1/2	—	7 15 0
Brazil Tractions ..	Nil Nil	2 1/2	—	9 11 4
British Columbia Elec. Ry. Pice. ..	5 5	6 1/2	—	9 11 4
do. do. Preferred ..	5 5	6 1/2	—	9 11 4
do. do. Deferred ..	5 5	6 1/2	—	9 11 4
Mexico Trams 5 per cent. Bonds ..	Nil Nil	2 1/2	—	9 11 4
do. 6 per cent. Bonds ..	Nil Nil	2 1/2	—	9 11 4
Mexican Light Common ..	Nil Nil	2 1/2	—	9 11 4
do. do. Pref. ..	Nil Nil	2 1/2	—	9 11 4
do. do. 1st Bonds ..	Nil Nil	2 1/2	—	9 11 4

MANUFACTURING COMPANIES.

	Dividend	Price July 26, 1921.	Rise or Fall	Yield.
	1919, 1920.			per cent.
Babcock & Wilcox ..	15 16	23	—	6 14 6
British Aluminium Ord. ..	10 10	17 1/2	+6d.	11 16 4
British Insulated Ord. ..	15 15	14 1/2	—	10 0 0
Callenders ..	15 15	1 1/2	—	10 0 0
do. 6 1/2 Pref. ..	6 1/2	17 1/2	—	7 8 7
Crompton Ord. ..	10 10	10 1/2	—	12 6 6
Edison-Swan ..	10 10	16 1/2	—	7 7 1
do. do. 5 per cent. Deb. ..	5 5	6 1/2	—	13 6 2
Electric Construction ..	10 10	16 1/2	—	12 6 2
English Electric ..	8 8	12 1/2	—	8 0 0
do. do. Pref. ..	8 8	12 1/2	—	8 0 0
Gen. Elec. Pref. ..	6 6 1/2	17 1/2	+6d.	7 13 0
do. Ord. ..	10 10	21 1/2	—	12 13 4
Hawley ..	15 15	1 1/2	—	10 0 0
do. 4 1/2 Pref. ..	4 1/2	2 1/2	—	6 18 6
India-Rubber ..	10 10	1 1/2	—	10 0 0
Met.-Vickers Pref. ..	8 8	11 1/2	—	8 16 10
Siemens Ord. ..	10 10	28 1/2	—	12 0 0
Telegraph Con. ..	30 30	30 1/2	—	16 17 1

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, July 26th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
Acid, Oxalic ..	per lb. 8 1/2d.	1d. dec.
Ammoniac Sal ..	per ton 405	£10 dec.
Ammonia, Murate (large crystal) ..	" 488	£7 dec.
Bisulphide of Carbon ..	" 234	"
Borax ..	" 231	"
Copper Sulphate ..	per lb. 6d.	1d. dec.
Potash, Chlorate ..	" 8d.	"
Perchlorate ..	" 15 10s.	80/ dec.
Shellac ..	per cwt. 217	£1 dec.
Sulphur, Sublimed Flowers ..	" 217	£1 dec.
Lump ..	per lb. 4d.	"
Soda, Chlorate ..	per ton 217	"
Crystals ..	per ton 7d.	"
Sodium Dichromate, oaks ..	per lb. 7d.	"
METALS, &c.		
Babbitt's Metal Ingots ..	per ton 495 to £300	"
Brass (rolled metal 3" to 12" basis) ..	per lb. 11d.	"
" Tubes (solid drawn) ..	" 1 1/2 to 1 1/2	"
Wire, basis ..	" 11d.	"
Copper Tubes (solid drawn) ..	" 1 1/2	"
" Bars (best selected) ..	per ton 2105	£7 dec.
" Sheet ..	" 2105	£7 dec.
" Rod ..	" 2105	£7 dec.
" (Electrolytic) Bars ..	" 27 1/2	40/ dec.
" " Sheets ..	" 2145	"
" " Wire Rods ..	" 2145	40/ dec.
" " H.C. Wire ..	per lb. 11d.	1d. dec.
Elbonite Rod ..	" 9 1/2	"
" Sheet ..	" 8 1/2	"
German Silver Wire ..	" 2 1/2	"
Gutta-percha, fine ..	" 13 1/2	1d. inc.
India-rubber, Para fine ..	" 11d.	1d. inc.
Iron Pig (Cleveland Warrants) ..	per ton Nom.	"
Wire, galv. No. 8, P.O. qual. ..	" 23 1/2	"
Lead, English Pig ..	per ton 23 1/2	"
Mercury ..	per bot. 21 1/2	"
Mica (in original cases) small ..	per lb. 4d. to 4 1/2	"
" " medium ..	" 12 1/2 to 13 1/2	"
" " large ..	" 14 to 19	"
Phosphor Bronze, plain castings ..	" 2 1/2 to 3 1/2	"
" " rolled bars and rods ..	" 2 1/2 to 3 1/2	"
" " rolled strip & sheet ..	" 2 1/2 to 3 1/2	"
Silicium Bronze Wire ..	per lb. 1 1/2	1d. dec.
Steel, Magnet, in bars ..	" 1 1/2	"
Tin, Block (English) ..	per ton 2158	£7 10s. to £8
Wire, Nos. 1 to 16 ..	" 2158	3d. dec.
White Anti-friction Metals ..	per ton 478 to £300	"

Quotations supplied by—

G. Boor & Co.	J. James & Shakespeare.
Thos. Bolton & Sons, Ltd.	H. Edward Tilt & Co.
Frederick Smith & Co.	J. Boling & Lowe.
F. Wiggins & Sons.	R. Richard Johnson & Nephew, Ltd.
India-Rubber, Gutta-Percha and	P. Ormiston & Sons.
Telegraph Works Co., Ltd.	J. W. F. Dennis & Co.

Battleships Controlled by Wireless.—The efficient performance of the battleship *Lena* under radio control during recent aerial bombing tests may, naval officers at Washington believe, lead to revolutionary changes in naval development. Without a soul on board she was manoeuvred from the battleship *Ohio*, five miles away, with the utmost precision, and there was not a hitch in the mechanism in more than two hours while the *Lena* was being bombed. So perfectly did the control function that the officer on the *Ohio* manoeuvred the *Lena* away from the attacking air force at the moment the bombs were being released, varying the speed of the target vessel at will. It is pointed out that the blocking ship of the future might sail serenely into an enemy harbour without a soul on board and be sunk to obstruct its channel by the electrical explosion of her magazines.

Already the United States Navy is working out plans for shifting control at will from a surface vessel like the *Ohio* to aircraft, either heavier or lighter than air. A movement is on foot to install radio control on at least one more obsolete battleship and two old destroyers, to serve as targets for aerial bombing practice and further experiments with radio control. Extension of experiments to the possibility of applying the radio control idea to aircraft also is under consideration.—*Reuter's Trade Service* (Washington).

Manchester Motor Parade.—Five electric vehicles participated in the parade of commercial motor vehicles at Manchester on July 23rd that was organised by the Manchester Branch of the Commercial Motor Users' Association. All of them were entered by the Corporation, and consisted of a 10-cwt. Electromobile van, a one-ton Edison lorry, a two-ton Ransome, Sims & Jeffries lorry, a 34-ton Walker tipping wagon, and a five-ton General Vehicle tipping wagon. The Edison vehicle was five years old, and had travelled 48,200 miles.

Measuring Emotion.—An interesting demonstration in experimental physiology was given at Paris on July 15th at the Institute Marey, by Dr. Augustus Waller, of the Physiological Institute and the University of London. His experiments, it will be remembered, show that the electrical resistance of the body varies under the influence of emotion.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

ANNUAL MEETING.

(Continued from page 110.)

Financial and Business Aspects of Municipal Electricity Supply.

By C. W. CHARLESWORTH.

(Wolverhampton Electricity Supply Department.)
(Abstract.)

Capital.—The effect of the present conditions is that, in addition to an increased outlay, the rates of interest on borrowed moneys have advanced; thus while the capital expenditure amounts to two and a half times the pre-war figures (150 per cent. increase), the total charge to revenue, including interest (364 per cent. increase), and repayments (438 per cent. increase), is almost three and a half times as much as it was (nearly 250 per cent. increase). Present conditions will arrest development and hinder progress of economical fuel utilisation; it is therefore imperative that the situation be relieved without avoidable delay by either lowering the price of plant, mains, &c., or financing the industry so as to reduce the capital charges. The weight of interest is a serious item where moneys have to be borrowed for capital purposes, and it seems worth considering whether any help could be obtained by devising a system of loans with variable interest, the rate being fixed on a base with increases or decreases similar to those operating in connection with other charges.

All capital expenditure is in reality deferred revenue expenditure, because revenue must provide the moneys necessary to renew the assets or repay the outstanding debt, if a loss is to be avoided. It will be found much cheaper to buy assets direct out of revenue than to borrow for the purpose, and although it is not feasible to provide very large amounts out of any one year's revenue, particular attention is directed to the desirability of buying all small items such as meters, services, tools, and instruments, either out of the reserve fund where these exist, or out of current revenue.

Cost of Production and Charges for Supply.—The large percentage claimed by capital charges, together with fuel, completely overshadow in importance all other items in the cost of production. Table I illustrates the composition of the total costs of electricity supply (per cent.).

TABLE I.	1913. 1916. 1919.		
	14.	17.	20.
Capital charges	...	36	30
Fuel	...	25	40
Repairs, maintenance, water, stores, &c.	...	18	11
Shift and running wages	...	5	6
Local rates, management expenses, and salaries	...	16	12

The fuel item in costs in some cases amounts to nearly 80 per cent. of the works costs, but although a fuller use of plant decreases the fuel consumption per unit, the effects are more complex, and under specified conditions beyond a certain point very little improvement can be expected. Care in the purchase of fuel and the use of more efficient plant have been out-balanced by the enormous rises in the price of coal during the past few years. The author shows in the original paper how the increases have altered the proportion of expenditure under each head to the whole.

The rises in the price of coal have not been based on a percentage of the pre-war price, but on a flat rate per ton, with a tendency to level the prices to industrial users. This has brought about a peculiar result in throwing a proportionately heavier burden on those undertakings that before the war were fortunate enough to obtain a cheap supply of good coal. In one undertaking, while in 1915-16 the total revenue expenses on all items, including approximately 40,000 tons of coal, amounted to just over £60,000; in 1920-21 the cost of coal purchased, just about 40,000 tons again, alone exceeded £60,000! It was a good thing that that undertaking to be able in 1920-21 to generate almost 8,000,000 more units with a rather smaller total quantity of coal than was used in 1915-16, by means of which economy no less than £28,000 was saved on this one item. Such an instance provides a particularly apt illustration of one of the main effects of modernising plant.

Labour is an important item, not so much because of its relative heavy expense, but on account of the numerous ways in which leakage and waste may occur. There would seem to be a tendency to cut down supervision rather too much, and stress is laid upon the benefits and increased economy to be obtained by the provision of sufficient officers and foremen properly to check and direct the large number of operations in a supply undertaking.

That the principles underlying the cost of production of electrical energy do not differ fundamentally from those present in most other manufacturing businesses, appears to be true if the effect of output upon overhead charges only is taken into consideration, but a closer analysis reveals vital differences. Thus classification or grading of prices on the usual commercial lines will not meet the whole of the conditions so as to produce the best results. The question is perhaps somewhat complicated by the legal provisions relating to charges.

The ordinary principles of business, which allow freedom for the operation of economic laws, and any adjustments necessary upon consequent effects, have by these provisions been ren-

dered somewhat inapplicable in practice in framing tariffs. Section 19 of the 1882 Act is probably wide enough to enable any reasonable case to be met, but the uncertainty that has prevailed about the meaning of Section 20, which prohibits undue preference, has provided fertile matter for contention, and has tempted the opponents of electricity supply interests into active operations in attempts to secure narrow and fettering legal decisions with a view to crippling electrical enterprise. The decision of Mr. Justice Astbury in the Hackney test case is that the reason for different charges must be different costs, and it is now abundantly clear that differentiation may be made in relation to cost. The means adopted to meet the conditions were treated from a legal point of view by Mr. Justice Sargent in the case Attorney-General v. Long Eaton Urban District Council. This judgment laid down that the charge for supply must in equity be based upon the cost, and this now seems the only tenable ground upon which a defence of any particular method of charging can be put up with any chance of success. In the course of judgment it was said: "It would seem that A must not be charged less than B, merely to overcome a greater reluctance on the part of A to become a customer, or to induce A to become a customer in respect of another supply, although either of those reasons might be a good commercial reason for charging less to A were the public undertakers merely carrying on any ordinary commercial business." Undue preference, in the sense that supplies which cost less are sold at higher prices and supplies which cost more are sold at lower prices, is shown in the commercial world, the justification put forward being that when the cost of production of anything is affected by the production of other things, the best way to develop the business as a whole is to adapt prices as fully as possible to the character of the demand.

It is only possible to obtain a true analysis of costs by dividing the expenditure into running costs, embracing items that vary with output; and the standing expenses, covering all other items. Unfortunately, while the legal decisions quoted make it clear that prices must be based on costs, Sections 31 and 32 of the 1899 Act completely overlook the facts of the matter. The third provision under Section 31 enables a just tariff to be put into operation, if sanction be obtained, but the right of consumers to be charged at their option by the amount of energy or electrical quantity renders it impossible to secure a reasonable return in many cases. The schedule mentioned in Section 32 has during the past few years created hardship in a number of undertakings. It is out of date and requires revision to enable it to be effective.

The proper provision to meet the conditions experienced is a multipart tariff, and if approved and generally adopted this would be the means of removing some of the injustice now present.

The author shows the distribution of expenditure as between standing expenses and running costs and the relative importance of the items comprising these. It is also shown in the original paper how these two portions of the costs are built up from various sections, sub-sections, and items in the total expenditure.

Load factor is extremely important, because the output of a given station can be increased enormously by keeping the plant more fully loaded throughout the day without affecting the standing expenses. However, it is possible to improve the load factor and yet actually increase the average costs per unit, and the improvement must come about in any given plant with a maintained or increased maximum demand.

Utility factor has an effect on the average costs, and completes the picture only partially presented by load factor in bringing out the effect of the plant necessary as spare, or not utilised, at different stages of development.

Divergence in the demand periods enables more load to be met from a given plant than would be possible if all the demands made coincided, thus reducing the commitments on plant and mains in respect of individual demands, although this advantage is lessened by the additional expenditure necessary to extend the number of consumers. In normal circumstances an undertaking will only be called upon to supply 50 or 60 per cent. of the consumers' installed lamps, motors, heaters, &c., at any one time, and the figure is being reduced as domestic supply develops.

A high diversity factor is an effective means of improving the load factor, and it has been estimated that the diversity factor of different loads is in the following order:

Lighting, 1.1 to 1.5, average probably 1.25.

Power, 1.5 to 3.0, average probably 2.00.

Heating and cooking, 4.0 to 10.0, average probably 7.00.

The period during which supply is taken is a point that should receive full attention, as by arranging for load during the times of light demand to fill in the valleys in the load curve, both diversity factor and load factor can be increased. A consumer with a 25 per cent. load factor may, if his demand is made and maintained during the off peak periods, be more profitable than one with 100 per cent. load factor, in which case the demand would, of necessity, be maintained during the peak period. One hundred per cent. load factor con-

sumers are undoubtedly entitled to very low rates of charge, as such a load has a big effect on the average overhead expenses, but there is a limit to even better propositions. A good consumer with an all peak demand can be profitably supplied at a surprisingly small price per unit. There are great possibilities of saving by a rearrangement of working hours to flatten the peak load, an attractive alternative to securing off peak custom. With the present inflated prices no undertaking can afford to ignore the resultant decrease in efficiency brought about by low power factor supplies.

In practice it is admittedly difficult to try to take care of individual consumers, and therefore the costs to be met should be allocated on the basis of the current and declared pressure, varying the expense in such a way that it will pay the consumer to provide the best type of machinery and most efficient arrangements. The increased costs to carry out given work are so heavy when the power factor is low that the most effective correction can probably be obtained if these are properly allocated and charged.

The danger of considering an undertaking as a whole or in using averages based on the output in units, is clearly shown by the author, who brings out the effect of varying increases in the different items of cost on different load factor supplies, and the need for care in the allocation of such increases to each class of consumer.

The law of diminishing utility (which shows that the total utility of a commodity to a consumer increases with the increases in the amount he can get, but not at the same rate) is of particular interest. A curve representing this law has a close similarity to a curve representing the cost of production of electrical energy, thus proving the necessity of constructing a tariff on the general lines indicated. This economic law means that, although a consumer may be willing to pay, say, 8d. per unit for 100 units per annum, he would not, other things being equal, continue purchases beyond this amount at the same rate of charge; to induce him to purchase 1,000 units it may be necessary to reduce the average price by half. Elasticity of demand has a bearing on the question, a person's desire for supply will probably diminish with the increased quantity available, but if this decline is slow, the reduction in price to induce purchase need only be small, while if it is rapid, the reduction must be a large one; in the first case the demand will be elastic, but in the latter case it will not. The action applies conversely to an increase in prices. This principle may be applied in considering a domestic consumer who uses supply for lighting only, and who might be quite willing to extend its application to other purposes if a sufficient reduction is made, depending upon the savings that could be effected by disposing of domestic assistance, &c., and the extra comfort and leisure resulting.

The writer places as of first importance the division of consumers into classes. This has generally been settled up to now by differentiating between power, lighting, and heating. It is open to question, however, whether this crude but commercial division is the right one, and whether the results brought about by it are as satisfactory as they might be.

The best general solution the writer has met with up to now, combining expediency and ability to meet the factors involved, is the multipart tariff. It is a great improvement on the maximum demand indicator system. To be generally acceptable the bases of charge for power and industrial users, business premises, and domestic consumers cannot be the same. An important point is to bring the unit charge down as low as possible, and the writer has found a standing charge of 15 per cent. of the rateable value, with a follow-on charge of 3d. per unit, very popular. The consumer is content in the knowledge of his fixed amount, and realises that it does not pay to worry about the exercise of those petty economies which are pressing in the case of a flat rate. Consequently, output tends to grow rapidly, and general domestic devices come into use with good effect all round. Figures, covering a year's sales for residential supplies, are given in the original paper to show what effect can be produced upon output and revenue by the introduction of a multipart tariff.

One of the advantages of this method of charging is that it does away with the necessity of separate circuits and meters for different uses of the supply—a really important point.

Multipart tariffs may possibly be the means of bringing about a general system of charging for all supplies, and the writer looks forward to the day when electricity will be put on tap and supplied without very great restriction for an inclusive figure per kilowatt per annum, independent of the number of units consumed.

Application of Revenue Earned. The usual clause inserted in Electric Lighting Orders relating to the application of revenue is on the lines of Section 7 of the Electric Lighting (Clauses) Act, 1899, but the section falls short of present-day requirements.

There is probably no need to submit a full argument for the establishment of a reserve fund. It is important to understand the essential difference between reserve funds and reserves, however, which lies in this: That a reserve is a charge made against revenue to provide for an expected loss, whereas a reserve fund is an allocation of surplus remaining available after payment of all charges, known and contingent.

The security provided against future contingencies would be very well worth the sacrifice of a small present enjoyment. It is possible to have investments outside an undertaking and yet be without a reserve fund.

Regarding depreciation in municipal undertakings, the merits of the case have been somewhat disguised by reason of the inherent difference between private and public trading; when it comes to the application of the reserve, the difference is at once apparent. The company can dispose of it as may be decided, but the local authority must apply it in repayment of the loan debt. This, however (and it is here the confusion has arisen), makes no difference in effect, as in both cases the capital has been preserved, and thus the process known as depreciation entirely provided for.

Should a case arise, however, where the loan period is too long or where obsolescence occurs (the latter fact having entered largely into the affairs of electricity supply undertakings), the necessary adjustment should be borne out of a reserve for contingencies, which ought always to be provided as a charge against revenue, being available to correct any under-provision for depreciation by liquidating any outstanding debt on plant, &c., superseded or discarded, and to meet expenditure on renewals.

In omitting to provide power to borrow for working capital the Legislature has passed over a vital matter, and it is difficult to understand how it could be conceived possible for undertakings to carry out their obligations under these conditions without acting *ultra vires*. A certain amount of relief can be found by arranging to issue monthly accounts for supply to all large consumers. Where a bank overdraft has to be obtained, costing £1,300 per annum in interest, the position could be met by a loan costing in all £2,150 per annum; but in the one case, at the end of 20 years, conditions would not be improved, while in the other case the loan would be liquidated, and at a gross extra cost of £17,000 the undertaking would have accumulated a desirable reserve fund of £30,000.

Any local rate relief, either direct or indirect, and *per contra* any aid from local rates, is unsound and actively against the real interests of both trading and non-trading departments of the same Corporation. The modern tendency in Special Orders is towards the abolition of provisions enabling rate aid or relief to be given or received. The risk incurred by the general body of ratepayers nowadays in guaranteeing loans for electricity supply undertakings is a small one, and it cannot be too strongly urged that rate relief must retard development. To use it as a means of indirect taxation is to depart from the prime reason for its establishment.

The provision included for limiting the surplus in any year to five per cent. of the aggregate capital expenditure deserves attention. The basis adopted seems to have little to recommend it and a better basis would be the aggregate capital expenditure, less the value of plant, &c., superseded and discarded, or the total revenue is thought to be the best basis. With the slow turnover in electricity supply the maximum rate of surplus would have to be higher than 5 per cent.; 15 per cent. is suggested as being reasonable to meet the requirements at the present time, but taking pre-war figures this percentage would have to be increased, probably to 20 per cent.

Records and Statutory Form of Accounts.—One of the most valuable features in any scheme of control is the provision of an efficient and reliable costing system, as the benefits derived by concerns that have invested in scientific costing machinery prove.

To ascertain costs it is necessary accurately to measure quantities and time and, in addition to the usual apparatus for checking workmen's attendance and for measuring stores, &c., sufficient instruments must be installed on the water, steam, and electrical systems. A quick appreciation of the position is very necessary to enable any changes desirable to be made, so that any benefits therefrom may be realised without delay; and although all records may be most carefully kept and balanced, their usefulness is to an extent impaired if they are not available quickly.

The broad scheme of control put forward by the Departmental Committee on the Accounts of Local Authorities, whose report was issued in 1907, is a sound one, and briefly amounts to this: That the engineering department should be responsible for the policy adopted; for purchasing, the certification of all expenditure, and records in connection therewith; for sales, the certification of all revenue receivable, and records in connection therewith; the finance department to deal with the actual handling of cash and to be responsible for raising capital moneys, records in connection therewith, &c. Successful arrangements can be made on these lines.

Distribution of Supply.—The market for electrical energy is the consumers' terminals, and though production can be increased enormously at low cost, the means of distributing electrical energy will probably present obstacles to its economical marketing for some time to come. Mains extensions are directly covered in the 1899 Act by clauses 21, 24, and 25, but were such provisions strictly adhered to or enforced the undertakers concerned would be the first to feel the effect of such a narrow policy.

It is extraordinary that the average business man, who accepts the commercial principle of paying interest out of capital in the case of new concerns during the first years or few years until established, should so often criticise proposed mains extensions on the ground that they will not secure enough revenue at once.

Delivery is a factor that cannot be overlooked, as a wise and far-seeing policy in extending mains or providing reasonably large conductors in the first instance may result, by

making the supply available quickly, in business otherwise impossible to secure.

The cost of converting plant to-day is of the order of £5 per kilowatt. The changing over from d.c. to a.c. distribution is becoming an important problem, but valuable work is being done by carrying out all mains extensions with four-core paper lead cables and arranging services accordingly (although operating these in the meantime with d.c.), thus gradually building up the skeleton of an a.c. network to utilise when the most opportune time arrives. In this way, too, the expenditure necessary is met gradually—a valuable help.

Sales and Commercial Department.—The absorbing attraction of engineering detail would seem to have been given an unduly large proportion of the management's attention in the past; more surprising effects can often be produced on the financial results by a live and progressive sales department that is successful in extending the use of supply and increasing output.

It is a mistake to rely on catalogue illustrations to show what might be done; the effect of having apparatus available for actual demonstration is of noticeable benefit. Advantage can be obtained by studying the methods adopted in up-to-date retail shops and stores in other trades. The industry is particularly fortunate in having the Electrical Development Association now, and provided the greatest possible use is made of this Association the help so obtainable should prove invaluable. All members of the staff of an undertaking, from the chief engineer downwards, should be required to use electricity for service in their homes. There is nothing like a practical belief in one's wares to carry conviction. The retail or selling side of electricity supply has been more or less left to look after itself in a number of cases. Service is the object, and though the supply itself may be perfect, the sales results are liable to be disappointing if consumers do not obtain a reliable and economical means of achieving their ends. To ensure this the most suitable appliances must be installed, *their use fully understood*, and prompt help must always be available to deal with failures and defects. Stress is laid on the importance of a maintenance section; all complaints and faults in apparatus should be dealt with immediately. The value of this can hardly be exaggerated, as satisfaction cannot be entirely measured by a good supply, and if apparatus in use does not fulfil requirements, very often prejudice is created against electrical methods. Indeed, the interests of the consumer and the undertaking are so tied together that it is a little difficult to see how great progress can be made unless powers are given to sell and hire-purchase the various lighting, power, heating, cooking, &c., appliances and to carry out repair and maintenance work. Section 23 of the 1919 Act grants hiring powers, and the position would be very much helped if these could be extended at least to hire-purchase, which is an essential part of any scheme of development owing to the cost of installations and apparatus, and unless cultivated it would appear that the domestic uses of electricity (in all but the higher class of residence) must be very much restricted for some time to come.

One of the most important questions in administering a sales department is to work on co-operative lines with the local wiring contractors. Every effort should be made to secure a mutually satisfactory arrangement, as up to a point the interests are to be regarded as identical. Both parties can be of great assistance to each other, and the unfortunate position—almost amounting to antagonism—in some towns is entirely due to a want of appreciation of the dependence of each branch of the industry on other branches. Generally it may be said that an undertaking should not tender against the wiring contractors so long as sound work is carried out and a combination is not formed to raise or maintain prices.

The greatest field for development is in domestic supplies. The number of consumers any undertaking has connected compared with the number of dwellings in its area of supply, in the majority of cases only amounts to 10 per cent., and in many cases it is even less. A town of, say, 200,000 inhabitants will have about 40,000 dwellings, and assuming only half this number electrified, and an average demand of but one kilowatt per house, the resultant demand is 20,000 kilowatts! The future generation of housewives is passing through its school days at present, and with the inclusion of domestic economy in the curriculum, if electrical methods could be introduced into school demonstrating classes this would be of help in enabling students to become accustomed to the uses of electricity and to realise the many advantages to be obtained, in the lightening of domestic labour, in better conditions, in superior cooking, in greater cheerfulness, and general all-round economy.

Electric vehicle progress is an excellent illustration of the enterprising manner in which municipalities have helped to foster the growth of a new form of demand, and there is a big future for the electrically-propelled vehicle.

Legislation.—Since the 1882 Act a further Act has been passed practically every ten years, in 1888, in 1899, in 1909, and in 1919; reasonable criticism arises from the fact that the opportunities provided by each subsequent enactment do not appear to have been taken to amend certain clauses which are obsolete and which under the altered conditions do not secure the effects desired.

It would be a great help to development and a progressive step if general arrangements could be made to widen the supply areas of undertakers by enabling them to deal with surrounding districts which could be economically served from

existing stations without the need for creating new undertakers. A large number of "fringe" Orders have been granted under Section 6 of the 1909 Act, which have been very useful, but these are restricted to specific consumers, and there is a need for expansion on the lines suggested.

Unfortunately, up to the present time the industry has been starved—by lack of cheap capital, by its small revenues, and by the absence of large conceptions of enterprise. It is hoped that the Act of 1919 is an earnest of the opening up of a new chapter.

DISCUSSION.

Mr. C. W. Charlesworth's paper was read and discussed on the first day of the meeting following the President's address, and BAILEY W. B. SMITH, in opening the discussion, agreed with the president's appeal for closer co-operation between municipalities and companies, but he pointed out how the two kinds of undertaking differed inasmuch as the companies could repay their capital whenever they chose, whereas the municipalities had to do so within a fixed term of years. Their costs were, therefore, immediate and higher than those of the companies. Municipalities must be allowed to do more as they liked, and not be guided by Commissioners in London (who probably had less experience than the municipalities themselves); they must be allowed more latitude with regard to their loans and financial affairs.

Ald. W. WALKER, however, had less confidence in municipalities than the first speaker, and was of the opinion that Corporations should be very closely watched. He entirely disagreed with the fatal policy expressed in Bailey Smith's retrograde speech.

BAILEY KENNEDY (chairman of the Glasgow Electricity Committee) hoped the meeting would not assume that the propositions put forward by Bailey Smith were those held at Glasgow. He thought that Corporations should be held well in hand; a sinking fund was very necessary as well as a depreciation allowance, so as to enable their engineers to spend money more freely. He had confidence in their engineers being able to pay off their debts.

Ald. J. A. G. BEAUMONT explained the manner in which municipalities were placed at a distinct disadvantage so far as raising working capital was concerned. They could only do that by creating a special reserve out of the surplus revenue at the end of each year, but by doing so they might place themselves in a very delicate position. Some satisfactory way of solving the difficulty would have to be found, and he was glad to announce that they at Marylebone had commenced to build up such a reserve, which he hoped in time would become commensurate with the size of their undertaking.

Mr. S. J. WATSON thought that part of the paper which referred to the sale and development of electricity supply was one of its most important sections; it was a subject which had been neglected in the past, and no time should be lost in recommencing activity in that respect. The author's suggestion that accounts should be collected monthly would ease the situation as regarded current working capital very considerably. Considering the conversion of a.c. to d.c., it might be assumed that the generation of l.p. d.c. had practically ceased. They could at least congratulate themselves that the price of electricity had only advanced by 100 per cent. notwithstanding the immense increase in costs; but costs would not remain at their present high level, though, of course, pre-war figures would not be again reached. Cost would have to come down if this country was to continue to prosper. He endorsed what had been said about the desirability of imposing a compound charge for all kinds of supplies, except domestic supplies, and gave the cost of installing plant at the present time as £27, £28, or £29 per kW, including land, water arrangements, sidings, &c., with a probability of the figure falling within the next 12 months to £25 per kW.

Mr. E. E. HOADLEY did not agree that difficulty was experienced in finding current working capital during the first years of an undertaking's existence. His undertaking was only now, after some 20 odd years, feeling any real disadvantage in that respect. The Commissioners, however, could give them no relief, neither could they do so with regard to the method of charging for supply. He estimated that only by imposing a charge of from 16d. to 18d. per kWh would such classes of premises as shops, &c., commence to be remunerative on a flat rate system. The Commissioners had eventually allowed him to charge 1s. per kWh for the first 90 hours, and after that 5d. on the maximum demand system, but he had no idea how they had managed to do so, because they had previously informed him that they had no power to make any concession of that sort. He was glad to announce that they now had at Maidstone an automatic sub-station located 2.5 miles from the generating station which was operating with complete satisfaction.

Mr. A. H. DYKES thought that the crux of the whole problem was the provision of capital, and the subject of working capital had not been sufficiently emphasised. It would be a great step in the right direction if they could bring pressure to bear on Parliament so that the Electricity Commissioners could be given power to readjust methods of charging, which was particularly required in the case of the smaller undertakings. The difficulty would not be solved by the domestic load, as was so often argued.

The CHAIRMAN, Major H. RICHARDSON, M.C., pointed out that they were not striving to obtain a price, no matter whether it was 1d. or 2s., but a system of charging.

Mr. C. W. CHARLESWORTH, in reply to some of the points raised, explained that he had not advocated the postponement of the repayment of capital. The matter of the sinking fund was made clear by the first set of curves in his paper, but after all, that was only a small part of the total charges to be met. With regard to working capital, that difficulty could be overcome by borrowing for the purpose, and automatically creating a reserve.

At the conclusion of the discussion a meeting of the chairman members (only) of the I.M.E.A. was held.

ANNUAL DINNER.

The annual dinner of the Association was held at the Hotel Cecil on Thursday, July 22nd. The president, Major H. Richardson, I.E.S.E., occupied the chair and there was a large attendance of members and guests, including all the Electricity Commissioners and many other distinguished members of the electrical industry. After the loyal toast, proposed by the president, Sir JOHN SELL proposed the toast of the Incorporated Municipal Electrical Association, expressing the regret of the Commissioners at their being the unconscious cause of depriving the Association from meeting at the Institution of Electrical Engineers by the prolongation of the inquiry. He expressed their pleasure at meeting old friends and enjoying the comparative rest of that delightful entertainment. The Electricity Commissioners, he said, had concentrated upon the work that was formerly done by five Government departments, together with the developments that had been arrested by the war; on top of that came the new legislation and re-organisation of electricity supply. Those who had had the misfortune to attend the London inquiry had listened to a number of chameleon-like schemes, and out of this melée they could see the expediency of crystallisation from the fluid element—he hoped that the perfect crystal would be born. Nineteen years ago he was president of the Association; now he was one of the few honorary members, a distinction which he genuinely valued. The experience which he gained on the Parliamentary Committee of the Association proved of value in his practice, and might to some extent have led to his attainment of his present post. The Association now wielded a really great influence. Had not this and other Associations been organised it would not have been possible to deal with the emergencies that arose during the war period and the industrial crisis that followed. A vastly greater development would occur in the years to come, for which they must fit themselves, and he implored the members not to look at the problems in their districts in a purely parochial spirit, but to adopt a wider vision and assist the Commissioners in meeting the problems with which they would be confronted. He paid a tribute to the splendid war service of his old friend Major Richardson, who had been privileged to go overseas and to gain the Military Cross. In conclusion, he reminded them that each had a great and common duty to perform in the rehabilitation of this country as a great industrial nation and as the financial centre of the civilised world. He believed that in that new era electricity supply

would be one of the key industries which would contribute to the prosperity of the country.

Responding to the toast, Major RICHARDSON said they had had a very serious and businesslike meeting this year, working the whole time. He could answer Sir John's very kind remarks at some length, but all would agree that he had already done it in his presidential address. Electricity supply was undoubtedly going to be a vast industry, and he believed that their enthusiasm would make it a success. The way was being pointed out by the Electricity Commissioners, of whom they were proud; and they were grateful that, due to their personality, they were not likely to cultivate that quality of Government departments called prudence, but which he called "frigid insensibility." He concluded with thanks to Sir John for his encouraging remarks and to Capt. Sankey for the hospitality afforded to the Association by the Institution of Mechanical Engineers.

Ald W. WALKER proposed the toast of "The Visitors," and remarked that the papers that had been read were second to none in the history of the Association; they formed a most valuable contribution to the industry. He had no doubt that the curve of progress would resume its natural direction. They had every confidence in the Commissioners, and closer working between the companies and municipalities was already manifest. They came together on the district and national commissions, and found that both parties were necessary to the public interests. He spoke as the chairman of the National Joint Council and Board. The work of those Councils had taken off the hands of the members much individual work, replacing it by collective bargaining. He asked them to remember that the Board and Council were their direct representatives, and that their decisions should be recognised, otherwise they would slip back into the old position; 95 per cent. of the undertakings had accepted their decisions, and he asked the small minority to remember that they were part of a great industry, and their action might injure the whole of it.

Mr. J. S. HIGHFIELD, responding to the toast, said he admired the extraordinary patience with which the Commissioners had listened to the exceedingly complicated problems put before them during the past few weeks. He had himself been a member of the Association; since then he had worked for companies, and he could not say how pleased he was to read the president's remarks in his address, aiming to bring the companies and municipalities together. It did not matter who did the work, so long as it was well done. The prosperity of the manufacturing industry in a large measure depended upon the supply engineers. The man with money was the need of the moment, and the only way to make a man with money was by making profits. The municipal men realised the importance of profit, and without it private companies could not exist.

The PRESIDENT proposed the health of the hon. secretary, Mr. C. R. Cramb, remarking that his work was done in the background, but they should let him know they were grateful. Mr. CRAMB briefly acknowledged the toast, and thanked the members for their assistance in making the meeting a success after the inevitable postponement.

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

ANNUAL CONGRESS.

(Continued from page 133.)

Electric Arc Welding.

By HENRY M. SAYLES, M.I.E.E. (Abstract.)

TRAMWAY engineers have made as extensive use of arc welding for repairs and maintenance work as anybody. It is only by trial that its limitations can be defined, and from the results of trials which are not wholly successful, lessons may be learned which will either widen the usefulness of the method or show definitely what it cannot be expected to do—both useful results. The author illustrates this by some instances of non-success, showing that it was not arc welding that failed, but an ill-considered application of it. Generally, when it is sought to repair a part which has failed from repeated bending stresses, or other reversed stresses, the repair should be carried out by reinforcing the part, which can very often be better done by welding on a reinforcement than by other means. This is not an admission that arc welding is useless for such repairs, but a warning that it should not be expected to accomplish impossibilities. No one would expect to make a permanent repair in, say, a brass piece which had failed in such conditions, by making a butt braze across the fracture.

If a part has failed owing to some unusual accident, it is quite sufficient and reasonable to make a welded repair which restores the normal section. If a part has failed under its normal working conditions, it should be sought to make the welded repair of such a character as to reinforce the part against the working stresses. Particularly it is undesirable to put a weld in such a position that considerable bending stresses come upon the weld itself. The weld metal may, and, if the work is properly done, will, unite thoroughly with

the original metal. It may also match the chemical composition of the original metal, but it may very probably have somewhat different mechanical properties, and such a difference, even if to the advantage of the weld metal, will produce some concentration of stress in the neighbourhood, exactly as a sudden change of section in a stressed member concentrates this stress. It is easier to give due application to these principles by the use of welding than by any other method in a great many cases.

Some relatively recent applications of arc welding for constructional purposes, as distinguished from repairs, include the building up of lattice-work masts or poles by arc welding ordered by an electricity supply company for transmission lines. A welded mast of this kind has a greater initial stiffness than a riveted mast; there is a saving of weight over a riveted structure of about 10 per cent.; the speed of manufacture is higher than for riveting, and the total cost of manufacture is about 40 per cent. less than that of a riveted mast, or, say, one can buy three welded masts for the cost of two riveted masts.

Another direction in which a good start has been made is steel structural work. During the last two years several steel buildings have been erected in this country, and others abroad, in which welding takes the place of riveting, and for large jobs the process offers very considerable advantages.

The welding method has advantages which probably have been hardly realised; the facility of riveting dominates the design, which requirements add to the weight of the structure, sometimes to quite a large percentage, and more to the cost of materials.

It is possible to design members which could not possibly

be riveted but can be welded very readily. The facility of joining conduces to economy in the cost of material, because standard sections can be utilised throughout with no parts cut to special shapes and dimensions, which special parts cost much more than their weight value, and frequently cause cumulative delays. There is a considerable saving of labour cost by welding as against riveting in this kind of work.

Long lengths of steam pipe have been made up with welded joints and give complete satisfaction. A rather newer development is the welding up of large steel pipes for hydraulic power work, and tests have satisfied those who are doing large work of this kind; preparations are in hand for the welding of well over 100 miles of very large pipe which will be welded on the longitudinal seams and circumferentially at the joints.

Another application is the welding up of steel wheels for heavy motor vehicles, including omnibuses, and it may be possible to lighten and cheapen the construction of car bogies and frames by a skilful application of welding in place of riveting and bolting. This seems worth the consideration of tramway engineers and car builders. Many broken truck side frames have been arc welded, and have stood up well in service, so that it seems that the effects of the shocks and vibrations to which cars are subject are quite well withstood by arc welding properly done.

Special technical points of welding technique are of interest to traction engineers, because they indicate a wider application of the art, and they are also of scientific interest.

In this country the use of covered electrodes for arc welding has been developed much more fully than elsewhere. The Americans for some reason are extremely sceptical about the advantages of covered electrodes. Certainly bare electrodes are cheaper, and perhaps as long as one confines arc welding to work on mild steel, where a weld metal of nearly pure iron meets the requirements, quite good work can be done with the bare electrodes. But I am sure that properly covered electrodes give better welds. I think this is especially the case when alternating current is employed.

The covering protects the electrode and the work around the arc also from oxidation. If the covering is of proper composition it acts as a flux, which not only protects the hot surfaces from oxidation, but unites with any oxides into a fusible slag. This slag should be so much more fusible than the metal that it will rise rapidly to the surface, and not remain entangled with the molten metal, forming a slag inclusion and a point of weakness in the weld.

By properly relating the chemical composition of the covering, i.e., eventually the slag, to that of the electrode and the metal to be welded, chemical action will take place between the slag and the molten metal, which will give the latter a final composition closely approximating to that of the stock metal, so making a homogeneous joint. Doubt has been cast on this claim, but I have been convinced of its soundness by the results. For example, arc welding on cast iron has been generally considered as somewhat unsatisfactory, because the weld metal is much more nearly a pure iron in composition and structure than a cast iron. It is, however, quite possible, by using an electrode and a covering (both of proper and related composition), to deposit a weld metal which under the microscope is indistinguishable in structure from typical cast irons. The electrode is not a cast-iron one, but the resulting weld metal is a synthetic cast-iron produced by the reaction between the slag from the covering and the metal of the electrode. Similar results have been obtained on a number of special steels. Manganese steel, of particular interest to permanent-way engineers, can be satisfactorily welded by a proper combination, and it is quite consistent with well-known facts in steel metallurgy that this should be the case. In all modern steel-making processes the slags play a most important part in controlling the composition of the metal.

All electrode coverings which really flux, contain either silicon or some other body which combines with iron oxide to produce a more fluid slag. Molten iron in contact with air (besides being oxidised by the oxygen) absorbs nitrogen, which remains in the metal as a nitride of iron, in the form of thin plates. It is believed that these nitride plates make the metal brittle. Americans make a good deal of this nitride formation, and state that the compound is always present in arc welds. American arc welding is almost entirely done with bare electrodes, so that there is nothing to keep the air away from the hot metal. Electrodes with fluxing coverings protect the hot metal from air contact to quite a large degree. Hence there is not only less oxidation, but also less nitrogen absorption, and welds made with such electrodes show very much less evidence of iron nitride than those made with bare electrodes, which is a considerable gain, because there is strong evidence that nitrogen is a bad constituent of steel in respect to mechanical qualities.

DISCUSSION.

Mr. R. J. HOWLEY said that electric welding would play an important part in tramway work in the future. He would like to know what was the effect of phosphorus and sulphur in the rails with regard to arc welding. He had read that an increase of these in the rail was apt to be against the making of a good weld, and it was important from the point of view of the specification. Was it necessary absolutely to remove the rust before welding, or would the effect of the high temperature be such as to drive out the oxide and combine it with the silica and so have no deleterious effect upon

the weld? He also would be glad to know whether it was possible to harden the tread of the rail by applying welded metal to it. He was glad to hear Mr. Sayers say that manganese steel could be welded, because he had heard Sir Robert Hadfield say that he had not yet found a satisfactory method of doing this. Arc welding certainly gave very much more satisfactory results than oxy-acetylene welding; that might be due to the fact that in the case of the latter local action was possible, and this affected the surrounding metal, which should be avoided.

Mr. A. NORTON said the inventor of stainless steel—Mr. Harry Brearley—had said that this steel would not weld.

Major J. CALDWELL, speaking with regard to electrodes, recommended the use of the very best that could be obtained. The cost of electrodes was very small compared with the total cost of the job. For instance, on a £200 job the cost of the electrodes might be £2, and on another job £5 out of £300. Where large quantities of metal were deposited, the cost would be greater, but, generally speaking, it was wisest to use the very best. A great many experiments had been made to manufacture synthetic cast-iron, without success, but there was no doubt that it was done in a small way in the process of welding, although it had not become a commercial operation. There was no difficulty whatever in depositing manganese steel, but there was some difficulty in preventing the cracking of the metal during the operation. Considerable heat must be used, and in many cases it was impossible to get a satisfactory job unless the work was pre-heated before welding. After reading some extracts from a report upon the use of electric welding upon the Belgian State railways, Major Caldwell mentioned the successful use of the process in connection with automobile wheels which had been shod with solid as well as with pneumatic tires. Welded wheels had half the weight of an ordinary steel wheel and cost less to maintain, and the London General Omnibus Co. had carried out a number of quite successful experiments with such wheels in actual service.

Mr. W. THOM said he had been using electric welding plant for 12 years, and he did not consider that there was an undertaking of a reasonable size that could do without one. Electric welding was not only a great convenience in enabling repairs to be carried out without pulling cars to pieces, for instance, but it enabled repairs to be carried out very cheaply, and a great deal could be done when dealing with ordinary steel. Where special steels were involved, it was necessary to have special electrodes, but he had been able to make some good welds on manganese steel points. His experience with regard to boilers was the same as that of Mr. Sayers, and in one case the repair had lasted the same time as the boiler did originally, viz., 9 years. At the end of that time it failed again and was re-welded, and had been working now for six months. Another application of electric welding was with regard to overhead wire standards, it having been found impossible to fit new top sections.

Mr. W. J. ALLEN referred to experience in America where, he said, an electric welding plant was regarded as an essential part of the repair outfit of every tramway shop. Bare electrodes were practically standard in America, and he thought the bare electrode deserved just as much credit for bringing the art to its present state as the coated electrode. The great essential was to have a constant heat and that could only be obtained with a constant voltage. Therefore, a system had been devised in America of having a control panel in circuit with a motor-generator which kept the voltage constant. He had not experienced any trouble in welding manganese.

Mr. E. H. EDWARDS, who was in the Chair for this paper, said he had been electric welding for ten or eleven years, and it was a mystery to him how, in these hard times, a tramway undertaking could do without a plant. There was hardly any part of his system that he had not electrically welded at some time or other with more or less success. He was not yet convinced with regard to covered electrodes. They were very much more expensive than bare electrodes, and he did not agree with the speaker who said that the expense of electrodes did not matter. Before the war the cost of bare electrodes was anything up to £150, and when they had four electric welding plants going continuously, the expense had to be considered. He had tried all sorts of covered electrodes, but had not found that they gave better results than the bare ones, and for that reason he was continuing to use bare electrodes except in special cases like manganese steel, when he was using covered electrodes more or less successfully. The greatest difficulty they were all experiencing was to get the correct hardness of metal, especially for rail welding, and although he had tried one or two systems of hardening the metal afterwards, they had been failures. He would like to know of such a process, if it existed. With cast-iron, the greatest difficulty was that the joint was generally cracked owing to the intense heat.

Mr. H. M. SAYERS, replying to the discussion, said that so long as the proportions of phosphorus and sulphur were about the same as in ordinary rail steel, there was no effect on the weld. Large proportions would be injurious to the metal surrounding the weld. It was desirable to get rid of rust before welding, but it was not necessary to have the job chemically clean. He agreed that arc welding was better than oxy-acetylene welding, although there was a special field for the latter in which arc welding could not touch it. Outside that field, however, arc welding was by far the best. The voltage of

the arc should be the smallest at which they could maintain the current. With machine-operated arc welding he had seen the voltmeter needle stuck at 18 volts for minutes. It was difficult to get that with hand welding, but, generally speaking, 20 or 25 volts would be found quite sufficient and should not be exceeded. One of the great secrets of arc welding was to keep the voltage low and work with as short an arc as possible; the shorter the better, so long as there was an arc. With regard to a separate machine for each welder, with direct current, that was the only satisfactory method, but if a.c. was being used, it was possible by the proper use of chokes or something equivalent to a choke, to supply a number of welders from a single transformer, and they did not interfere with each other. An advantage of the covered electrode was that better results could be obtained by the partially trained welder than with the bare electrode.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Testing and Repairing Magnetos.

I believe it would be of great interest to a large number of your readers to have some discussion in your columns on the subject of "practical testing and repairing of high-pressure magnetos." There has recently been an extremely able series of articles on the theoretical and designing sides of magneto work in your paper, but as far as I am aware there is absolutely no literature on the matter of magneto testing and repairing, which is of far more general interest, and of huge importance at the present time, when the number of magnetos is daily increasing, and one would imagine that something like a standard system of handling repairs would have been evolved. I venture to say that at the present time hardly any two shops handling repair work adopt the same system, and the great majority have no system at all.

In the hope of starting a profitable discussion, I would invite the opinions of your readers on the following every-day jobs in magneto repairing. What are the best methods of testing for each of the following?—

Low insulation resistance of armature liable to lead to breakdown to earth.

Earth in windings (without disconnecting or unwinding anything), and how to determine whether in primary or secondary.

Punctured condenser (without removing from armature).

To mention only the first of these—low insulation—one firm I know of employs a 500-V "megger" to test for this (surely a hopeless test applying 500 V to a winding which will have to stand 10,000 V or thereabouts). Another connects the armature core to one side and the winding to the other side of a 3/16 in. spark gap energised by a coil and accumulator; and yet another employs a small step-up transformer giving 5,000 V. A similar variety exists in the means adopted for the other tests. All the tests mentioned entail disconnecting the windings.

To come to repair work, the same firm which uses the 500-V megger for testing makes a practice of never attempting to remove a ball race in order to put on a new slip ring; it simply breaks it off and fits both a new ring and a new ball race. Another firm always attempts to remove the ball race intact, but only succeeds in one case out of five, and usually with much loss of time; its method is to grip the race in the vice (sometimes with the aid of jaw liners shaped to fit the race), and then drive the shaft out with a hammer and soft punch, but the race usually breaks directly it passes off the larger diameter of the shaft on which it is fitted.

Examples of this kind could be made to cover pages of your paper, but sufficient has been said to show that at present many shops are doing this class of work in a haphazard and inefficient manner, and a good discussion would do much to clear the air of the magneto shop from this disease.

Mag.

July 20th, 1921.

Dr. E. K. Rideal's Book on Ozone.

Your remarks on books submitted to you are, as a rule, so fair and just as to disarm any criticism on the part of your readers, but I am impelled to draw your attention to what I consider is a very thoughtless or careless remark which has been made by the reviewer in the last paragraph of his review on the above book (*page 24th issue*).

During the period covered by the last few years the value of ozone apparatus and plant sold to the writer's knowledge amounts to not less than £2,000,000 (two million pounds). The capital of the companies employed in these operations is in the neighbourhood of probably another £1,000,000 (one

million pounds), and has given and is giving direct and indirect regular employment to some thousands of persons, each of whom may be taken to represent the support of an average of two others. Surely this is more than an imaginary promise. It is an actual performance, however prosaic it may appear to your reviewer.

I agree that too small a proportion of space in this or any of the other books on ozone which have been published during recent years is devoted to the really interesting and practical subject of actual application. On the other hand, I can readily sympathise with the authors. The usual channels for gleaned information are more or less closed, for the reason that many of the valuable commercial technical applications are the result of long and special technical research, often involving very large financial expenditure. The successful user is not anxious to disseminate his hardy-gained knowledge far and wide for the benefit of his competitors, and ultimately to his own undoing. This may appear selfish, but it is human nature. Over and over again I have supplied apparatus, as to the ultimate use of which I am kept in the dark, although I may have a shrewd suspicion as to the purpose for which it will be applied. You will, I am sure, agree that it would be wrong if I were to publish any details or information on these matters.

Again, I am constantly consulted regarding processes in which ozone can be employed. After prolonged research, many of these mature, but there again my hands are tied. Other makers of ozone apparatus in foreign countries are in a similar position. So that the author of a book on ozone can only deal with generalities.

I disagree, however, with your reviewer to this extent. Sufficient general information is given in this book, to prove to the interested reader the various and multitudinous directions in which ozone can be applied, and if his interest be real and not academic, it should stimulate his zeal to investigate the subject further or to employ a capable person for that purpose. I may perhaps illustrate my meaning with a single example—the manufacture of synthetic vanillin from isoeugenol. This article is now made in very large quantities, is a profitable industry, and is the direct result of some years of close study. It is hardly likely, however, that the manufacturer of vanillin is going to publish the details of his industry so that Tom, Dick, or Harry can start in opposition, and commence where he now is.

If, as I take it, Dr. Rideal's idea is to stimulate interest which will result in individual research and further profitable application and use of ozone, then I believe he has done his "bit" and done it well.

The use of ozone in air purification is growing very rapidly, and may now be taken to be the result of beneficial experience as differing from curiosity or experiment.

The result is, in my opinion, only in a very small degree psychological. It is to a much larger degree physiological. The presence in the air of only a minute percentage of ozone is sufficient to destroy the foul emanations of body, lungs, &c., which to a large extent are the usual cause of discomfort in crowded places. Although a high concentration of ozone may be necessary for instantaneous sterilisation, yet prolonged contact with such a dilute mixture as is used in ordinary ventilation will make a very marked improvement. This is shown in the use of ozonised air in food preservation, and the fact that moulds will disappear in places when ozonised air is introduced. The fact that moth can, in time, be cleared from flour mills by the use of ozonised air may also be taken as further proof.

Of great interest to electrical engineers should be the fact that the alternating current for production of ozone has a leading power factor, so that the extended use of ozone apparatus on an alternating-current system should be helpful and profitable.

The electrical industry, with a few notable exceptions, has hitherto shown a lamentable lack of interest in the subject of ozone. It has treated it much in the same manner as the farmer treated the egg supply. It is a subject which can be turned to profitable and pleasurable account, and it needs only the stimulating assistance of the leading (electric) lights in each of our cities to make its use become popular and general, not only for air purification, but also the hundred and one industrial applications for which it is eminently adapted.

Edward L. Joseph.

London, S.W.

Reduction in Price of Lamps.

I should be interested to know whether any of your readers have been able to get rebates for stocks of lamps held on February 1st, 1921.

I hear that, in some cases where firms have "pegged away," they have obtained the full rebate.

I have adhered to my decision of February, 1921, to buy no further supplies of "ring" lamps, and further, I am now passing no orders of any kind to any of the T.L.A. lamp manufacturers.

I should be glad to hear from firms willing to take the same attitude as myself.

C. Culmer Hodges.

Electricity Works, Dawlish.
July 19th, 1921.

Charges for Service Mains.

This is a question which has been very difficult for central-station engineers to solve, especially during the war. The trouble has been brought about by the abnormal increase in prices, in some cases 300 per cent., of labour and material, whereas we have been restricted in our increased charges for energy supplied, and consequently some one must pay at some time or other.

I quite agree with "J. A. G." that there is a wide field in picking up the working-class dwelling-houses, but some cheap though efficient method must be adopted. If excavation has to be made for every new service to each house, it is quite out of the question.

If the mains are run along the buildings, one tapping must serve at least a dozen or more houses, tapping in W. T. boxes or by looping-in a service for each customer, but here again we are restricted owing to the property being "private," and we must not only obtain permission but pay wayleaves, with which I do not agree.

When legislation bars our way to progress we have no alternative but to pay.

Central Station Engineer.

July 19th, 1921.

Trade Cards and Trade Discounts.

On sending to town for some fans our man was asked about some goods that had been supplied on our card previously.

These goods were not for us, but someone who had one of our business cards had apparently walked in, paid cash, and got trade discount.

Cannot something be done to stop this practice, which is very unfair to legitimate traders?

If firms would only supply goods to a written order from traders having accounts with them it would soon cease, but apparently the average wholesale firms do not trouble, and they ask no questions, so long as they receive cash.

A man, not in business, told the writer yesterday that he finds it very easy to get hold of business cards, and that by presenting one and paying cash he can get goods at trade prices.

S. G. Allen & Son.

Gravesend.

July 22nd, 1921.

Oil Consumption and Prices.

In connection with a prospective price war on lubricating oils, the following paragraph appeared in the *Daily Mail* of the 18th inst.:

"On an average a 1,000-h.p. engine will need about 4,000 gallons of lubricating oil in the course of a year's working," said the manager of Messrs. Vickers-Petters, Ltd., the oil engine manufacturers, to a *Daily Mail* reporter on Saturday.

"The oil used in our engines costs 4s. 3d. per gallon. Cheaper oil will represent another nail in the coffin of steam power."

Being in South Wales a few days after this announcement appeared, the writer called upon the chief engineer of a colliery and, without giving any reason, inquired the amount of oil used during the past year on a 1,000-kW turbine under his charge. It appeared that the turbine together with the auxiliaries used seven barrels—a total of 350 gallons. It may be mentioned that during the year this turbine ran seven days a week and 24 hours per day for 98.6 per cent. of the total possible time, all stoppages being voluntary ones.

The nail appears to be in the other coffin.

E. F. Butler.

London.

July 23rd, 1921.

The E.P.E.A. and Dover, &c.

It is rather amusing to read the recent advertisement referring to the breach of agreement *re* salaries by the Dover Corporation.

What about the breach of agreement or promises by the E.P.E.A. and the original industrial members? In the early days the E.P.E.A. took the money of the industrial members and used it to boost up the positions of one class of members only—the public supply stations—consequently up to approximately 18 months ago about one-third of the original E.P.E.A. members had resigned by refusing to continue subscriptions for which they got no benefit, myself amongst the number; this was admitted by the secretary at a meeting of the Midland section which I attended.

Now for more amusement. A few months ago the E.P.E.A. was very active with advertisements calling meetings of industrial engineers with a view to new members. It has now apparently dawned on the E.P.E.A. that it would not matter two pins if all its members went on strike, as engineers could be got from the industrial side, and particularly men who have been with the large turbine and electrical manufacturing companies, to run all the public stations in the country—exit the E.P.E.A.! Station operation is only routine work—there is nothing in it; but if the public stations go on increasing their charges to 10d. per unit for lighting, and more, the E.P.E.A. members will fade away for want of work. You cannot sell electricity at 10d. per unit.

Wake Up.

July 24th, 1921.

Dishonest Employers.

I should be glad to know if any readers can tell me of a private inquiry agency which specialises in confidential reports on employers, for the benefit of prospective employes.

If there is no such agency there ought to be, and I feel inclined to establish one. I have been victimised by a dishonest employer; I had to decide on acceptance of the post rather hurriedly, but if I had been able to get a correct report from someone in response to a telegram, no doubt I should have kept out of it, as I very soon found, when too late, that I was up against a chief with a bad reputation. Prevention is better than cure.

Justice.

July 24th, 1921.

Abnormal Meter Records.

With reference to Mr. R. Forrest Preston's letter in your issue of July 1st *re* "Abnormal Meter Records," and in mine with "Ferranti's" letter in your issue of July 15th, I beg to submit the following solution:—

That an error in reading the meters was made by someone who was not used to meter reading. The meters evidently register to one-tenth of a unit, and this has been taken as units (*i.e.*, 1.0).

The readings for March, 1921, should be 12.3, 9.8, 11.5, 10.5, 20.2, 22.8, 9.3, and 13.9.

Theo. R. Kernick.

Pontypool.

July 16th, 1921.

[This, we believe, is unquestionably the correct solution of the mystery. That a large number of meters distributed over a network should simultaneously give records tenfold the normal must obviously be due to no fault of the instruments, but to some external agency common to them all—viz., the reader. Messrs. Ferranti inform us that they have had pleasure in presenting a prize of one guinea to the writer of this letter indicating the correct solution.—EDS. ELEC. REV.]

Leeds Electrical Training Centre.

Re your note in the issue of July 22nd on the construction of a 20,000-volt transformer, &c., by the above centre, are we to understand that this work is the everyday thing or quite special, and how much is done by skilled staff and by the trainees themselves?

What is the value of a trained ex-soldier in a commercial workshop alongside a competent man?

Is the department run on business lines or school practice, and was the job a success first time, or after several trials?

What was the result of the discharge, total breakdown, or flash over?

Rotary.

July 25th, 1921.

Metric System in Japan.—With reference to the note on this subject in a recent issue of the *Board of Trade Journal*, the Board has now obtained a translation of the recent Japanese Law (No. 71 of 1921), the object of which is the ultimate substitution of the metric system of weights and measures for the present Japanese system. Among the provisions of the new law are:—

Article 1.—The unit of measurement shall be the metre and the unit of weight the kilogramme (these are substituted for the "shaku" and the "kwan").

Article 2.—The meter shall be determined by the standard metre delivered to the Imperial Government in accordance with the Metric Treaty, and the kilogramme by the standard kilogramme delivered to the Imperial Government according to the Metric Treaty.

Article 5, Clause 2. provides that weights and measures or standards of measurement not in accordance with the new law, or with Imperial Ordinances based on that law, may not be used in business transactions or for purposes of certification unless otherwise determined by Imperial Ordinances.

Articles 6 to 14.—In the old law these imposed certain restrictions on the manufacture and sale of weighing and measuring appliances, provided for the official inspection of such appliances, and set up regulations regarding the sale of goods marked with their net weight. In the new law these are all retained.

Penalties.—Among the penalty sections of the law, it is provided by Article 15 that persons infringing Clause 2 of Article 5 above are liable to a fine not exceeding 100 yen or a police fine.

Supplementary Articles. The date of enforcement of this law will be determined by Imperial Ordinance. The weights and measures in common use hitherto may continue in use for such a period as will be determined by Imperial Ordinance. A copy of the law may be inspected at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W. 1.

(NOT YET PUBLISHED)

18,570 "Automatic recharged starters for remote control of electric motors." C. G. A. Woodford, July 8th.

- 18,757. "Automatic relay-actuated starters for remote control of electric circuits." C. G. A. Woodford, July 8th.
- 18,758. "Acoustic resonant transmitters." L. Segal, July 8th.
- 18,759. "Means for preventing disintegrations in electric circuit." W. E. Bottom and M. Goldsbar, July 8th.
- 18,760. "Electric accumulators." A. Dinin, July 8th.
- 18,761. "Means for joint transmission apparatus." W. J. McIlvenna-Jackson, No. 10, Parnassus, La., July 8th.
- 18,762. "Sparkless plugs." C. A. West, July 8th.
- 18,763. "Electric switches." I. R. W. Grange and A. R. Hurle, July 9th.
- 18,764. "Electric controllers for alternating-current electric machines." J. A. Smith, July 9th.
- 18,765. "Communications or distributors for internal-combustion engines." J. E. Mead, July 9th.
- 18,766. "Electric transmission or reproduction of sound." S. G. Brown, July 12th.
- 18,767. "Electric contacts or switches." W. Blenheim, July 11th.
- 18,768. "Electric magnets." H. R. Jones, W. E. Lawton, and C. E. Wason, July 11th.
- 18,769. "Electric measuring apparatus." De v. Dutch, July 11th.
- 18,770. "High-tension cable connections for internal-combustion engines." H. C. Lumbert, July 11th.
- 18,771. "Oil-filled high-tension insulators." I. C. R. Marks, Akt-Ges. (Germany, Pat. No. 616,749), July 11th.
- 18,772. "Mercury vapour lamp." P. Eversham, July 11th. (Germany, July 10th, 1920.)
- 18,773. "Electrical measuring instruments." J. W. Record, July 12th.
- 18,775. "Electric press switches." J. H. Gath, July 12th.
- 18,778. "Electric heaters." W. A. Moss and May & Padmore, Ltd., July 12th.
- 18,779. "Electrically-actuated lawnmower." L. N. Raven, July 12th.
- 18,811. "Binder for securing telegraph, &c., wires to insulators." O. R. Williams and D. D. Williams, July 12th.
- 18,820. "Electric switches." C. G. Bennett, July 12th.
- 18,823. "Magnetic material and its use for loading telephone and telegraph conductors." Western Electric Co., Ltd. (Western Electric Co., Inc., July 12th, 1920.)
- 18,825. "Electric message terminals." I. V. Johnson (Balt Manufacturing Co.), July 12th.
- 18,827. "Electric switches." J. Hall & Co. and G. F. Ostins, July 12th.
- 18,846. "Operating circuit and switch arrangement for car motors." F. B. John (National Pneumatic Co.), July 12th.
- 18,847. "Electric control of fluid pressure actuated motors." F. B. Dehn and National Pneumatic Co., July 12th.
- 18,850. "Control of air compressors." British Thomson-Houston Co., Ltd. and General Electric Co., July 12th.
- 18,868. "Electric heating device." P. Grant, (R. F. Zimmermann), July 12th.
- 18,880. "Electric conductors." A. D. Shuter and W. S. Smith, July 12th.
- 18,932. "Self-starting apparatus for self-propelled vehicles and vessels." Hamilton, July 12th.
- 18,933. "Electric light fittings." J. Scott, July 13th.
- 18,939. "Contact breakers for flywheel magnets." J. Bradley, F. Pountney and Velox Engineering Co., July 13th.
- 18,953. "Apparatus for controlling relative speeds of motors, &c." Igranice n, Ltd., (Tulfer-Hammer Manufacturing Co.), July 13th.
- 18,963. "Electric light transmitters." Western Electric Co., Ltd. (Western Electric Co. Inc., July 13th).
- 18,964. "Electric switch gear." W. A. Coates, D. R. Davies, G. E. Griffiths and Metropolitan-Vickers Electrical Co., Ltd., July 13th.
- 18,965. "Electric switches." W. A. Coates, D. R. Davies, G. E. Griffiths, and Metropolitan-Vickers Electrical Co., Ltd., July 13th.
- 18,970. "Electrodeposition of metals upon aluminium or its alloys." Q Electric Co., July 13th.
- 18,971. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.), July 13th.
- 18,973. "Device for attachment to telephone recording data." J. Manley and E. Medall, July 13th.
- 18,975. "Means for indicating adjustment or output of dynamic electric circuits." H. H. Darden and J. Stone & Co., Ltd., July 13th.
- 18,982. "Electric-lighting and heating systems for railways, &c." A. Spenser, July 13th.
- 18,987. "Indoor-lighting unit." A. J. Stephens, A. A. Dorsey, July 13th.
- 19,000. "Water-tight interlocked electric switch and plug and pocket container." J. Scott, July 14th.
- 19,007. "Adjustable inductor, sparking plug and engine tester." S. W. Mead, July 14th.
- 19,010. "Fusion of tungsten and tungsten filaments." Siemens Bros. & Co., Ltd., July 14th.
- 19,011. "Circuit arrangements for automatic, &c., telephone systems." Siemens Bros. & Co., Ltd., July 14th.
- 19,013. "Means for starting or accumulating." G. J. M. Archer, July 14th.
- 19,067. "Electric wire fence." Western Electric Co., Ltd. (Western Electric Co., Inc.), July 14th.
- 19,067. "Electric switches." G. Odham, J. Odham, and O. Odham, July 14th.
- 19,075. "Communitator for electric dynamos and motors." W. Adlard and J. Miles, July 15th.
- 19,127. "Automatic valve devices, &c." Radio Communication Co., Ltd., No. 1, Longport, July 15th.
- 19,130. "Thermionic valve devices, &c." Radio Communication Co., Ltd., No. 1, Longport, July 15th.
- 19,145. "Transformer, &c., valve." F. Leonard, July 15th.
- 19,145. "Switches for electric circuits." V. Beeze, West & Co., Ltd., No. 1, Longport, July 15th.
- 19,147. "Electric arc induction." I. C. R. Marks (See also 18,771) Akt-Fabrik, No. 1, Longport, July 15th.
- 19,150. "Means for direct driving of slowly rotating shafts, by means of a motor." G. E. R. Rues, July 15th. (Switzerland, January, 1917.)
- 19,151. "Means for electrically heating, &c., boxes, and controlling means." G. E. R. Rues, July 15th.
- 19,152. "Automatic telephone." Automatic Telephone Manufacturing Co., No. 1, Longport, July 15th.
- 19,153. "Means for attenuating currents." See 19,150.
- 19,204. "A device for preventing electric arcs during electrical discharges." G. E. R. Rues, July 15th.
- 19,222. "Electric lamps." S. R. Sullivan, July 16th. (France, July 17th, 1920.)
- 19,227. "Photoelectric device for measuring current systems." Alfery, No. 1, Longport, July 16th.
- 19,228. "Thermionic valves." Marconi Radio Valve Co., Ltd., and S. R. Rues, July 16th.

19,248	"Devices for supplying unidirectional currents of electricity." A. K. Angus. July 16th.	pulsating or intermittent
19,249	"Electric heating devices for internal combustion engines, &c." W. L. Davies and E. H. J. Duberly. July 16th.	combustion engines, &c.
19,250	"Apparatus for metal vapour rectifiers." Siemens Schuckertwerke, July 16th.	
19,251	(Germany, July 31st, 1930.)	
19,252	"Electric detecting alarms." R. Dittmarver. July 16th.	
19,253	"Devices for testing insulation of electric conductors." F. Bröncke. July 16th.	three-phase, high-tension

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1918.
 2,504. "Pumps or syringes for changing self-oiling tram wheels." D. I. Davies and Haslam & Stretton. June 10th, 1918. (165,458.)
 15,197. "Electro magnetic recording apparatus for telegraph circuits." J. S. Withers (K. C. Cox). September 18th, 1918. (165,460.)

1919.

22,622. "Methods of and means for reducing the lagging current on alternating current systems supplying induction motors and the like." H. A. L. Barry and A. M. Taylor. September 30th, 1919. (Addition to 132,761.) (165,470.)

22,623. "Electric distributing switches for ignition purposes." A. L. Linkin. October 24th, 1920. (165,476.)

22,624. "Wireless signaling." F. A. Kolster. March 31st, 1916. (137,061.)

1920.

415. "Marine condensers and the like." W. H. Sanford. January 6th, 1920. (165,484)

416. "Apparatus for charging and discharging electric storage batteries." I. C. Hodges. February 25th, 1920. (165,488)

5,899. "Electron tube apparatus." Westinghouse Lamp Co. February 7th, 1919. (139,514)

5,872. "Electron tube apparatus." Westinghouse Lamp Co. (February 7th, 1919. (Addition to 138,514.) (139,518)

8,663. "X-ray apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). March 23rd, 1920. (165,512)

8,768. "Electric motors." W. S. Dennett. March 24th, 1920. (165,515)

8,906. "Telephones." J. Kay and J. Jennings. March 25th, 1920. (165,517)

9,251. "Selector switches for telephones." H. J. Palmer and Telephone Manufacturing Co. March 25th, 1920. (165,517)

9,251. "Electrolytic deposition of iron and the treatment of the deposits." Lovecock and Fry & Son, Ltd. March 30th, 1920. (165,535)

9,251. "Electrolytic treatment of ores containing zinc and other metals." Electrolytic Zinc Co. of Australasia Proprietary, Ltd. April 4th, 1919. (165,589)

9,486. "Electric condensers." Duffiler Condensers Co., Ltd. April 11th, 1919. (165,600)

9,844. "Visual mine signalling devices." D. M. Ritchie, W. Ritchie, and Smith. April 8th, 1920. (165,554)

10,232. "Electric overload circuit breakers." R. A. R. Bolton. April 13th, 1920. (165,563)

10,374. "Circuit indicators for telephone systems." Automatic Telephone Manufacturing Co., Ltd., S. S. Saxon, and S. R. Smith. April 14th, 1920. (Addition to 129,563.) (165,669)

10,552. "Inductance or reaction coils." A. R. Taylor. April 15th, 1920. (165,670)

12,245. "Electric burglar alarms." W. J. Allbright and L. J. Allbright. May 13th, 1920. (165,621)

13,373. "Electric coils." C. S. Munmya and Ever-Ready Co. (General Electric Co.). May 14th, 1920. (165,623)

13,491. "Electric motor controlling switch gear." M. Solomon. C. C. Carter and W. Wilson. May 17th, 1920. (165,626)

13,516. "Protective fuses for electric circuits." F. W. Uren. May 17th, 1920. (165,627)

13,906. "Duplex electric welding machines." J. Ledwinka. May 20th, 1920. (165,632)

13,912. "Electric transformers." J. Ledwinka. May 20th, 1920. (165,634)

16,701. "Electrostatic plant for depositing dust and particles from gases." J. Ledwinka. May 20th, 1920. (165,634)

20,510. "Electric lamps and the like." Diamond Electric Spec. Inc. Corporation. May 2nd, 1918. (148,855)

20,513. "Contact finger for rheostats and other similar electrical apparatus." Societe des Electriciens de Belgique Soc. Anon. April 2nd, 1919. (148,570)

24,491. "Electrical measuring instruments." W. Clarke and Clarke New Devices, Ltd. August 25th, 1920. (165,686)

26,449. "Electric fans." R. R. Reed. March 27th, 1920. (161,154)

172. "Electric arrestor." H. P. Bendmann August 9th, 1919 (157,298)
173. "Electrical apparatus for railway signalling." Tver & Co., Ltd.
J. P. Downes. May 21st, 1920. (Divided application on 162,553.) (165,720.)

Electricity Commission Building at Melbourne.—The Victorian Government is about to construct an eight-storey concrete building in a central position in Melbourne (Australia) as the headquarters of the Electricity Commission. The heating and ventilation of the building will be by means of electrically driven fans.

The heating and ventilating of the structure promise to be models of electrical equipment. Two electric lifts, one hand controlled, and the other with dual equipment, will be installed. *Reuters' Trade Service* (Melbourne).

International Commission on Illumination.—The first technical session of this Commission was recently held in Paris. Representatives of France, Great Britain, the United States, Italy, Spain, Belgium, and Switzerland were present under the presidency of Prof. Vautier (France). International subcommittees were appointed to deal with various branches of the subject, such as photometry, nomenclature, factory and school lighting, &c. It was decided that the unit of candle-power employed by America, Britain, and France should be standardised and termed the "international candle." The president for the ensuing three years is Dr. E. P. Hyde (United States), and it is expected that the next meeting of the Commission will be held in New York in 1924.

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No. 2,280.

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INDUSTRIAL ENGINEERING IN EUROPE AND IN AMERICA.

It is always instructive to hear what other people think about one, even though it be proverbial that listeners never hear any good of themselves. It may be wondered whether there is not a subtler meaning in this saying than that which is apparent on the surface. For if Bill Jones were to hear it said of himself that he was a splendid chap, energetic, hardworking, resourceful, and generally a paragon, to be feared by his enemies, envied by his rivals, and courted by his friends, Bill Jones might be tempted to sit back and say to himself that he might as well take things a bit easier, and trust to his normal energies to take him towards his goal with less effort. Such a result would be just what a rival would be very desirous of bringing about, and such a method might well be the only one by which that end could be achieved.

We think we shall be justified in acquitting Mr. Dwight T. Farnham of any intention of that kind. In a survey of European industrial conditions now before us, being a reprint from the transactions of the Society of Industrial Engineers, he warns American industry of what it has to apprehend from European and notably from British activities. No doubt it will be a salutary tonic to our kinsmen to be told that methods are in use in very large concerns in Europe, of which they have only recently announced themselves to be the originators. "I never knew what a desirable and healthy child Safety First was," says Mr. Farnham, "until I met his father in Italy, in Germany, and in England."

Well, we know it has been said, though we forget by whom, that an American thinks his country the finest in the world, and he will tell you so; while an Englishman thinks his country is the finest in the world, but refrains from mentioning the fact, because he thinks you must already be aware of it without being told. And salutary tonic though such news as Mr. Farnham has to give may be to the American nation, gratifying as it may be to our self-esteem, all is not well with industrial conditions in any part of Europe, and certainly not in Great Britain. What is lacking is not knowledge, not ability, not tools, not even reductions in wages, since wages are notoriously higher in America. It is the will to work. Mr. Punch sardonically hits the thing off when he shows Sir Alfred Mond calling a halt in the Government's housing programme by appearing at the window of an unfinished house and saying, "Stop work" to two bricklayers who are lounging and taking their ease, pipe in mouth, accepting their wages and not giving a fair day's work in return. The 'canny' policy of, among other unions, the A.E.U., who are said to fine a man heavily for doing more than is held to be a day's work, or for not absorbing all the time allotted to a job, in declining to be parties to a Whitley Council for the engineering industry, and in adopting a selfish view generally, is one of the factors that is playing havoc with British trade. The efforts of employers to make cuts in wages that cannot be warranted by the cost of living, as in the cases of coal and engineering, have the natural effect of increasing the distrustfulness with which labour re-

gards the employer class. It is the besetting sin of selfish narrow-mindedness that must be fought against and conquered before real and permanent progress can be made.

The lessons addressed by Mr. Farnham to his American friends ought to be taken to heart by British workers, whether employers or employed. Forget the words of praise, which will not do you any good, and think of the home truths about the work Germany is doing. Whatever any other nation can do, Britain can. Whatever any other nation is doing, Britain must do something better. If industry in this country will but do itself justice, we need have no fear for the future.

The Society of Industrial Engineers, of which Mr. Farnham is a vice-president, favours us with a brochure descriptive of its activities, which are numerous, and cover the whole ground of the engineering industry. The scope of this society may perhaps be best appreciated by a statement of its avowed objects. These are:—

I.—To furnish a medium for bringing out original contributions to the science of management.

II.—To provide an organisation through which persons who are applying scientific methods to the solution of the problems of production and distribution may exchange views and co-ordinate their efforts.

III.—To co-operate with other societies.

IV.—To codify and standardise professional principles and practice.

V.—To develop the professional standards of the industrial engineer.

VI.—To promote efficient energy-conserving management.

VII.—To enhance the efficiency and prosperity of American industry.

To advance these laudable objects, two national conventions are held annually, at widely separated industrial centres. At these conventions, from 1,000 to 1,800 industrial executives are present, together with engineers and educators from all parts of the world. They have, in addition, monthly district meetings in the larger industrial centres, and issue special publications as well as their regular *Proceedings*. There is a Speakers' Bureau, the duty of which is "to furnish industrial organisations with competent speakers on various subjects of general and special interest, and with programmes of subjects selected with a view to the promotion of efficiency in industry." There is a reference library in Chicago; and, last but not least, there are nine committees, dealing with research, education, finance, promotion, fatigue elimination, publication, programme, membership, and executive matters.

Here is a society that ought to be followed by industrial engineers in this country. We have lately seen the first issue of the *Journal of a Society* which exists in Great Britain, whose objects are, or ought to be, somewhat similar to those enumerated above. The Society referred to was founded about three or four years ago to promote the interests of those engaged in technical pursuits, but up to the present little has been heard of its activities. We do not wish to be thought sarcastic when we congratulate the Society of Technical Engineers on having at last issued something over its own name, which can be read by the ordinary busy engineer without having to make tedious reference to a lot of other documents, which he may or may not have kept, but which are almost certain not to be at hand when wanted. We have not been invited to express any views on this society, as we have by the American Society to which reference has been made, but we think this a fitting occasion to observe that the advice once given against the hiding of a light under a bushel is worth following, not merely that the light may shine before men, but that it may not extinguish itself.

It may be true, as some think, that the Americans are not so far in advance of us as some Americans would have us believe. Mr. Farnham is almost certainly right in his observations, and probably also in the deductions to be drawn from them. But this is no time for self-complacency, or for thinking other people ought to be aware of our good qualities, or for anything but a spirit of real hard work, and a determination to get on with the job that lies before us.

It will be remembered that some little time ago there was much discussion both in public and private on the question whether the members of the National Joint Council for the Electricity Supply

Industry should be elected direct by the thirteen District Councils, instead of by the employers' associations. The proposal was for the time being negatived. Now, however, the National Council itself, or rather at the moment the employers' side, has decided that this side shall be enlarged straightway to 26 members (instead of 12 as at present) and that each District Council shall nominate thereto one municipal and one company representative. From the views originally expressed by the District Councils, we may take it that the proposal will meet with practically universal approval. It will certainly weld the Whitley system, as adapted to the electricity supply industry, into a more thoroughly systematised and organic whole.

An interesting point, and one which can hardly be called finally settled, is what the Trade Unions will do with regard to their side of the National Council. Their view as expressed in the National Council is that they are satisfied with their present mode of election—and apparently with their present total of twelve. (The inequality numerically of the two sides is immaterial, as all resolutions must be carried by a majority on each side independently.) But the view of the present Trade-Union members of the National Council is not necessarily the view of the various local branches of the Unions. Some of these seem certainly in favour of the members being elected from the Trade-Union members of the District Councils. What the general feeling is remains to be seen. The question touches on one of those smouldering controversies within Trade-Union circles—namely, the movement to throw more power into the hands of the rank-and-file as opposed to concentrating it in the hands of a small Executive. For the Trade-Union members of the National Council to be nominated by the local branches would obviously score a point for the democratic party. Anyhow, this is a matter for the Trade Unions themselves to settle.

This method of electing the National Council is, of course, contrary to the Whitley Reports, which lay it down as essential that the employers' side must be nominated direct by employers' associations. But however cogent this recommendation may be for partially unorganised industries, the electricity supply industry is so highly organised as to entitle it to treat itself as an exception, especially on a practically unanimous decision of the whole.

The French Manufacturing Industry.

ACCORDING to a French contemporary, the reports of the big firms manufacturing electrical machinery show that this industry is in a privileged situation. Despite the general crisis, the order books of the firms continue to be well stocked, and the reduced value of the turnover is relatively slight as compared with 1920. This favourable situation is due partly to the fact that quite a number of hydro-electric works are in course of erection, which work extends over a considerable period. In addition, the industrial reconstruction of the devastated districts has rendered necessary the preparation of a special programme for the electrification of the industries in the North, and steam power generating stations are being constructed or extended in these regions in the vicinity of coal mines. The supply companies also report an enormous expansion in consumption, as contrasted with last year, and this is leading to a large demand for electrical plant and materials.

As was mentioned in this journal some time ago, the production of aluminium in Germany was greatly developed during the years of war, but the use of the metal is said no longer to command the interest which is desirable for the advancement of the industry. The principal works are the property of the Reich. These are those of the United Aluminium Works Co. at Lauta, with an output capacity of 12,000 tons per annum, the Horrem works and the Bitterfeld works, each with a capacity of 3,000 tons, and the Erft works, having a productive capacity of 12,000 tons. The Lauta works is based upon power raised from lignite, while the Inn works, which is not yet producing, was erected for operation by power from hydro-electric works. Although the Lauta works was established for the working-up of clay won in the vicinity, bauxite of non-German origin is mainly used. Hitherto the German bauxite mines have not been able greatly to develop because the native product is inferior to foreign bauxite, and the latter is offered at comparatively low prices at present. The producers of aluminium have to contend with great difficulties in disposing of the output, as various industries are unwilling to work up the metal. Thus, for instance, high-pressure transmission lines are chiefly being made of foreign copper despite the fact that overhead conductors of aluminium have been made for many years past in the United States. Since the middle of May, 1921, 18,000 tons of American copper has been imported into Germany, whereas the stocks of aluminium amount to 5,000 tons, for which no home market can be found owing to the large imports of copper.

Indian Government Contracts.

As a result of a consideration of the reports presented late last year by the Stores Committee which was appointed to examine the question of the purchase of Indian Government stores, the Government of India proposes to revise the system hitherto in use, and for this purpose a series of rules has been prepared for the guidance of the local governments, although the rules have not yet been brought into operation, pending the establishment of an organisation by three officials whose appointment has been sanctioned by the Secretary of State. A circular has been issued to the local governments informing them of the proposed changes, and copies of the letter and of the text of the projected rules were recently received by the Board of Trade from India, and were set forth in part in the *Board of Trade Journal*. The three principal rules relate respectively to the encouragement of Indian manufacture, the production in India of manufactures from imported materials, and articles not manufactured in India.

The third rule is certainly the most important from the British export point of view, as it lays down the principle that stores imported into India for the public service are to be purchased through the London Stores Department, except in certain specified cases, to which additions may be made subsequently as experience is gained. The rule states that articles not made in India should be procured by indent upon the Stores Department, London, except in the following cases: (a) When the articles are already in India or are on their way out, and their price and quality are not unfavourable as compared with those at which similar articles could be obtained through the London Stores Department. When the total value of the articles required is trifling it is generally desirable to purchase them locally; (b) in the case of important construction works placed out on contract, articles not made in India and required for the carrying out of such works may be supplied by the contracting firm provided that the firm is included in the list of those approved by the Government, and the materials are subject to the current specifications and tests prescribed by the Government; (c) plant and machinery and component parts thereof may be purchased from branches established in India of British

manufacturing firms, whose names are on the list of the London Stores Department and are approved by the Chief Controller of Stores, India, provided that the following conditions are observed: (1) That the purchase is to be made by the Chief Controller of Stores, India, or by a qualified engineer directly responsible to the Government; (2) that the plant and machinery are to be of standard patterns such as are ordinarily constructed by the firm; (3) that the branch firm maintains a staff of expert mechanics capable when so required of erecting and repairing the plant and machinery; (4) that the actual cost price (exclusive of the cost of erection) is as low as that at which the articles of the same make can be supplied by the London Stores Department; (5) that the cost under any one order or detailed estimate in respect of any one type of standard plant or machinery is not to exceed 50,000 rupees; (6) that when test or inspection is necessary, arrangements are to be made for the work to be carried out by the London stores department. It is further provided that branch firms may be held to include approved selling agents who are also in a position to render the same kind of technical assistance in India as the actual branches of the firms. As to the purchase of plant and machinery from the branches of British firms, the view of the Government of India is that the establishment of such branches will encourage the development of local manufacture, and is indeed the only practical means of introducing certain specialised forms of manufacture into the country.

Coming to consider the remaining two rules, it has to be noted that the explanatory memorandum accompanying them states that it is the policy of the Government of India to make purchases of stores for the public service so as to encourage the industries of the country as far as is consistent with economy and efficiency. But as the Local Governments are practically forbidden to pay more for locally-made articles than the market prices, or to grant special bounties, and as indigenous stores can only be purchased by them at a "negligible excess cost," it is not easy to understand where the preference given by the first rule comes in. The second rule, too, appears to be even less encouraging to Indian industries. It deals with the preference to be granted to articles wholly or partly manufactured in India from imported materials, but it is stated not only that the price must be as low as that at which articles of similar quality can be obtained from the London Stores Department, but also that this condition is less favourable than the first rule with its preference amounting to a "negligible excess cost." The three rules clearly demonstrate that the interests of indigenous manufacturers are not to be financially assisted at the cost of the general body of the taxpayers.

The London Inquiry.

LAST Friday, as foreshadowed by Sir John Snell, the inquiry in connection with the London and Home Counties Area was brought to its conclusion, having occupied a total of 26 days in a period of seven weeks—and at what a cost! In view of the importance of this inquiry, affecting a population of some eight millions, and a capital of 32 millions sterling already invested in electricity supply undertakings, with generating plant aggregating some 400,000 kW, we have felt it to be our duty to report the proceedings as fully as space permitted, and have in fact devoted nearly 53 columns to this matter. Whether the time of those concerned in the inquiry was utilised to the best advantage remains to be seen; we hope to comment on the procedure somewhat fully in a later issue—but it will be realised that if our condensed report runs to some 50,000 words, the mass of information with which the Commissioners have to deal, including numerous written statements, tabulated data, and statistics must be colossal. We trust that their health will not suffer under the strain which has been imposed upon them, and that they will be able to find a satisfactory solution to this exceptionally important problem.

SUBMARINE CABLE TESTS.

By J. RYMER-JONES.

The following article deals with methods of measuring the C.R. and D.R. of a laid submarine cable while it is subjected to the pull of "earth," or "tramway," currents of varying strength and polarity.

Measuring the D.R.—By direct deflection:

In spite of 10.5 n.m. of earth-cable-core at the testing end, the cable to which the writer refers is almost incessantly traversed by earth-currents of changing polarity due to electric tramway systems, causing the spot of light to make excursions all over the galvanometer scale, sometimes as much as 300 divisions or more, on the wrong side of the zero position.

In consequence of this, the mean of the excursions during, say, the first five or ten minutes with the negative testing current could not compare respectively with the mean of the first five or ten minutes with the positive current, when earth currents affected the insulation readings.

In making a D.R. test, when earth currents are strong and of unequal duration, *time* is a very important factor; and, therefore, the writer prefers a special test sheet where every minute for one hour, when testing with the negative current, and also every minute for one hour with the positive current, is divided up into 12 vertical and parallel columns, for every five seconds, to be used in case the earth currents are very unsteady.

After putting the negative current to the cable through a dead-beat galvanometer, the electrician mentions the particular moment to his assistant, who has the test sheet and a watch in front of him, and who, at exactly, say, 5-seconds interval, says in a loud voice, "Now"; and the electrician immediately calls out the deflection, observed at that moment, to be recorded by the assistant. The same procedure is gone through at exactly every succeeding five seconds for one full hour.

After this the cable is wholly discharged, and a similar test of one hour's duration is made with the reverse current.

It is a long and tedious test, but gives remarkable comparable *mean* results between the negative and positive insulations if, in each case, the test is continued for one hour.

When the E.C.'s do not change very frequently, and the deflections are consequently much more regular, readings at intervals of only 15 seconds, or more, will be sufficient.

Formula to obtain the mean deflection with either the negative or positive testing current:—

Add together all the five-second readings, if any, on the *minus* side of the scale zero during, say, 30 minutes, and subtract their sum from the sum of all the five-second readings on the *plus* side of the scale zero; then divide the result by the sum of all the plus and minus five-second readings.

This will give an approximate mean scale deflection during the first 30 minutes, which should be compared with the mean deflection during the first 30 minutes with the reverse current. Similarly, the mean of all the five-second readings, obtained in the same way, during the second 30 minutes with the negative current should be compared, or less satisfactorily, with the mean deflection with the positive current, according as the earth currents are more or less irregular. If negligible, the mean deflections will be exactly the same (for both the negative and positive currents) for the same period of time. If the E.C.'s are very strong and changeable in direction, the more minimized the test readings, and the shorter the equal intervals of time between them—

say, five seconds only—the more accurate will be the calculated D.R. value.

The accuracy of the result is due to the test being prolonged over many changes in the strength and polarity of the earth currents; and also to the very important influence on the *mean* observed deflection or the *time* during which the deflections remain in approximately the same positions on the scale. During a test continued for, say, one hour with the negative current, the E.C. will probably undergo as varied changes as during one hour with the reverse current.

It should, of course, be understood that the average deflection of, say, 30 minutes—or 60 minutes, as the case may be—will give the *average* D.R. of the first 30 minutes—or 60 minutes—and not for the thirtieth or sixtieth minute respectively.

If the electric tramway—in spite of the ten miles of earth-core-cable at the testing end—keeps the dead-beat galvanometer deflection rising and falling continuously, the foregoing method of *averages* is absolutely necessary in order to get even an approximately correct D.R. value.

It is of interest that when tests were made from the other end where there is only an earth-cable-core of 1.5 n.m., and no tramway disturbance, the insulation deflections were quite steady enough to dispense with elaborate methods of testing.

The writer had much the same experience with the San Francisco-Honolulu cable, the electric tramcars at the former end causing considerable disturbance; whereas final tests made at the Honolulu cable hut were often so free from any earth currents that, when about to start testing, the electrician had to assure himself that the cable was really connected to the testing apparatus. Hence the advantage, when such different conditions are known to exist, in making the final tests from the cable end least disturbed by earth currents.

C.R. by "Bridge" Test.—So great and frequent were the reversals in the earth currents that no attention could generally be paid to adjusting the "tens" and "units" on the bridge. The method adopted was simply to reverse both battery and galvanometer reversing-keys as nearly as possible at the same moment (*), so that *too much* or *too little* would always come on the same side of the scale-zero and confusion on this account be avoided.

The electrician has merely to confine his attention to turning the hand-knobs of the sliding contacts of the hundreds and thousands, and to keeping his eye on the spot of light, while quickly sweeping it along the scale to the zero to improve the balance.

After calling out to his assistant the approximate bridge reading, the electrician very quickly indeed switches over both of the R-J(*) reversing keys, and again brings the spot of light towards zero—not paying too much attention to a few divisions of error—and calls out any important change in the resistance to be recorded.

In this way he can obtain a "series" of, say, 20 readings, the mean of which, if very quickly done, will give an approximately correct value. Three or four *series* are sometimes desirable. There is no doubt a certain amount of reliability resulting from a large number of reversals, but there is greater certainty still in judiciously selecting any series which most closely agree with each other.

It is necessary to be very quick in reversing both the battery and galvanometer, otherwise the bridge reading with one polarity may have little relation with the resistance measured with the other battery pole.

* The Rymer-Jones reversers—both for the battery and galvanometer—are found convenient if connected up so that their handles point in the same direction; and a small fraction of a second suffices to switch both over for a reversal.

JOINT ELECTRICITY AUTHORITIES.

London and Home Counties Inquiry.

(Concluded from page 143.)

On Wednesday, July 27th, Mr. TYLER continued his speech for the railway companies, and reiterated the willingness of the companies to co-operate in every way possible in the development of electricity supply in the Metropolitan area. One important means to that end would be representation upon the Joint Authority. The schemes before the Commissioners, however, treated the railway companies solely as large consumers, but he submitted that it was clearly the intention of the Electric Supply Committee of the Board of Trade that the railway companies should have representation as railway companies. Matters of wayleaves, feeder routes, &c., would have to be discussed by the Joint Authority, and the railway companies could offer valuable technical assistance. The railway companies thought that the administrative expenses of the Joint Authority should not be spread over all those represented on the Joint Authority, but only amongst those who would benefit in the matter of supply. Mr. Tyler said the railway companies had no objection to contributing to the administrative expenses when they became consumers of the Joint Authority.

Sir HARRY HAWARD said this meant the railway companies wished to be placed in a better position than if they erected their own power stations, because preliminary expenses must be incurred before revenue was earned.

Mr. TYLER, in concluding, asked for two railway representatives to be appointed by the Railway Association or by the Commissioners on the representation of the Railway Association. So far as the supply to railways was concerned, the schemes proposed 50 cycles, but he was instructed that 25 cycles involved less difficulty for railway purposes.

Sir JOHN SNELL said that nobody would suggest supplying a railway on a system which involved a change from 50 to 25 cycles.

Sir HERBERT NIELD, K.C., speaking on behalf of the Surrey County Council, asked that counties should not be split up by any scheme devised. As the schemes stood, there was no immediate prospect of many parts of the county getting a supply of electricity. Indeed, Barnes and Kingston were the only two stations which it was proposed to link up in the first stage. On the question of representation, he urged direct representation for the county. Dealing with some of the details of the Conference scheme, Sir Herbert drew attention to the clause giving the Joint Authority power to oppose Bills in Parliament. There should be no power to any authority now to promote Bills in Parliament or to oppose them without the consent of the Commissioners. Another matter raised was the possibility of territorial encroachment by the L.C.C. into the home counties. Only quite recently electricity supply had been given as one of the reasons for a greater County of London area. Coming to the opposition of Hertfordshire, counsel said the case for exclusion was even stronger than that of Surrey, because there was an intervening county between London and Hertfordshire, which made the likelihood of Hertfordshire getting a supply from the Joint Authority even more remote. His general reasons for not wishing to be included were those already put forward for Surrey, and if Hertfordshire were included then there must be direct representation. It was part of the reconstruction proposals of the Government, but contrast the conditions then with what was the position to-day. The Minister who promoted the Bill had fallen, and the Ministry of Transport, to which the administration of the Act was entrusted, would disappear very shortly. The financial conditions of the country, too, were a serious factor in considering large schemes of this kind, and for all these reasons he hoped the Commissioners would see fit to exclude Hertfordshire from this scheme, Surrey would like an opportunity of putting proposals forward if the Commissioners desired it, as an alternative to being included in the larger area.

Mr. DONALD, on behalf of the East London scheme, summed up the position. First of all there was the unfortunate limitation of the powers of the Commissioners to apply driving force to any such schemes as those put forward now. The real powers of the Commissioners could not be made use of at the present time, but were held in reserve until the various undertakings came to the Commissioners for extensions of their plant, should such undertakings not be willing to come under the Joint Authority. The real powers of the Commissioners were under Section 19 of the Act, which provided for neighbouring authorities giving mutual assistance. It seemed to him that at the present time it would be impossible to set up one Authority for the whole of the delimited area which would meet with the approval of both companies and local authorities. Having briefly reviewed the past history of electricity supply legislation since 1882, Mr. Donald suggested that the fact that the L.C.C. proposed in 1914, after only having had the purchase powers over the London companies since 1908, to transfer them to another body, and now proposed to transfer them to a Joint Authority, had made the local authorities somewhat distrustful of the L.C.C. The local authorities of London had sold energy at a lower average price than the companies, and the lowest price anywhere in London was in the East of London. The local authorities' undertakings were in a sounder financial position than those

of the companies. This difference in the financial position, he suggested, provided an insurmountable difficulty in forming a Joint Authority which could include both companies and local authorities. There was not a single authority which had expressed its willingness to join in the L.C.C. scheme. So far as the engineering scheme was concerned, he contended that no one scheme as put forward could accurately represent the ultimate financial working of the three proposals of the L.C.C., the Conference, and the Nine Companies, solely because the difference in the values of the company undertakings and the local authority undertakings, as he had indicated, had not been taken into account.

Mr. DONALD continued his speech on Thursday, and dealt with the question of subdividing the large area delimited by the Commissioners into smaller areas, as suggested by the East London scheme. He called in aid in this connection the evidence of Sir Alexander Kennedy, Mr. Rider, and Mr. Merz, as indicating that development would take place more efficiently in smaller areas than that taken in the L.C.C. scheme. As regarded the advisability of building capital stations at once or postponing them, his clients favoured the former course. To elect a large Central Authority to take over the control of the generating stations in the larger area after the manner proposed in the L.C.C. and Conference schemes, would be to eliminate the very factor which would lead to a supply of cheap electricity being given, because one of the preliminaries to any such transfer was a guarantee that power would be supplied to the undertakers at a figure not less than the present generating costs. In the bulk of cases where public control had failed, it was due to the fact that the problem was an extremely complex one, and too much was attempted to be done under one control. That was a result to be feared if the larger area was adopted by the Commissioners. Criticising the figures in the engineers' report, Mr. Donald suggested that credit had been taken for certain existing plant as regards generation, but nothing had been allowed for capital charges on that plant, the assumption being that the loan had been paid off at the period to which the figures related. His contention was that in this event something should be allowed for capital charges, otherwise the cost of generation was much lower than would be the case in a very short time afterwards when the plant must fall completely out of use. At the same time, he denied the possibility of plant amounting to 440,000 kW, being capable of use to the extent shown.

Sir JOHN SNELL assured Mr. Donald that the Commissioners would very carefully consider that point.

Mr. DONALD, concluding his speech, urged for the delimitation of workable areas, and not a larger and theoretically perfect area.

Mr. KENNEDY, for the nine companies, said that so far as the technical scheme was concerned, he claimed that it was by far the best scheme that had been put forward yet, provided the proper administrative means were found for giving effect to it. He was desired to refute some of the opinions expressed by Mr. Merz. In particular, he denied that the engineers of these schemes had taken up an obstructive attitude, as Mr. Merz had suggested, or that they had been controlled by their clients in the views given. The whole Committee of Engineers regarded these statements not only as a reflection on their professional skill, but almost upon their *bona-fides*, and he wished to bring that strongly to the Commissioners' notice.

Sir JOHN SNELL said it could be taken that none of the Commissioners would for a moment doubt the *bona-fides* of the Committee of Engineers.

Referring to the position as between the nine companies and the County Co., about which an announcement would be made later, Mr. KENNEDY said that any agreement came to would not abandon the Beckton site for a power station. It was believed that a power station would be required at Beckton as well as at Barking. Again, a defect in the technical scheme of Poplar was the proposal to erect a power station at Dagenham, because the transmission costs would be greater from there than from Beckton or Barking. So far as the railway load was concerned, the impression given to the engineers of the schemes before the inquiry was that the railway companies did not intend to take a supply from a Joint Authority, but that attitude had been modified. His clients were quite willing to take into consideration the railway supply now. If, for instance, the Great Eastern Co. could say that it would want 40,000 kW in a few years' time, the Charing Cross Co. would put down that amount of plant at Bow. Similarly, if the railway companies indicated that railway electrification would be put in hand within the next few years involving 100,000 kW, then his engineers would advise the companies or the Joint Authority to erect a capital station at once. To do this, they would want an assurance that they would get the business.

Sir JOHN SNELL said there was an essential difference between this and the view of the County of London companies, which was prepared to erect a station at once primarily for its own area, but also for the railway load.

Mr. KENNEDY said the Joint Authority or the companies would not put up a station costing £2,000,000 without some reasonable assurance that the railway companies would take supply. However, he was certain that the railway companies and the Joint Authority would come to an arrangement.

Dealing with the area, Mr. Kennedy frankly said it was

thought by Sir Alexander Kennedy and Mr. Partridge that no good purpose would be served by including a large area outside which could not be supplied for some years. His clients viewed with anxiety the choice of an area which might place an undue burden on the Joint Authority, because pressure might be placed upon the Joint Authority to give supply in areas involving long transmission lines, the cost of which would react upon the cost of the general supply.

Discussing the constitution of the Joint Authority, Mr. Kennedy said he did not think the companies would object to representation of the County Councils outside London provided local authorities in the county areas did not have representation also. His clients thought that those who found the money should have the largest proportion of the representation.

At this point Mr. Kennedy broke off to make a statement as to an agreement come to with the County of London Co. He said that his clients believed that the proposed Barking station was for the needs of the County Co.'s statutory obligations only. They felt it would not be proper for them in any way to hamper the County Co. in this matter. His clients agreed that the Barking proposal, as outlined, did not necessarily conflict with their scheme.

Mr. MORSE, for the County of London Co., said he was instructed to agree with this statement, and to state that his company was prepared to co-operate with Mr. Kennedy's clients in every possible way.

Mr. KENNEDY then went on to deal with the suggested transfer of the companies' generating stations, saying it was doubtful whether this could be done without further Parliamentary sanction.

Mr. CRAIG HENDERSON said he was going to argue that under the L.C.C. scheme, further Parliamentary powers would not be necessary.

Mr. KENNEDY said that under the Act of 1908, the sale could only take place to the L.C.C., and to the Joint Authority.

Mr. BOOTH said the Act of 1908 referred to the whole undertaking, but he did not believe there was anything to prevent a company selling its generating station to anybody who was authorised to buy.

Mr. KENNEDY, dealing with the control, submitted that it would be *ultra vires* for the Commissioners to impose a control of the undertakings as proposed in Clause 14 of the L.C.C. scheme. The Act of 1919 said that no undertaking should be transferred without the consent of the undertaker, and Clause 14 of the L.C.C. scheme conflicted with this.

Coming to the terms of purchase, Mr. Kennedy challenged the right of the local authorities to be purchased on the same terms as the companies, because in the case of the local authorities it was merely a change of ownership from one public authority to another, whereas in the case of the companies they would, by transferring their generating stations now, be giving up something with a cash value in 1931 more than the price now being asked. This must have the result of reducing the price of electricity. As to the alternative method of dealing with the value of the companies' stations by arbitration, instead of cost less depreciation, the companies did not see their way to give up this option, because there might be cases in which the true value could be arrived at on the cost basis.

Questions by the Commissioners indicated that they did not altogether like this decision, because it was pointed out that the alternative completely threw over the main principle of cost less depreciation.

Mr. KENNEDY said he would advise his clients carefully to consider this question. In conclusion, Mr. Kennedy claimed for his scheme that it was the only one for which the capital for the preliminary work was assured.

Mr. TURNER followed for the Conference of Local Authorities scheme. After pointing out the chief differences between the various schemes, he stated reasons why there should not be such a small area as that proposed by the East London scheme, nor should an important industrial area like this be separated from the remainder of London. On the question of capital stations, his own scheme was flexible in that a capital station could be erected the moment conditions were favourable as regarded land and conditions of finance.

Sir JOHN SNELL said that since the Conference estimates were prepared the cost of money and the cost of plant had fallen. Did these facts cause Mr. Turner's clients to persist in the policy of interlinking and not erecting a capital station?

Mr. TURNER said he would rather consult his clients and answer the point later.

During the evening, counsel discussed Mr. Merz's evidence at some length, and it was noted that the position of London was so unique that part of the case of what had been done elsewhere was

On Friday, July 29th, Mr. TURNER, continuing his speech, referred to the point raised by the Chairman on the previous evening regarding the reduction of cost of money and plant. He said it had always been the policy of the Conference that the companies' stations, under the terms of the agreement generally were more suitable, they would be willing to consider the reduction of cost of money and plant. That did not represent any change of policy on the part of the Conference, because its clients had been asked to consider the possibility of erecting the capital stations would be erected the moment conditions were favourable.

Continuing with his general speech, Mr. Turner criticised

Mr. Merz's view that the dominating factor in the supply of electricity was the cost of coal. The proportion of the total costs attributable to coal was 20 per cent., whereas capital charges represented 50 per cent., and his case was that the County Co.'s Barking station would have to bear higher capital charges than a station erected by the Joint Authority. On the question of railway supply, counsel took up the same attitude as that adopted by Mr. Kennedy.

During the course of arguments with regard to the administration of the scheme, Mr. TURNER said the attitude of the Conference was against acquisition of the generating stations by the Joint Authority until a capital station was built. Meantime, there should be control of the existing stations.

Sir JOHN SNELL said that in the event of its being found possible to erect a capital station at once, that would mean acquisition at once. Therefore, why put off dealing with acquisition in the scheme?

Mr. TURNER said that some of the authorities in the scheme were not at present willing to part with their stations, but the Conference hoped that time would bring them to change their view.

Sir JOHN SNELL asked if the 34 authorities in the Conference would accept an order by the Commissioners providing for transfer.

Mr. TURNER thought they would, subject to an appeal to the Commissioners, although he could not pledge the individual authorities to part with their stations on any terms. Commenting on the East London scheme, Mr. Turner said the view of the Conference was that it would be an unwise proceeding to tie the hands of the Joint Authority by saying that it should appoint a District Committee for the East London area. From this Mr. Turner passed to the financial proposals, and said that the Conference, through its individual constituents, was willing to provide the £1,050,000 necessary at the commencement, on the security of the rates of their areas.

The most difficult question of all was the terms upon which undertakings or power stations should be acquired. The dominating factor in this was that nothing could be done except by agreement. At the moment he understood that the terms of acquiring the Companies' undertakings were a matter of negotiation between the L.C.C. and the Companies, but it must be remembered that those terms could only apply to the Companies concerned with the Companies' scheme. Moreover, he contended that these terms, in any case, should be fair and equitable, *vis-à-vis* the local authorities' undertakings. It had never been suggested that the terms of purchase of companies' and local authorities' power stations should be identical, but the case of the local authorities was that the terms should be on the same basis and no less liberal. As to the terms of purchase of the Companies' generating stations coincident with an extension of tenure, which latter the Executive of the Conference had opposed in a resolution, Mr. Turner said that a full meeting of the Conference had now been held reiterating the view that the extension of tenure should not be made a condition of transferring the generating stations before 1931, and expressing the view that the Companies would not be injured if they were guaranteed electricity at a price not higher than the Companies could generate at. Subject to this, the Conference did not object in principle to an extension of tenure of the distribution rights of the Companies on terms to be arranged in each case. This resolution had been passed by the full Conference absolutely unanimously. As to the basis to be taken for depreciating the plant of the Companies in the event of purchase on the basis of cost less depreciation, Mr. Turner said the Companies had selected the Income Tax basis, because it was the most favourable to them. As showing the difference effected by the difference in the method of calculating the depreciation, counsel said that on the basis of the L.C.C. method of depreciation, the value of the Companies' undertakings in 1921 would be 6.72 millions sterling; on the local authorities basis of depreciation it would be 5.5 millions, but on the Companies' basis, or the Income Tax basis, it would be 8.2 millions sterling. Transferring those figures to cost per unit, on the basis of 64 per cent. over an output of 1,000 million units, it would be seen that the Companies' valuation would add an extra 0.3d. per unit to what it would be under the L.C.C. basis, or 0.6d. per unit over the Conference basis, whilst if the local authorities' generating stations were transferred on the basis proposed by the Companies for their stations, it would add another 0.6d. per unit to the cost, or a total of 1.2d. per unit over the whole area.

The next point dealt with was representation on the Joint Authority. Mr. Turner suggested that if the smaller authorities were willing to be represented by the Counties, then the Counties should have one each. He also proposed that the Port of London Authority should have one, the railways one, other larger consumers one, and labour one. That would have the effect of increasing the number by one and making the total number the same as in the L.C.C. scheme. At the same time, he hoped to convince the L.C.C. that it could do with a smaller representation than the three members proposed in the Conference scheme; indeed, he rather thought that the L.C.C. would achieve its real object more effectively if it had no representation at all. It would be better for a large body like the L.C.C. to remain outside the Joint Authority, in order that it could bring pressure to bear in the interests of the consumer. The Conference certainly strongly resented the proposal of the Companies that representation should be on the basis of financial assistance and the voting power dependent on the amount of money provided.

Before Mr. Henderson began his speech for the L.C.C., Sir JOHN SNELL said it might interest the parties to know that he had reason to believe that the Ministry of Transport would reintroduce the Electricity Supply Bill (No. 2) next session, and endeavour to secure its passage.

Mr. CRAIG HENDERSON then made the final speech of the Inquiry. He said the area delimited by the Commissioners was a proper area, and the test of it was the attitude one took towards the power companies whose areas were adjacent to London. The Electricity Act of 1919 clearly intended that power companies should be included in the area of a Joint Electricity Authority, because the powers to supply were expressly limited in the areas of power companies. Therefore Sir James Devonshire's objection to being included in a Joint Authority's area was an objection to the Commissioners' giving effect to Clause 12 of the Act of 1919. Moreover, before a Joint Authority could give a supply in a power company's area, the consent of the power company must be obtained, and there was an appeal to the Commissioners if the power company objected. Then the Commissioners would have to consider the terms upon which the Joint Authority was offering to supply. Therefore Sir James Devonshire's objection was one of principle and not because of fear of competition. As to the advantage which the power companies would derive from the scheme, he contended that quite apart from receiving a supply from a capital station, the linking-up of the power companies' stations would benefit them enormously. Increased sales must follow for the power companies, which should result in cheapening the supply with an increased demand. The two Willesden power stations were an integral part of the main load in London, and could not be left out of any consideration of the problem. If, therefore, the parts of the power companies' areas were taken in, the logical course was to take in the whole of the area, and that was what the Commissioners had done. He thought the Port of London Authority had made out a case for separate representation. Passing to the estimates, counsel said they had been prepared at a time when money was dear. Since the Inquiry began, the bank rate had fallen twice, and therefore if his estimates were too high on the old basis, it would be possible for a Joint Authority to go ahead at once, and more cheaply than a company. On the other hand, he put it that if the capital charges owing to the cost of money and plant were 40 per cent. of the total, then the time had not come to erect capital stations. Mr. Merz could not have it both ways. When considering what Mr. Merz said, they must remember that he was an engineer, but much of his evidence was that of a commercial man out to get orders, and when a man gave evidence which rightly did not come within his province, they were entitled to discount that evidence. It was in this category that he placed Mr. Merz's evidence with regard to building capital stations far in advance of the railway load. Mr. Merz was not the business manager of the County of London Co., but when they read the evidence before the House of Lords Committee dealing with the County of London Co.'s Bill a few days ago, Sir Harry Renwick, the managing director of the company, said that he would cater for the railway load if he got a contract, and that was the very thing which Mr. Merz had criticised the L.C.C. for doing. No prudent business man would do otherwise. It would be the duty of the Joint Authority to erect capital power stations as soon as possible, but only when it could be shown that a saving in the cost of supply could be effected. The immediate erection of a capital station would be all to the interest of the Joint Authority, because that would get rid of all the difficulties of purchasing existing stations and give control over the whole area at once. In effect, therefore, both the L.C.C. and the objectors were following the same path, but the objectors were paying less regard to the financial conditions than the L.C.C.

Sir JOHN SNELL asked whether, assuming the reduced cost of plant and money made the resultant cost of energy cheaper than was shown in the estimate, the Joint Authority would spend the extra capital compared with the amount required for linking-up during the past few years.

Mr. HENDERSON said the Joint Authority would certainly go ahead in that case, because of the cheaper supply of energy resulting, but the extra capital expenditure would, of course, be incurred in stages. That was the policy the L.C.C. was prepared to advocate. It was anxious to spend the capital as soon as it could be done with advantage. As some guide to the financial conditions to-day, counsel mentioned the issue of capital of the Shropshire, Worcestershire & Staffordshire Electric Power Co. at 7½ per cent., the issue price being 97, making the total interest 8 per cent.

Contrasting the evidence of the L.C.C. and the County of London Company, Mr. Henderson said that the Company had the idea of "jumping the claim" in order to get a station at Barking in advance of the general scheme. There had not been put forward any witness who was an executive officer of the Company, and no details of the Barking proposal had been placed before the Commissioners.

Sir JOHN SNELL mentioned that the Commissioners had laid the limitations on the County Co.'s evidence.

Mr. HENDERSON agreed, and said he regretted it, although he did not complain.

Continuing, counsel urged the Commissioners not to do as the East London scheme asked, and split up the area or compel the Joint Authority to appoint District Committees. Moreover, the East London scheme would perpetuate the old antagonism between companies and local authorities which was

dying out, and he hoped the Commissioners would be able to kill it for all time.

Turning to the proposal of the Nine Companies, Mr. HENDERSON said the L.C.C. was in favour of the leasing scheme, but he doubted whether it could be done without further statutory authority. Apart from this, however, there were difficulties in arriving at the terms of acquisition, and here the L.C.C. and the Nine Companies differed from Mr. Turner for the Conference scheme. He did not know now what the wish of the Conference was on this matter, because the resolution passed by the full Conference apparently objected to the extension of tenure and then agreed to it in principle. The position as he saw it was that the London Companies had a perpetual tenure subject to the option of the L.C.C. to purchase at certain intervals. It was not bound to exercise that option, and there was nothing to prevent it entering into a bargain with the Companies that the option would not be exercised for 60 years if the Companies would do something, viz., transfer the generating stations.

Mr. SYDNEY MORSE said it had frequently been pointed out that a body with a statutory option, such as the L.C.C. had here, could not, by entering into a bargain with the Companies, deprive its successors or the Joint Authority of the right to purchase.

Mr. HENDERSON disputed the point, but said this was a sample of the legal difficulties that had to be overcome. As to control, if there was to be a proper scheme, there must be such a control as would enable the central advisers to see that the undertakings were run in the general interest of the whole area. The L.C.C. scheme provided for that control, and he certainly objected to any scheme where the representation on the Joint Authority was based on financial support. As to County Council representation, that was the original intention of the L.C.C., but the Statute said the undertakers should have representation, but if the local authority undertakers all agreed to representation by the County Councils, then it would considerably simplify matters. Concerning the administrative expenses, if the Commissioners thought the L.C.C. ought to contribute, that would not be a matter of difficulty.

Sir HERBERT NIELD joined with Mr. Henderson and the other parties in expressing thanks to the Commissioners and the Institution of Electrical Engineers.

Sir JOHN SNELL acknowledged these sentiments, and said that a decision would be given as soon as possible. The Commissioners hoped to deal with it without loss of time, because they appreciated that interests were suffering by want of knowledge of what was to be the line of development. In conclusion, Sir John referred to the use of the Institution building, and to the manner in which all the facilities of the Institution had been placed at the disposal of everyone concerned with the Inquiry, and expressed a wish that the thanks of the Commissioners should be conveyed to the Council of the Institution.

South-West Midlands Electricity District.

BIRMINGHAM CORPORATION AND SHROPSHIRE, &C., CO.'S
JOINT SCHEME.

The following is an abstract of a scheme for improving the existing organisation for the supply of electricity in certain parts of the Counties of Shropshire, Staffordshire, Warwickshire, and Worcestershire, that has been submitted to the Electricity Commissioners jointly by the Birmingham Corporation (Mr. R. A. Chattock being the city electrical engineer) and the Shropshire, Worcestershire & Staffordshire Electric Power Co. (of which Mr. J. T. H. Legge is chief engineer).

In view of the fact that 98 per cent. of the electricity at present generated by authorised undertakers in the district is generated by the Birmingham Corporation and the Shropshire, &C., Co., it is not deemed necessary to set up a Joint Electricity Authority. It is suggested that the orderly development of supply in the district can be dealt with more thoroughly and economically by pooling the resources of the existing large undertakings through the medium of an Advisory Committee, the Electricity Commissioners being the final arbiters.

No actual fusion of financial interests on the part of the undertakings is either practicable or desirable, but subject to this reservation, the desired end can best be attained by developing and co-ordinating the existing organisations. It would be the duty of the Advisory Committee, among other things, to consider and to make recommendations respecting: (a) The development of the capital stations; (b) the construction of main transmission lines, and (c) the manner in which existing power stations in the district should be dealt with.

It is not intended that there shall be any disturbance with regard to the distribution of electricity in the district, except by agreement. In the urban districts of Rowley Regis, Stourbridge, Lye, and Walsley, the Shropshire, &C., Co.'s rights are exercisable only by consent of the Midland Electric Corporation for Power Distribution, Ltd., but the area of these urban districts is only 22½ sq. miles, and the Shropshire, &C., Co. already has mains laid through these districts for supplying outside them, and now seeks the necessary authority to supply within this small portion of the provisionally determined district, but without interfering with the 50-period supply which the Midland Co. is now actually giving therein. In consideration for this (but not otherwise) the Shropshire, &C., Co. is prepared to relinquish its rights to supply 1,224

supplies of the northern portion of its area of supply in the Counties of Staffordshire and Shropshire.

The Worcester Corporation and the Redditch Urban District Council are each affording a 25-period supply within their respective areas, and there is no desire to vary the position of these authorities unless and until they are prepared to receive bulk supplies from the Shropshire, &c., Co. In the case of Redditch, the Shropshire, &c., Co. already possesses authority to supply power users and for other purposes on the premises of such undertakers.

The Kidderminster and the Haslewood Companies are controlled by and take the whole of their supplies in bulk from the Shropshire, &c., Co., and the latter, under agreement dated December 1st, 1917, with the Midland Co., furnishes a supply to the system of tramways in the Black Country owned and operated by the companies constituting the Birmingham and Midland Tramways Joint Committee. Suitable provision to enable the Shropshire, &c., Co. to continue this supply of supply should be specified in the Order constituting the district.

The Shropshire, &c., Co. also requires protection for the 25-period supply to the Tipton Fuse Factory of Messrs. Harper, Sons & Dean, Ltd., which supply was commenced during the war, under the instructions of the Ministry of Munitions.

A modification of the district provisionally determined by the Electricity Commissioners* is desirable by the omission of the rural district of Atherstone and the parishes of Austrey, Newton Regis, Seckington, Shuttington, Avington, and Stony Delph, Bolehall and Glascote, Wilnecote, and Castle Liberty (all within the rural district of Tamworth) in the County of Warwickshire, indicated in the accompanying map, which also shows the positions of the stations and transmission lines. This portion of Warwickshire contains a number of collieries which already receive an a.c. 50-period supply from the Leicestershire & Warwickshire Electric Power Co., and

or any portion of the district. The committee shall advise upon such matters as: The operating time-tables of the undertakings; the best load factor obtainable; conservation of fuel; proper return upon the capital moneys; the standardisation of systems; and regularising the supply. The committee shall also be responsible for making recommendations to its constituent authorities as to the expenditure of capital moneys on extensions, but it shall not be competent for the committee to incur any capital expenditure nor to borrow moneys for such purpose.

Existing undertakings shall not be transferred either in whole or in part to the committee. The Birmingham Corporation and the Shropshire, &c., Co. shall be responsible for the capital expenditure incurred by them respectively in the areas defined above, and the financial arrangements as to capital and revenue accounts shall continue on a separate basis as heretofore.

The portion of the district within the County of Warwick shall be supplied in bulk by the Birmingham Corporation. The distribution of energy in the City of Birmingham shall continue to be dealt with by the Birmingham Corporation, and that in the Borough of Sutton Coldfield by the Corporation of Sutton Coldfield unless otherwise determined by agreement with the Birmingham Corporation.

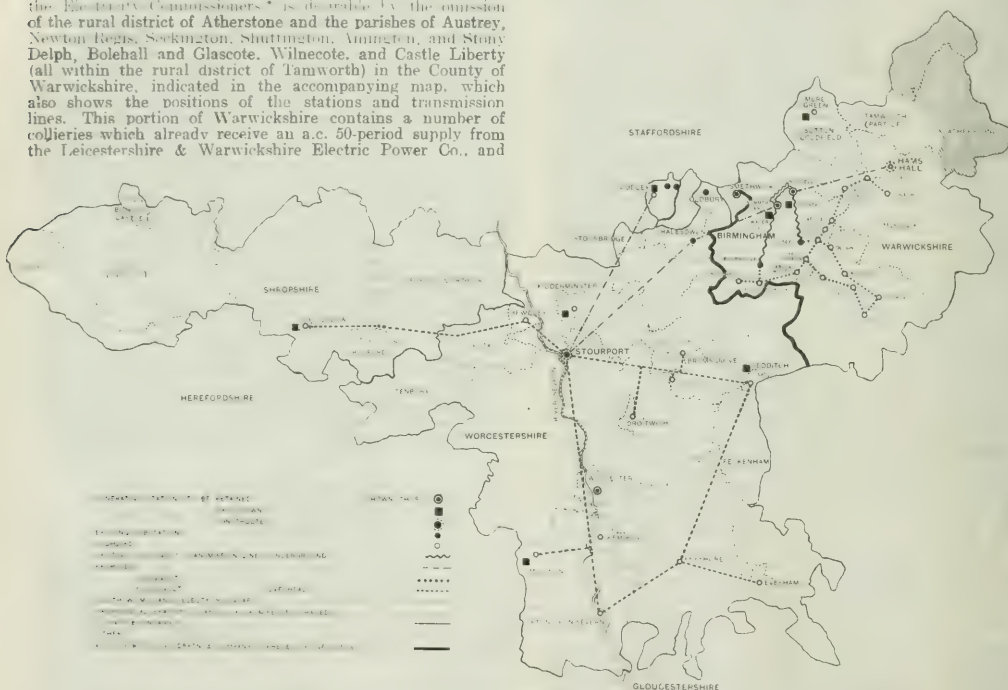


FIG. 1.—SOUTH WEST MIDLANDS ELECTRICITY DISTRICT.

it may be met that the supply to this area should continue to be served as at present.

The electricity supply in the district is to be administered in the following manner. The Birmingham Corporation shall be responsible for the electrical development of the City of Birmingham and that portion of the district situated in the County of Warwickshire, which latter shall by Order be transferred from the area of the power supply of the Leicestershire and Warwickshire Electric Power Co.

The Shropshire, &c., Co. shall be responsible for the development of the remainder of the district under the Shropshire, &c., Co. Act, 1919, and the Leicestershire and Staffordshire Electric Power Acts, 1903 to 1919. The South-west Midlands District Electricity Committee shall consist of four members, two of whom shall represent the Birmingham Corporation electricity supply undertaking and two the Shropshire, Worcestershire & Staffordshire Electricity Co., Ltd.

One of the members to be appointed by the Birmingham Corporation shall be a member of the Electricity Supply Committee, and the remaining member shall be appointed by the Corporation of Birmingham for the time being. One of the members to be appointed by the Shropshire, &c., Co. shall be a member of the board of directors, and the remaining member shall be the chief electrical engineer for the time being of the Shropshire, &c., Co. Each member shall have one vote only on all matters.

The duties or functions of the committee shall not be delegated to any other body of persons as regards the whole

The distribution of energy in the rural districts of Meriden, Solihull, and the portion of Tamworth within the district shall be carried out by the local authorities for those areas, or may (by agreement) be undertaken by the Birmingham Corporation. In the latter event, the energy shall be supplied by the Corporation to consumers in such areas at the selling prices fixed for like supplies from time to time for consumers in the City of Birmingham, with a reasonable adjustment to cover any extra costs and contingencies involved. In that portion of the district within the Counties of Shropshire, Staffordshire, and Worcestershire the existing authorised undertakers may take supplies in bulk by agreement as may be required from, or they may transfer any portion of their undertakings to, the Shropshire, &c., Co.

The Birmingham Corporation and the Shropshire, &c., Co., respectively, shall exercise control of the generating stations and main transmission lines belonging to them in their respective portions of the district, and the responsibility for providing further interlinking main transmission lines shall be dealt with by the Corporation and the Shropshire, &c., Co. respectively, after consultation with the committee.

In the event of a local authority within any portion of the district for which the Shropshire, &c., Co. is responsible deciding to exercise purchase powers it may possess under any Act or Order, the Shropshire, &c., Co. shall supply electricity in bulk to such local authority. Authorised distributors shall accept supplies of 25-period 3-phase a.c., which shall be the standard system throughout the district, and those furnishing a supply within their own areas at the date on which

* Elec. Rev., Oct. 1st 1920, p. 434.

this scheme becomes operative may continue as generating authorities in their own areas, so long as it is considered economically advisable, and until they are receiving full supplies in bulk from the capital stations of the Corporation or of the Shropshire, &c., Co. as the case may be.

The Birmingham Corporation and the Shropshire, &c., Co. have identical systems of supply which are linked together at the present time, and a further link of substantial capacity for mutual interchange of supply will be installed. The main underground transmission pressures in Birmingham and Warwickshire will be 33,000 and 11,000 volts. The pressure of the main underground transmission lines from Stourport to Halesowen will be 33,000 volts, and that of the main overhead transmission lines will be 66,000 volts. The supply will be stepped down to 5,500 volts for local secondary transmission.

The arrangements as regards existing generating stations are as follows: There shall be utilised in conjunction with the new capital stations, an existing temporary generating station situated at Neshells, and the most economical portion of the plant in the Summer Lane generating station, both of which belong to the Birmingham Corporation, also the most economical portion of the plant in the Smethwick station belonging to the Shropshire, &c. Co. As considered economically advisable, the existing stations at Water Street and Chester Street, belonging to the Birmingham Corporation, will be closed down, also the generating station belonging to the Sutton Coldfield Corporation, and the uneconomical portion of the generating plant at the Summer Lane station of the Birmingham Corporation; the generating stations at Kidderminster and Dudley, belonging to the Shropshire, &c., Co., as well as those of the Redditch and Malvern Urban District Councils, and the Ludlow Electric Light Co. will also be closed down. All these stations will, however, continue to be used as sub-stations or distributing centres for the districts which they now serve. The existing generating stations belonging

to the Worcester Corporation will continue to run, but the supply from these stations will be augmented by means of a bulk supply from the new capital station at Stourport when the load on the Worcester Corporation undertaking is greater than the present plant is capable of supplying.

The generating and other plant belonging to the Birmingham Corporation and the Shropshire, &c., Co. that will not be required will be disposed of, and the amount so realised applied to extinguish the loans outstanding against these assets, or credited to capital account, as the case may be. The balance, if any, will be made good from the reserve fund account of the undertaking concerned. The auxiliary supply, which is now being purchased from the private generating station of the Dunlop Rubber Co. by the Birmingham Corporation, will be discontinued.

The following capital power stations are in course of construction or are to be constructed in successive stages as required:—

Birmingham Corporation—	Plant being installed, kW.	Ultimate capacity, kW.
Neshells	35,000	110,000
Hans Hall	—	300,000
Shropshire, &c., Co.—	—	—
Stourport	—	105,000

No works under Section 18 of the Electricity (Supply) Act, 1919, will be constructed, and there are no existing generating stations in the district used solely for (a) railways, (b) tramways. Negotiations have been opened with the Midland Railway Co., in connection with a supply of power for railway purposes.

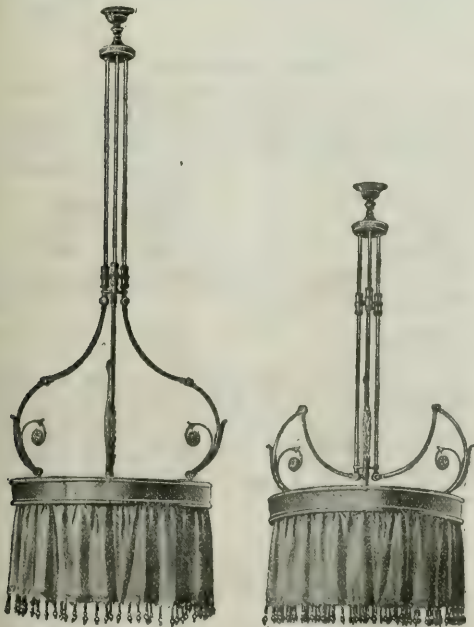
The Hans Hall site is an ideal one for the supply of railways over a large area, and a supply of 25-period a.c. is peculiarly suitable for railway working. The district at present contains approximately 390 route miles of railways, and there are about 2,000 route miles of railways within a 50-miles radius of Birmingham.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Adjustalite" Pendant.

An adjustable lighting pendant without visible cords and the usual counterpoise is made by THE RHODES FITTINGS CO., LTD., 224, Upper Thames Street, E.C.4. This device, known as the



(a) Extended.

(b) Raised.

FIGS. 1 AND 2.—THE "ADJUSTALITE" PENDANT.

"Adjustalite" pendant, is illustrated in figs. 1 and 2. It will be seen that when the fitting is raised from the fully extended position (a), by sliding the pendant holders over the tubular guides, the upper arms of the fitting are raised, drawing up the lamp and shade (b). In this particular example the range of adjustment is 18 in.

The "Priory" Distribution Board.

We have received from the PRIORY ELECTRICAL ENGINEERING Co., Bath Street, Birmingham, a new distribution board (fig. 3) which has just been placed upon the market. As will be seen from the illustration (fig. 4) this board is made to facilitate the work of wiring up. Two pieces of angle iron are fixed to the wall and the frame supporting the fuse units is hinged to one of them. The service cables and distributors are then connected and the frame is swung back and held in place by means of screws which fit into two pillars cast on the other piece of angle iron. The sheet steel case is then slipped over and fastened by screws into the sides of the angle iron supports. The board is arranged for six ways with two fuses per way. The cables are led into the box through an insulating separator and an asbestos fillet is fitted between the upper and lower rows of fuses. The service cables are connected to a small busbar to which one terminal of each fuse is clamped by a screw. The construction of the board is very

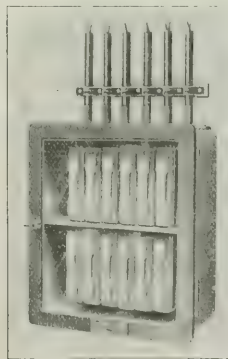


FIG. 3.—THE "PRIORY" DISTRIBUTION BOARD.

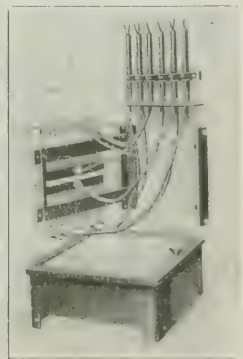


FIG. 4.—METHOD OF WIRING.

substantial, and all parts are easily connected up and assembled.

The "Baby Paragon" Switch and Fuse.

In our issue of February 25th last (page 258) we described the "Baby Paragon" switch designed by THE MIDLAND ELECTRIC MANUFACTURING CO., LTD., Barford Street, Birmingham.

lamp. We have now been made acquainted with a further development of this line, the "Baby Paragon" combined switch and fuse gear. As will be seen from the illustration (fig. 5), the fuses are arranged above the switch, which is of the type previously described. The fuses have a looped break of 2½ in.

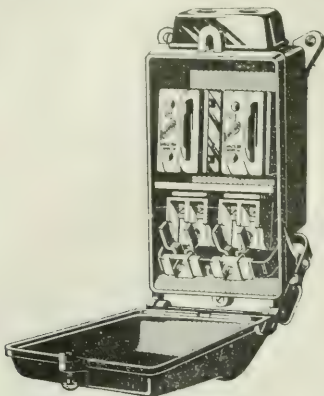


FIG. 5.—THE "BABY PARAGON" SWITCH AND FUSE.

and are designed in compliance with the Home Office regulations. This gear is made in either two or three-pole types for 250 or 500-V circuits.

A Selenium Current Regulator.

In connection with the 5,000-amp., 6-volt motor generator which was installed at the National Physical Laboratory for the purpose of assisting in the buried cables research and general work,* a current regulator has been constructed which employs selenium cells as a means of operating the first relays. It will be seen from the diagram, fig. 6, that leads from the standard resistance used for current measurement are brought to an ordinary potentiometer circuit; the two selenium cells are mounted one on each side in front of the ground-glass galvanometer scale and are arranged so that when the galvanometer is out of balance, due to the current varying from the normal, the light spot completely illuminates

cells was not sufficiently constant from day to day, and they could not always be relied upon to remain sufficiently uniform for regulation to be effected without adjustment of the bridge arms for a longer period than 10 hours, but the method has such great advantages for the regulation of large currents that further work is being done both by way of endeavouring to make selenium cells which will remain more constant and also of using a thermopile to be operated by the heat transmitted from the galvanometer mirror. The main advantages of regulation of this type are that the operating forces are extremely small; the drop over the shunt being only 0.1 volt, a high degree of sensitiveness can be obtained; and the regulator will deal, with the aid of suitable shunts, with currents up to several thousand amperes.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Self-synchronising Rotary Converters.

Would you, or some of your readers, please supply a good theoretical explanation of how a self-synchronising rotary-converter brings itself into synchronism? A recent book on rotary-converters seems to fail badly by skimming over this question very lightly.

1,500 kW.

July 25th, 1921.

Battery Explosions.

Could you through the medium of your excellent paper explain the following phenomenon:—

The power-house attendant at my place of employment was placing a fourth cell on charge (the three previously charging were connected to the +ve side of the board and had received practically a full normal charge); when he connected the fourth cell to the -ve and then to the three cells previously charging there was a report like a pistol shot, and quite as loud, and the electrolyte in the fourth cell assumed a milky-white appearance, and seemed to be greatly disturbed. There was also a disturbance in the third cell, but not to such a large extent as in the fourth. He attempted to reproduce the effect but could not, but a few weeks later the same thing occurred under exactly similar conditions.

Denze.

July 29th, 1921.

Abnormal Meter Records.

With further reference to the above subject, the solution of Mr. Kernick does not appear to be entirely correct.

If we assume the coincidence of the readings at the end of February to be zero, the following would appear in the reading book for the first meter:—

	Reading.	Difference.
December, 1920	9947.0	
January, 1921	9982.0	35.0
February, 1921	0000.0	18.0
March, 1921	123.0	123.0
April, 1921	144.0	21.0

This should have been, according to Mr. Kernick's solution (assuming that the March and April readings were taken by the same man):—

	Reading.	Difference.
February, 1921	0000.0	18.0
March, 1921	12.3	12.3
April, 1921	14.4	2.1

If the readings at the end of February were not zero, the case becomes more confusing, as will be seen by further study.

If the April readings were taken correctly the error would easily have been seen; if not, the April readings would not be normal or give the correct consumption. Any error of this description is neutralised or discovered when the meter is correctly read. It would be interesting to see the actual readings.

Thomas Southgate.

Ipswich.

August 1st, 1921.

Testing and Repairing Magnets.

With reference to "Mag's" letter in your last issue, as a practical magneto repairer, it surprises me to learn that any firm adopts the method which he mentions of removing slip rings and ball races.

The armature tests mentioned, from my point of view, are absolutely useless; however, to go into a technical discussion of these would take up much valuable space, so I will as simply as possible give an outline of methods practised in most repair shops.

With regard to armature testing, this is usually done on a specially constructed test board; current is supplied to the board from a battery of 4 to 8 volts, depending on the size

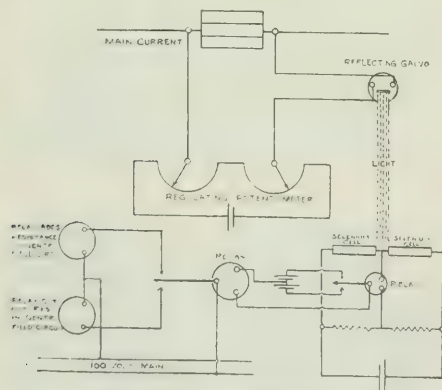


FIG. 6.—A SELENIUM CURRENT REGULATOR.

the surface of the cell. The two selenium cells are arranged as two arms of a resistance bridge, the other two arms being made up by a plug-resistance box, and a sensitive moving-coil relay is connected across the usual galvanometer terminals of the bridge with a 30-volt accumulator battery to give the necessary pressure. The arrangement of the remainder of the relays which finally vary a resistance in the excitation circuit of the current generator is shown in the diagram. The selenium cells respond very quickly, and the arrangement will maintain a current of, say, 1,000 amp. constant to within 0.2 per cent. for a whole day. A far higher degree of sensitiveness can be obtained, since in the case under review, owing to the current normally varying in rapid fluctuations of as much as 3 per cent., the galvanometer was stiffened so that the movement from the centre of the scale to one or other of the selenium cells corresponded to a change of current of 0.1 per cent. Unfortunately the resistance of the selenium

* *ELEC. REV.*, Aug. 20th, 1920, p. 232.

of the armature. This current flows through the primary winding of the armature under test and through a hammer make and break, actuated by the magnetism from the armature core; in some cases a motor-driven rotary make and break is used. The current in the primary circuit is interrupted in this manner on the test board, whereas, in the machine, it is interrupted by the contact-breaker, with this difference: In the machine the current in the armature is self-induced through the magnets, but on the test board the current is supplied from a battery. It naturally follows from this that a high voltage is induced in the secondary winding while under test. The high voltage is collected from the slip ring, and taken to an adjustable spark-gap.

A standard capacity condenser and switch are included in the test board connected across the make and break. With this test board it is possible to test the condenser, primary and secondary circuits, and slip ring without disconnecting the armature windings.

To operate the test board, current is switched on the core, or armature; if the make and break fails to act through lack of magnetism in the core, it shows either an open or short circuit in the primary winding, though these faults are rare. With a dead short the safety fuse in the primary circuit will blow; it is usual in a case like this, that the fault will be found in the condenser. Taking the primary winding as O.K., the make and break should be vibrating steadily but fast, without sparking at the points. If sparking is taking place badly, at the points, it shows a faulty condenser, such as low capacity or punctured. In this event the test board condenser is switched into circuit, which will give sparkless make and break.

With primary winding and condenser O.K. there should, if the h.p. winding and slip ring are O.K., be a continuous line of sparking taking place between the points of the adjustable spark-gap, the distance between the points varying with different sizes and makes of armatures.

Should it be found that no sparking takes place, if the adjustable gap is opened beyond a certain point which practice tells it should spark at, it naturally points to a broken-down slip ring or h.p. winding. For example, supposing an armature should be capable of sparking across a 12-millimetre gap at 6 volts, and that no sparking occurs at a 5-millimetre gap, it clearly shows here that the sparking is taking place either in the high-pressure winding, or in the slip ring; if the fault is in the slip ring, it will betray itself by the smell of burning ebonite, otherwise the h.p. winding has broken down.

With regard to the removal of ball races and slip rings, a ball race is drawn off the spindle by a special tool, of which

there are several kinds. The tool I am writing of has a lip grip, which grips down and all round the ball track of the race, a screwed bolt through the centre of the tool is screwed down on the end of the spindle, drawing the race off easily and quite undamaged; it is then, of course, an easy matter to remove the slip ring.

I quite agree with "Mag" that the majority of magnet repair shops have no system, and I might add, no knowledge, if they employ the methods "Mag" writes of.

Repairer.

August 1st, 1921.

The E.P.E.A. and Dover, &c.

With reference to the letter in this week's issue from "Wake Up," who seems easily amused, I think all public supply engineers will be equally amused at the latter part of his letter.

His statement: "Station operation is only routine work—there is nothing in it," reminds me of a little episode in my experience of seven or eight years ago.

The station, a small one, had three a.c., three-phase generators, each of 200 kW capacity, and the machine panels on the switchboard were fitted with an ammeter on each phase, but without a wattmeter or power-factor indicator.

The manufacturers were asked to send someone to test these ammeters, so they sent the engineer who had originally erected the switchboard and generators to superintend the job. This gentleman, who, like "Wake Up," was bursting with the "nothing in it" knowledge of power station work, of course declined the offer of assistance of the charge engineer in changing the sets over as required, with the remark that he could manage that himself quite easily. Two of the machines were on load and the other one was run up to speed. There would be about 200 amperes on all three ammeters of both machines at the time when the charge engineer left to attend to other duties. It was not very long before the manufacturer's representative sent for the charge engineer, who found him in a bewildered condition; he had paralleled the third machine, and had now about 250 amperes per phase on all three machines, and was wanting to know where the other load had come from. The charge engineer soon put him right, which, of course, any switchboard attendant could have done.

"Wake Up" should not underrate work which he has apparently never undertaken.

Nothinginit.

Coventry.

July 30th, 1921.

RESTRICTIVE COVENANTS.

By a Legal Contributor.

ALL men of business who have occasion to employ clerks or assistants, are well aware of the necessity of inserting a restrictive clause in the agreement of service. Keen competition makes it difficult to make and keep a connection; and the employer is often anxious to prevent a discharged clerk or assistant drawing off the custom of his late master, or entering into direct competition with him.

Again, when a business is sold, the purchaser will naturally want to prevent the vendor competing with him. In either case, a restrictive covenant of some kind becomes necessary. The case of *Bowler v. Lovegrove*, which was reported in *The Times* a few months ago, renders it desirable to refer to the matter once more. It is necessary to point out that, as a general rule, a covenant which binds a man not to practise his calling is looked upon with suspicion. The reason is that if a man deliberately sells the right which all men have in a free country to the exercise of their calling, he deprives the public of the benefit of his skill and experience, while he abandons what may be his means of livelihood. A principle of law has, therefore, been evolved, having its origin in the famous case of *Mitchell v. Reynolds*, which was decided in 1712, that contracts in restraint of trade are void, and must not be enforced by the Courts. If an electrical engineer at the present day were to enter into a bond which prevented him from carrying on his business anywhere for the rest of his natural life, no court of justice would enforce its due performance.

But while contracts in total restraint of trade are void, it has become a well settled rule that if restriction is limited as to area, and there is "consideration" for the bargain, the goodwill of a business may be made the proper subject matter of a contract. And so the well-

known "bond" into which the vendor of a business enters is recognised in, and will always be enforced and respected by a court of justice. Were it otherwise, the sale of a connection would be rendered impossible, as nothing could operate to prevent the vendor from interfering with the practice which he himself had disposed of for a substantial sum of money. Similarly, unless an assistant or servant could be put under restriction, employment anywhere would be dangerous on any terms.

Such is the bare outline of a branch of law which is surrounded with many technicalities. Into these it is not our purpose to inquire at any length, but there are a few points which demand further elucidation. It has been pointed out that the restriction must be limited as to area. It would be wholly unreasonable, for instance, to prevent an assistant from exercising his calling anywhere in the British Isles. Many cases have arisen in the Courts as to what is a reasonable limit. In *Horner v. Graves* (7 Bing. 735) it was held to be unreasonable to restrict a dentist from practising anywhere within 200 miles from York. On the other hand, to borrow an instance from the legal profession, a covenant preventing a solicitor from practising as such anywhere in England for 20 years has been held to be reasonable and capable of enforcement (*Whittaker v. Howe*, 3 Bras. 383). It follows, therefore, that in marking the border line, the Court will be influenced in a large measure by the nature of the business. The available means of communication are also important. By means of railways, telephones, &c., a practice can be extended over a much wider area at the present day than would have been possible at the close of the last century. That the Court is willing to enlarge the boundary in certain cases, even to the confines of the habitable globe,

was clearly demonstrated in 1896, when world-wide restriction was placed upon the manufacture of a particular class of guns and armament. Although this case could never have any direct application to the electrical profession, yet it serves to show the elastic nature of rules by which the Court is governed in these matters.

With regard to time, there does not appear to be any restriction. Nevertheless, if a man binds himself not to practise for a limited period, the area of restriction may receive a slight extension. The rule by which the boundary should be determined was thus expressed in the case of *Horne v. Graves*, to which allusion has already been made:—

"The restraint must be only such as to afford a fair protection to the interests of the party in favour of whom it is given, and not so large as to interfere with the interests of the public."

The consideration—another essential feature of these contracts—is the next matter which deserves attention. And upon this point, so long as the Court is satisfied that there is a consideration which is not merely colourable, the contract will be enforced. The adequacy of the consideration is left entirely to the parties themselves. Instances could be cited without number to show what has been held as a reasonable consideration. In the case of *Saintier v. Fergusson* (7 C.B. 716) the engagement of the defendant as assistant was held to be sufficient consideration for an undertaking on his part not to practise within a radius of seven miles after the termination of his employment.

Having made an attempt to indicate the features which are essential to contracts in restraint of trade, we now propose to consider what constitutes a breach of such contract. In most contracts the covenant is in the following form: The vendor undertakes that he "will not at any time hereafter, directly or indirectly, and either alone or in partnership with or as assistant to any other person or persons, carry on the profession or business of, &c., within a certain area." A further clause prohibiting practice "in open competition" sometimes finds its way into the deed.

The question naturally arises, What constitutes practising? Most men—or their consciences—will be able to answer this question without difficulty, but doubtful points arise from time to time. In the case of *Palmer v. Mallett* (36 Ch. D.411) it was decided that a person acting only as a salaried assistant was carrying on the profession of a surgeon, and that to do so was a breach of the covenant. In that case Lord Justice Cotton said: "Carrying on a trade implies, to my mind, that the person engaged in it is engaged in it *qua* trade—that is to say, as a trade producing profit or loss which is to be shared by him; and that is not the case if he is merely a salaried assistant. . . . I cannot come to the conclusion that a man is less carrying on the profession of a surgeon because he is doing so as assistant to someone else. 'Profession' is different from trade, and it is much more emphatic, to my mind, than if 'business' alone were here. When, as here, the words 'carrying on the business or profession of a surgeon' are merely used to denote what is done by a man acting as a surgeon, a man, in my opinion, acts as surgeon none the less because he is not the principal or engaged in the business as a partner, but is merely carrying it on as an assistant."

It will be observed that the case just referred to involved the discussion of a covenant in force between the vendor and purchaser of a business. The Courts will construe such a covenant less favourably to the person bound than a covenant which prevents a servant from competing with his former master. At the same time, even in the case of a servant a covenant will be enforced if not unduly harsh.

An example of the class of case which often comes before the Courts is to be found in *Herbert Morris v. Sazely* (1916), (1 A.C. 688). In that case the plaintiffs were engaged in the manufacture of very special forms of machinery, including pulley-blocks, runways, and travelling cranes. Their business was a leading

one in the United Kingdom in this class of machinery, and extended over a large part of the United Kingdom. In March, 1911, the defendant entered into an agreement under which his salary was £3 17s. 6d. a week, and his engagement for two years certain. By Clause 7 of the agreement he covenanted with the plaintiffs that he would not:—

At any time during a period of seven years from the date of his ceasing to be employed by the company, whether under this agreement or otherwise howsoever, either in the United Kingdom of Great Britain or (*sic*) Ireland, carry on, either as principal, agent, servant, or otherwise, alone or jointly, or in connection with any other person, firm or company, or be concerned or assist, directly or indirectly, whether for reward or otherwise, in the sale or manufacture of pulley-blocks, hand overhead runways, electric overhead runways, hand overhead travelling cranes, or any part thereof, or be concerned or assist as aforesaid in any business connected with such sale or manufacture.

On leaving the plaintiffs' employment, the defendant at once went into the employment of the French agents of the plaintiffs, but in March, 1914, he entered the service of *Vaughan & Son, Ltd.*, Manchester, who were the principal competitors of the plaintiffs in the manufacture of some of the articles mentioned in the above Clause 7. Thereupon the plaintiffs brought these proceedings, claiming an injunction against the defendant substantially in the terms of this clause.

In these circumstances, Mr. Justice Sargant held that while the covenant was not unreasonable from the plaintiffs' point of view inasmuch as it was necessary for the purposes of their business, it would be wrong to enforce it against the defendant, as it would deprive him and the public of the benefit of the skill and experience which he had acquired while in the plaintiffs' employment, and prevent him using his knowledge. By a majority the Court of Appeal upheld this decision. The Master of the Rolls pointed out that restrictive covenants are usual in three cases: (i) Where a trade secret requires protection; (ii) where the goodwill of a business is sold; (iii) where the liberty of a former employé is to be restricted. While they must be construed very strictly in (i) and possibly also in (ii), a greater freedom is to be exercised in (iii). In applying the older decisions to the facts of the case, the Court was animated by the desire to prevent the defendant being deprived of the advantage of all his previously-acquired knowledge, and to relieve him from having to start the world afresh. The case emphasises the importance of consulting a lawyer before any document containing a restrictive covenant is signed.

A recent case on the subject (*Attwood v. Lamont*, 1920, 3 K.B. 571) which was reported in the December number of the *Law Reports*, is interesting as showing that the Court may declare a covenant void because it will prevent competition. In that case the plaintiff carried on business at Kidderminster as a draper, tailor, and general outfitter. By a contract of employment of the defendant by the plaintiff, as an assistant in his business at an annual salary and commission, in the tailoring department, the plaintiff declared that he was willing to employ the defendant upon his entering into the agreement not to trade in opposition to him. The defendant agreed that he would not at any time thereafter "either on his own account or on that of any wife of his or in partnership with or as assistant, servant, or agent to any other person, persons, or company carry on or be in any way directly or indirectly concerned in any of the following trades or businesses; that is to say, the trade or business of a tailor, dressmaker, general draper, milliner, hatter, haberdasher, gentlemen's, ladies', or children's outfitter, at any place within a radius of ten miles of Kidderminster." The defendant subsequently set up business as a tailor at Worcester, outside the ten miles' limit, but obtained and executed tailoring orders in Kidderminster. The Divisional Court held that the covenant was wider than was reasonably necessary for the protection of the

plaintiff's business, but that it was severable by striking out the enumerated trades except that of a tailor and limiting its operation to the trade or business of a tailor, and granted an injunction restricted to the tailoring trade. The Court of Appeal, however, held that the covenant being a single covenant for the protection of the plaintiff's entire business and not several covenants for the protection of his several businesses could not be severed, and that even if the covenant could be severed by confining it to the tailoring business, it would still be void as being in restraint of competition.

The following points may now be taken to be established:—

1. It is the covenantee who has to show that the restraint sought to be imposed upon the covenantor goes no further than is reasonable for the protection of his business.

2. The restraint must be not only in the interests of the covenantee but in the interests of both the contracting parties.

3. An employer is not entitled by a covenant taken from his employé to protect himself after the employment has ceased against his former servant's competition, although a purchaser of goodwill is entitled to protect himself against such competition on the part of his vendor.

4. Previously accepted rules as to the doctrine of severance require careful application if not entire reconsideration.

In *Bowler v. Lovegrove*, the case referred to at the beginning of this article, we see a remarkable application of this principle. There a young man agreed to act as clerk at a salary of £3 a week to auctioneers and estate agents. He bound himself for the term of one year after his employment ceased not to enter into or carry on the business of auctioneer or estate agent, or to act as clerk, &c., in Portsmouth and Gosport. Having left the employment he set up on his own account. The judge having found as a fact that the clause was put in solely for the purpose of preventing competition, he came to the conclusion that it could not be enforced.

REVIEWS.

The Engineer's Year-Book, 1921. Compiled and edited by H.R. KEMPE, M.Inst.C.E., M.I.Mech.E., M.I.E.E., and W. HANNEFORD SMITH. Pp. 2,642; figs. 2,250. London: Crosby Lockwood & Son. Price 30s. net.

First published in 1894, Kempe's Year-Book at once took the lead as the most complete and comprehensive work of its kind then obtainable by engineers, an enviable position which it has ever since maintained. Now in its twenty-eighth edition and extending to some 2,600 pages, this compendium of all that is most modern in civil, mechanical, electrical, gas, marine, mining, and metallurgical engineering places before the reader a veritable encyclopedia of up-to-date engineering practice. But unlike other encyclopedias, Kempe's is revised annually, all obsolete matter undergoing a drastic process of excision, and though many of the startling engineering novelties of the war period were not too well "boomed," few of them appear to have escaped inclusion in its pages. And thus we find in this single volume probably more recent information appertaining to well-nigh every phase of engineering than is to be found in any other book in the English language.

Following a succinct "Summary of Engineering Progress during 1920," the main part of the work is divided into 43 sections, each section forming a practically complete treatise, contributed by one or more experts on its particular subject. In these sections are interspersed miscellaneous data and numerous descriptions of typical mechanisms and appliances, a notable feature being the advantage which has been taken of the permission given by the leading engineering institutions to reproduce data and information from papers included in their recent *Transactions*. Section XIII, which treats of "Electric Traction," and that part of Section XXXVII which deals with "Electric Welding," have been thoroughly revised by Mr. A. H. Allen and Mr. T. T. Heaton, and will probably prove most serviceable for consultation purposes to our readers. Internal-combustion engines have received careful consideration at the hands of Mr. G. A. Burls and Mr. A. Vincent Clarke, while the present position regarding "Steam Engines and Boilers" and "Boiler Plants" has been dealt with at length by Messrs. Wm. H. Booth and D. Brownlie respectively.

The ever-growing part taken by electricity in mining operations is touched upon by Prof. Henry Louis in his absorbing exposition of "Mining" in Section XXIV. Other informative sections coming within the scope of our readers' possible requirements are those on "Steam Engineering," by Mr. Frank Foster; "Steam Turbines," by Mr. H. L. Guy; and "The Development of Water Power," by Mr. A. Surveyer.

As regards binding, paper, printing, and illustrations, the book leaves nothing to be desired, but the index to contents is inadequate for present-day high-speed requirements. It is not sufficient to say that Section XXIX commences on page 1339. The section extends to 244 pages, and is divided into six parts, each one of which calls for separate pagination. Nor can we find in the index, in which much cross-referencing still remains to be done, any mention of the names of many of the authors whose contributions appear in the book. For instance, in the "List of Associate-Editors and Contributors" we see that Mr. J. H. Horobin has dealt with "Steam and Power Plants," but the author's name is not indexed. We would also suggest that having now reached nearly five times its original size, the volume has become too "podgy" to handle conveniently, and in future editions an increase in the size rather than in the number of pages should be aimed at.

Domestic Fuel Consumption. By Prof. A. H. BARKER, B.A., B.Sc. Pp. x+159; figs. 26. London: Constable & Co., Ltd. Price 14s. net.

The work of Prof. Barker on heating and ventilation is well known; his independent attitude as a scientific investigator renders this latest contribution most welcome and valuable, particularly at a time when engineers are awakening to the possibilities of the domestic field and the promise of work valuable to themselves, their clients, and the State, so soon as the householder can be made to realise the place of science in the organisation of the home.

Prof. Barker's book should be read and kept for handy reference by all interested in the electrical industry; to the consumer's engineer and the contractor it will prove most useful, not the less so because the arguments are expressed in language and in similes suitable for passing on to the layman.

The early part of the work is devoted to a general study of the laws of heat, and an attempt is made to enable the reader to visualise its behaviour, and particularly the idea of heat quantity as apart from temperature; in later chapters, when discussing the design of cookery appliances, the writer also shows very clearly the importance of conditions which affect the rate of heat transmission as between the source, the utensil, and the food being cooked—exhibiting the quite subsidiary importance of mere temperature measurements in this connection, and so revealing important considerations in the design of ovens, &c.

The possession on the part of the householder of any clear ideas on the heat content of familiar notions of fuel, heated water, food, &c., is rare, whilst the notions associated with waste of calorific value in using fire and gas are generally most vague, and may be stimulated considerably by the professor's references to the B.T.U.'s contained in a cup of hot tea, and his explanations of the manner in which the heat is continually "soaking" out of hot bodies and into their colder surroundings.

The reviewer has found by experience the value of these simple expedients for popularising theory, and avoiding the sort of mental paralysis which seems to trouble even educated people when presented with the simplest engineering statements in scientific form; for example, the exhibition of weighed heaps of coal equivalent to the energy production required for keeping an electric lamp alight for an hour is quite an excellent way of countering the questioner who wants to know why electricity should be so dear as "it all goes back to the works again."

However, the author's attempt to write in a popular vein sometimes leads him to slip below the proper minimum of scientific statement, as when he ends his frequent praises of electricity by deploring its costliness, declaring, for example, that it should never be used for heating at rates higher than 1d. per unit, and making similar statements which, although perhaps revealing his meaning to engineering readers, have no intrinsic value unaccompanied by the comparative rates for gas and other fuels. Such generalisations are apt to confuse a reading public which may be paying to-day anything from seven-eighths of a penny to 4d. per unit for electricity against 2s. 6d. to 10s. 6d. per 1,000 cubic feet for gas; the dear gas sometimes being associated with the cheap electricity and *vice versa*.

Rather pessimistic references are made to the prospect of educating owners and servants in the proper use of well-designed and economical apparatus, as also to the apathy of property owners in relation to house equipment, and the possibility of getting higher rent for outfits which offer the tenant a tangible economy in daily use. The increasing number of owner occupiers, and the need for reducing expenditure will certainly lead to a much higher standard of skill and care in home work in the next few years; the passing of cheap coal and cheap domestic help is not entirely a disadvantage.

The author appears to think that hire of heating and cooking apparatus, whilst good at first, may prove a disadvantage later, as more efficient forms are produced, and hiring under-

takers may not be tempted to change the older types for fear of losing revenue.

Both gas and electricity suppliers have got beyond that crude stage of development, and realise that their users must have the best if the business is to continue extending, moreover the keen competition for the supply of heat which will be a feature of the future, will keep both industries keyed up to providing the latest means for using the energy which they desire to sell.

It would appear from internal evidence as if much of this work had been prepared during the war, not, however, a disadvantage so long as the miners elect to give us a reminder of those evil days at frequent intervals. The figures on page 18 concerning the values of gas rather remind us of the classification of eggs into new-laid, fresh, and mere eggs; the writer is perhaps unduly hard on the gas people, as he does not fully explain that in lowering calorific value and selling on a heat basis, they hope to get a higher percentage return from the coal, in which advantage presumably the user would share sooner or later.

Writers of books of this class on gas and electricity can seldom resist the temptation to show how meters should be read, and how they can be used to check the consumption in appliances, or even how appliances can be made to check the accuracy of the meters; this is always a dangerous sort of instruction to give owing to the variations in pressure and quality and the inaccuracies in the making or adjustment of consuming devices; however, the average householder is more interested in the amount of his quarterly bill, and generally satisfied that meters are about as reliable as the clocks, scales, and pint pots by which most of his many transactions are regulated.

Some figures are given to enable the cost of using electrical apparatus to be computed, and the rather happy expression "little unit" is employed to denote the watt-hour, but a little sum on page 33, in which a weekly bill is made up of two-thirds lighting and one-third kettle consumption, all at 8d. a unit, hardly represents average practice; whilst the writer's recommendation for obtaining a dim light by under-running lamps, and his comparisons of the cost of gas and electric lighting, show some neglect of the light/energy characteristics of the incandescent filament and of the results achieved with, and at their best only possible to, the combinations of reflector and light source which the electric lighting expert now gives us.

However, the author has nothing but praise for electric lighting, although he thinks most people take whatever they find installed; that is not so, they make considerable efforts to get the more modern light, even paying heavy prices for fitting it into houses which do not belong to them, and find in the end that their money has been well invested on account of the incidental savings and conveniences.

The chapters devoted to cooking and room heating are of great interest and value, and should be read with care by all electrical engineers; they put the problems in a clear light, and show how carefully statements on appliance efficiency should be received.

The author thinks it difficult to get the best results with modern appliances, because the owners or their servants do not know enough; the real trouble is that they know too much, and unlearn with difficulty—for generations it has been customary to regard the heat of a fire as one does the heat of the sun or the flow of a stream, something from which to snatch a certain value, but to regulate hardly at all. Even the household fuel bill is looked upon rather as a form of rent, wealth permitting the luxury of waste and poverty meaning deprivation; but the last idea of all has been to get better value out of the expenditure or to spend more on permanent equipment in order to reduce the running cost of fuel.

If this interesting work leads to a closer study of heat energy and its detailed use, and helps the layman to a clearer understanding of the value of fuels, whether crude or in the progressively higher forms of gas and electricity, it will have served a most useful purpose. J. W. B.

Electrification of Railways. By H. F. TREWMAN, M.A. Pp. vi+78; 13 illustrations. London: Sir I. Pitman & Sons. Price 2s. 6d. net.

In the space at his disposal the author has only been able to sketch in the groundwork of his subject with a wide brush, detailed consideration being left to the more pretentious text-books. Stress has been laid on the commercial rather than the technical aspects of the question, since the former constitute the true test of all engineering propositions.

This little book should be of service, owing to the fact that it deals with those basic principles which are apt to be obscured by masses of technical detail.

Some of the questions discussed are of a highly controversial nature, as, for example, the relative merits of alternating and direct current for traction purposes, but the author has evidently striven to be quite impartial in his statement of advantages and disadvantages.

To illustrate the remarks on the importance of the load-factor, a typical load-curve for a tramway station, with its heavy morning and evening peaks, is given. It would have been interesting to compare this curve with that for a power station of a main-line railway. It would appear that the latter should have a much more uniform load, especially if goods traffic is handled electrically, since this would be dealt with as far as possible during the slack hours for passenger traffic.

A comparison is made between the costs of operation of steam and electric traction, from which it is deduced that with electric working, goods traffic is likely to be more profitable than passenger traffic. The results arrived at would be more valuable if fuller information were given as to the components of the costs on which they were based.

The book is simply and clearly written, and very little technical knowledge is required to understand the text, so that it should prove valuable to all who wish to gain an insight into the nature of the problems to be considered in connection with the electrification of railways.

BUSINESS NOTES.

Bankruptcy Proceedings.—R. P. BAKER and F. C. STUBBS, electrical engineers (trading as The Sheffield Electric Construction Co.), 124, Pond Street, Sheffield. The following are creditors:—

Edison & Swan Electric Co. ...	133	Morton, Wm. A. ...	21
British Thomson-Houston Co. ...	56	Bairds, Ltd. ...	14
Hullamshire Electric Co. ...	30	Emmell ...	13
Dunford & Elliott, Ltd. ...	35	Griffin, Ernest, & Co. ...	13
Shannon, Ltd. ...	50	Metropolitan-Vickers Co. ...	11
Smith, H. W., & Co., Ltd. ...	30	Oliver Typewriter Co. ...	10
General Electric Co. ...	20		

JOSEPH FRANCIS LYONS, electrical engineer, 27, Palmerston Street, Front Street, Consett, Durham. The following are creditors:—

Anderton ...	15	Express Electrical Co. ...	10
Backhouse ...	200	Electric Lamp Mfg. & Supplies ...	98
British Electrical Mfg. Co. ...	18	Do ...	98
British Thomson-Houston Co. ...	27	Dean Ball Plant Co. ...	130
Challender's Cable & Construction Co., Ltd. ...	23	Davidson, J. R., & Sons ...	45
Do ...	23	Grobtree, J. R., & Co. ...	34
Do ...	23	Foster, R. C., & Co. ...	20
Do ...	10	Foxall ...	70
Do ...	23	General Electric Co. ...	108
Fletcher Bros. ...	14	Glendon & Co. ...	27
Gibson, W. R., & R. ...	17	Motor Electric Engineering Co. ...	128
Hudson's Electrical Eng. Co. ...	37	Railway Passengers' Assurance Co. ...	38
Jackson Electric Stove Co. ...	16	Do ...	38
Wardle Engineering Co., Ltd. ...	15	Z. Electric Lamp & Supplies Co. ...	21

I. J. HODSON and B. H. NEWMAN, electrical engineers, Exeter.—Trustee, Mr. A. H. Ward, O.R., 9, Bedford Circus, Exeter.

Re ROBERT CHARLES JONES, lately carrying on business as Elect-Ma. Engineering Co., 10, Caledonia Street, King's Cross, N. A sitting of the London Bankruptcy Court was held on July 29th before Mr. Registrar Francke for the public examination of this debtor, who failed

last March with liabilities £938 (unsecured £838), and assets, "cash at bankers, £6 18s. 8d." Questioned by Mr. F. T. Garton, official receiver, the debtor stated that having acted as a canvasser for the electrical trade till 1908, he commenced business on his own account as an electrical contractor at 27, Cursitor Street, Chancery Lane, W.C., under the style of "The Globe Electrical Co.," which he carried on till 1910, when he closed it and obtained employment in the same trade. In September, 1917, he again commenced business on his own account as an electrical engineer and power expert, under the style of "Elect-Ma," and later under the style of "Charles R. Jones," working principally from his private address. In October, 1919, he was joined by a Mr. Tanner, who agreed to find £200 on consideration of an equal share of the profits; they took premises at 10, Caledonia Street, and in June, 1920, in order to commence business as wholesale dealers in electrical accessories, witness advertised for a partner, with the result that a Mr. Midgley joined them, on terms that he provided £200 as a premium and a further £200 for a one-sixth share of the net profits, the balance to be divided equally between witness and Mr. Tanner. The business was carried on in that way until last January, when the landlord obtained possession of the premises, and witness then continued it alone from his private address up to the date of the receiving order. He attributed his insolvency to insufficient working capital and heavy expenses of management. The sitting was adjourned till August 9th, further accounts being required by the Official Receiver.

Company Liquidations.—**THE STOLS ELECTROPHONE CO.** (1914), LTD., 8, St. Martin's Place, Trafalgar Square, W.C.—At the offices of the Board of Trade, Carey Street, W.C., on July 26th, the statutory meetings of creditors and contributories were held. The statement of affairs showed, as regards creditors, ranking liabilities of £3,971 and net assets £3,786.

thus showing a deficiency of £185. As regards contributories, the paid up capital of the company was £5,000, to which has to be added the above deficiency of £185, making the total deficiency £5,185. Mr. Geo. Digby Pepps, Official Receiver, presided, and reported that the winding-up order was made on March 12th upon the petition of a creditor. The company was incorporated on June 6th, 1914, as the Stols Electrophone Co. (1914), Ltd., with a nominal capital of £5,000, to adopt an agreement dated May, 1914, made between the Stols Electrophone Co. (1913), Ltd., and one Robert A. Buddison on behalf of the 1914 company. The business consisted of the sale of electrophones, devices and instruments to improve the hearing. The instruments were at first purchased from America, and latterly the company manufactured its own instruments. The company's factory was at Shepherd's Bush, and branch businesses had also been carried on at Glasgow, Nottingham, Manchester, Liverpool and Bradford. On March 23rd, 1916, the name of the company was changed to the Stols Electrophone Co. (1914), Ltd. A large amount had been expended on advertising; the total sum from incorporation amounted to £9,000. In February, 1921, a debenture for £5,000 was issued, which would have to be inquired into. A Receiver for the debenture holder was continuing the business, and according to his account, he had made a small profit. The result of the company's trading was as follows:—1915, a net loss of £63; 1916, a net loss of £197; 1917, a net loss of £611; 1918, a net loss of £802; 1919, a net profit of £505; and 1920, a net profit of £550. At the creditors' meeting a resolution was carried that the liquidation should remain in the Official Receiver's hands, and this resolution was endorsed at the shareholders' meeting.

ELECTRICAL MAINTENANCE CO. (LIVERPOOL), LTD., London Road, Liverpool, electrical engineers and factors.—The creditors of the above were called together recently at the offices of Messrs. McAusland, Airey & Page, 8, Victoria Street, Liverpool. Mr. John Airey, the liquidator, submitted a statement of affairs, which showed liabilities of £4,423, of which £4,348 was due to unsecured creditors. There were fully secured creditors for £350, holding securities valued at £424, or an apparent surplus of £74. The assets were estimated to realise £1,740, from which had to be deducted £79 for preferential claims, leaving net assets of £1,661, or a deficiency as regarded the unsecured creditors of £2,761. It was stated that the fully secured creditor was the liquidator, in connection with the money advanced for which he held stock as security. The bank was guaranteed to the extent of £1,400. The partly secured creditors were two of the directors, and their claims arose in respect of cash advanced. The company was registered in December, 1919, with a nominal capital of £2,000, divided into shares of the face value of £1 each. The issued capital amounted to £1,400, of which £700 was issued as fully paid, and the balance for cash. The accounts to April, 1920, showed a small loss. The accounts since that date had not been audited, but it was believed that there had been a loss on the trading of about £1,600 or £1,700. The present position was attributed to heavy buying, and having to sell at a loss. An execution was levied, while at the date of the liquidation two creditors for £300 were in possession and had to be paid out. After discussing the position, the creditors passed a resolution confirming the voluntary liquidation of the company, while an informal committee was also appointed, consisting of the representatives of the Colson Co., Oldham; Oriental and General Trading Co., Ltd., Liverpool; and Mr. Parkin S. Booth. The following are creditors:—

Associated Electric Traders	...	25	General Engineering Co.	...	75
Bendall & Curphy	...	32	Harnes, W. & Co.	...	76
Blackwell, R. W., & Co.	...	125	Metallic Engineering Co.	...	27
Collier, John, Liverpool, Ltd.	...	19	North Western Motor Co.	...	18
B.T.T. Lamp & Accessories	...	13	Oriental & General Trading Co.	...	128
Colson Co.	...	347	Poore, G. & J., Ltd.	...	16
Concordia Electric Wire Co.	...	18	Oriam Electric Co.	...	15
Dowsing Radiant Heat Co.	...	42	Sharpe & Killitt	...	40
Dodd, C. F., & Co., Ltd.	...	103	Smithwork Lighting Co.	...	13
Dainty Modern Machine Co.	...	10	Gremens Bros. Ltd.	...	39
De la Rue, Thomas, Ltd.	...	256	Solar Electric Co.	...	10
English Electric Co.	...	11	Siluminite Insulator Co.	...	50
E.S. Supplies, Ltd.	...	13	Taylor, F.	...	94
Electric Heating Co.	...	81	Haves & Co.	...	25
Fuller's United Electric Works	...	109	Hycomet Manufacturing Co.	...	40

RE BOWER & TAYLOR, LTD., electrical, &c., engineers, 7 and 8, Great Winchester Street, E.C.—Under a compulsory winding-up order made against this company last December upon a creditor's petition, accounts have been lodged showing liabilities £1,899, assets valued at £822, and a deficiency of £1,080, as regards contributories. Mr. H. E. Burgess, Official Receiver and Liquidator, reports that the company was incorporated as a private company in April, 1920, with a nominal capital of £5,000 in £1 shares, and was promoted by Mr. A. Bower for the purpose of acquiring the business of automobile and electrical engineers carried on by him under the style of Motor and Electrical Industries. The only capital issued was £3 to the subscribers to the memorandum of association. Mr. Bower states that Mr. Charles Lawrence Taylor joined him in February, 1920, as manager at a salary of £8 a week and one-third of the profits, and to ensure his interests it was agreed that a company should be formed to acquire the goodwill, plant, machinery, office furniture, and stock-in-trade of the business for £1,000 payable in cash. Mr. Taylor applied for 200 shares in the company, but they were never allotted; no board meetings were held, and differences having arisen between the directors, he withdrew his application, and on December 9th, 1920, obtained judgment against the company for £900. The company has been financed to the extent of

about £1,000 by Mr. Bower and various companies in which he is interested. In August, 1920, it was found that the company was being carried on at a loss, and Mr. Bower refused to make further advances. The failure of the company is attributed to depreciation in the value of stock.

GRADY, LTD. Winding up voluntarily. Liquidator, Mr. R. E. Gray, 11, Gresham Street, E.C. Meeting of creditors was called for August 4th.

TECHNICAL INTELLIGENCE SERVICES, LTD., and **THE TECHNICAL REPAIR, LTD.** Meetings of creditors were called for August 3rd. Liquidator, Major A. Graham Clark, 53, Victoria Street. Particulars of claims to be sent to the liquidator by September 1st.

ALADDIN REPAIR ELECTRIC LAMP CORPORATION, LTD. (in voluntary liquidation for the purposes of reconstruction).—Meeting of creditors on August 10th at 82, Victoria Street, London, S.W.1. Liquidator, Sir H. S. Foster, 82, Victoria Street, S.W., who is authorised to consent to the registration of a new company, the Aladdin Renew Electric Lamp Corporation (1921), Ltd., and to enter into an agreement with the same.

ARMORCUT BRITISH CO., LTD.—Particulars of claims should be sent to the liquidator, Mr. H. A. Pepper, 14, Temple Street, Birmingham, by August 31st.

Trade Announcements.—**THE CIE. CONTINENTALE DES FOYERS TURBINE (SOC. AN.),** 29, Rue de l'Eveque, Bruxelles, was formed on June 26th, with a capital of one million francs, to exploit the turbine furnaces invented by Mr. V. R. Chadwick, now the technical director of the Turbine Furnace Co., Ltd., of London. Mr. W. H. Badams, the managing director of the English company, has a seat on the board of the Continental company, as representing the English interests. The managing director of the Continental company is Lieut.-Col. B. A. Thornton. The new company has been formed to work the whole of the Continent of Europe and such colonies as belong to the Continental countries.

New show-room premises at 48, Grosvenor Road, Tunbridge Wells, have been opened by **THE PREMIER ELECTRICAL CO.**

MR. JOHN D. MACKENZIE has recently removed from 155a, St. Vincent Street, to 16, Blythswood Square, Glasgow, where he will continue to represent the Scottish interests of the Park Royal Engineering Works, London; the B.E. Co. (of London and Birmingham), Ltd., and Messrs. C. J. Thursfield, Ltd., of Birmingham. He informs us that he is not the Mr. J. D. McKenzie who is starting as an electric light contractor in Edinburgh as noted in this column recently.

Catalogues and Lists.—**THE STANTON IRONWORKS CO., LTD.,** near Nottingham.—A well-illustrated booklet giving particulars of various types of "Stanton-Hume" reinforced concrete pipes.

CITY ELECTRICAL CO., LTD., 1, Emerald Street, W.C.1.—An illustrated and priced list of standard motor starters of several types.

MESSRS. REAVELL & CO., LTD., Ranelagh Works, Ipswich.—Pamphlet No. 91, illustrating and describing "Quadruplex" air compressors.

BRITISH INSULATED & HEATSEY CABLES, LTD., Prescott, Lancs.—"General Descriptive Catalogue," giving numerous illustrations and descriptions of cables and wires, cable racks, switchgear, joint and terminal boxes, tramway material, meters, Leclanché cells, welding machines, and telegraph material.

THE RHODES FITTINGS CO., LTD., 224, Upper Thames Street, E.C.4.—An illustrated and priced folder dealing with the "Adjustalite" pendant fittings and table standards.

MESSRS. J. H. TUCKER & CO., LTD., King's Road, Tulseley, Birmingham.—A folder giving illustrations and prices of quick "make and break" tumbler switches.

The County of London Co.'s Bill.—On July 28th, the Bill being promoted by the County of London Electric Supply Co., Ltd., to enable it to construct a station at Barking, was again considered by a Select Committee of the House of Commons. Sir Harry Kenwick gave evidence as to the necessity for the station. He said that there had been seven years delay in this matter, and the position as regarded supply had become very desperate. The company's City Road and Wandsworth stations were in congested districts and could not be extended. The Barking station would be designed to give an initial supply of 120,000 kW, and would be developed later to give 200,000 kW. The L.C.C. had powers to purchase the company's present system in 1931, but the new station would not be purchasable by the Council. The Barking station would give bulk supplies of electricity to a number of London stations, and when these stations were purchased by the L.C.C. if the Council decided not to continue to take the supplies, they would be disconnected, and special compensation against this contingency was sought by the company. The L.C.C. opposed the Bill, and especially the clause providing for the payment of compensation on severance of connections on the purchase of the London stations. The committee, on July 29th, approved the preamble of the Bill upon the insertion of amendments guaranteeing the L.C.C. a sufficient supply when the London stations were purchased, and providing that the station should not be taken over by a Joint Electricity Authority until a period of five years had elapsed from the passing of the Bill.

Copper and Lead Prices.—Messrs. F. Smith & Co. report August 2nd: Copper (electrolytic) bars, sheets, wire rods, and h.c. wire, no change. Messrs. James & Shakespear report August 3rd: Copper bars (best selected), sheet, rod, no change. English pig lead £25, 10s. increase.

Unemployment.—The Ministry of Labour's unemployment figures for the week ended July 22nd show another decrease. The total (men, boys, women and girls) was 1,570,000 as compared with 2,045,741 in the preceding week. The fall was evenly distributed among the four classes of workers.

Beaufest Subscriptions to Cease.—The practice whereby business firms are asked to contribute towards the expenses of social or athletic clubs by the employees of firms with whom they happen to do business has been under discussion in the Trade Association. Members of at least one Association have passed a resolution pledging themselves to discontinue altogether subscriptions to beaufests, clubs, &c., owing to the great increase in popular subscription.

Patent Restoration.—An order has been made restoring Patent 1902 of 1910 granted to Jules Carpentier for "an improved transmitter for transmitting telegrams composed in perforations on a band by the Baudot system."

A "Simplex" Competition.—SIMPLEX CONDUITS, LTD., recently offered a prize of five guineas for the most appropriate name for a new continuity fitting. The winning suggestion was "continuity," which fits the device very aptly.

Registration of Contractors in South Africa.—An ordinance has been passed by the Cape Provincial Council empowering the municipalities in the Cape Province to make regulations for the registration of electrical contractors and for the licensing of electric wiremen. Should any municipality neglect to make such regulations within four months of the passing of the Ordinance the power to do so becomes vested in the Administration.

The Cost of Living and Trade Revival.—In the course of his speech at the annual meeting of Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., last week, Sir Glynn West said, as reported in the *Financial Times*, that increased wages had brought about increased prices of material, with the result that the cost of everything required throughout the world became so excessive that, notwithstanding the wants of the people, orders were withheld after only most pressing requirements were fulfilled. The cost of living was now slowly declining and it was not unreasonable to hope therefore that within the next few months they might see a gradual revival in trade, but there was little chance of this unless they could have a period of freedom from industrial disputes, which benefited no one in this country, but were the greatest help to our competitors abroad. Further, while the export trade of England was of vital importance to the country as a whole, it was of special importance to them as ship-builders. A decline in export trade meant a decline in the demand for ships, and they now had to face not only a poor prospect of receiving further orders, but cancellation and suspension of orders already placed. If high wages and the cost of production were to continue in this country and not elsewhere there was little chance of orders for the manufacturers or work for employees. There were few manufacturing concerns which had not been faced with the necessity of providing further capital. If this great manufacturing country was to maintain its place among nations the world costs of production must fall, and the necessity for financing orders at excessive costs as in the immediate past would disappear. The firm had still a great deal of work in its shipyards and shops, and the acceptance of the principle that wages must vary with cost of living would greatly help it.

Commercial Travellers and the Week-end Ticket.—Considerable interest has been aroused amongst commercial travellers by the railway companies' restoration of the week-end tickets as from August 19th, but much disappointment is felt that the concession does not carry with it the old-time privilege of a return ticket at a single fare, available from any station to the traveller's home station. The National Union of Commercial Travellers has been informed by the Railway Clearing House that the return ticket will be issued at a cost of a single fare and a third, and the cost of the certificates and books of vouchers necessary to obtain these tickets will be 1s. and 5s. respectively, which is exactly double the charge made at the time the tickets were withdrawn in 1916. The minimum fares for commercial travellers' week-end tickets are now to be 5s. third class, 10s. first class, and tickets will be issued as before, i.e., after 12 noon on Friday, and the return journey must be made on Sunday or Monday following. Commercial travellers can obtain fuller details by writing the secretary of the Union at St. Bride's Institute, Bride Lane, E.C. 4.

Australian Telephone Orders in Arrears.—The Australian Commonwealth Postmaster-General has prepared a statement showing the amount of material on order in August, 1920, still undelivered. The most important of this is six switchboards, including two required for the exchange at Collingwood. Of 247 miles of cable on order, 100 miles have been delivered, 521 miles has been ordered since August, 1920, and the total of orders now outstanding is 544 miles. The position regarding wire is even worse, and 14,643 miles is now on order, awaiting delivery. In August, 1920, there were 13,699 telephone instruments on order, and 50,913 have been ordered since. Deliveries have been so few that there are still 32,871 telephone instruments undelivered. The value of the material at present on

Forthcoming Exhibitions.—The following exhibitions are being organised:—

LONDON.—September 7th to 28th, Shipping, Engineering and Machinery Exhibition; September and October, Textile Industries Exhibition; October 14th to 22nd, Commercial Motor Exhibition; November 4th to 12th, Passenger Motor Exhibition; November 17th to 25th, Public Works, Roads and Transport Exhibition; March 1st to 25th, 1922, Ideal Homes Exhibition.

GLASGOW.—September 19th to October 8th, Ideal Homes Exhibition; November 1st to 19th, Shipbuilding, Engineering, and Electrical Exhibition.

CANADA (Toronto).—August 27th to September 10th, Canadian National Exhibition.

AUSTRIA (Vienna).—September 11th to 17th, International Fair.

BELGIUM (Liège).—September 11th to 25th, International Machinery, Tools, &c., Exhibition.

CZECHO-SLOVAKIA (Prague).—September 1st to 8th, International Samples Fair.

FRANCE (Lyon).—October 1st to 15th, Metallurgy, Machinery, and Industrial Fair.

HOLLAND (Utrecht).—September 6th to 16th, International Industrial Fair.

ITALY (Naples).—September, Samples Fair.

NORWAY (Christiania).—September 4th to 11th, Norwegian Industries Fair.

POLAND (Lemberg).—September, International Fair.

ROMANIA (Bukarest).—Samples Fair and Rumanian Exhibition.

SPAIN (Barcelona).—September 1st to 10th, International Samples Fair.

TRIESTE.—September 11th to 25th, International Samples Fair.

JAVA (Bandong).—September 9th to October 19th, Netherlands East Indies Fair.

MEXICO.—September, Commercial and Industrial Fair.

Inquiry.—Makers of the "Euco" electric hand lamps are asked for.

Glasgow Ideal Homes Exhibition.—The Ideal Homes Exhibition promoted by the Glasgow Corporation will be opened in the Kelvin Hall, Kelvingrove, on September 19th, and will continue until October 8th. The exhibition will be divided into different classifications, including building materials, furnishings, lighting, heating, labour-saving and cleaning appliances, sanitary appliances, decoration, recreation, foodstuffs (prepared and preserved), and appliances for home nursing. Working exhibits and competitions, including one for amateur photographers, will add to the interest in the exhibition.—*The Times*.

Exploitation of Radium Deposits.—"Lidové Noviny," of Brno, states that an Anglo-Czecho-Slovak company is about to be formed with the object of exploiting the radium deposits near Jachymov, Bohemia. The capital of the company will be 20,000,000 crowns (about £70,000).—*The Times*.

Perth Salaries Dispute.—A stoppage of work at the Corporation electricity works has been averted. Some time ago the staff protested against a new grading arrangement, and notified the electrical engineer that if the original grading was not reverted to they intended to stop work on Thursday last week. A sub-committee, after hearing the assistant general secretary of the E.P.E.A., decided that the present system of grading and pay should be continued until the Town Council could submit the question to the Scottish District Joint Board for the Electricity Supply Industry, for its decision.

The Highland Show.—At the Royal Highland and Agricultural Show at Stirling, last week, there were a number of interesting electrical exhibits, including the "Silent Alamo" electric light and power plant shown in operation. MESSRS. WILLIAM BEARDMORE & CO., LTD., had a small display of typical lines of their manufactures. The exhibits included a 20-h.p. Beardmore oil engine, direct coupled to a dynamo generating lighting energy for the stand.

New French Company.—Among the new companies recently formed in Paris are the Groupement des Compagnies d'Énergie Electrique et d'Éclairage du Nord et de l'Est (94, Rue Saint Lazare), capital 1,000,000 francs; and the Société Union Hydro-Electrique, capital 38,000,000 francs.

Swedish Exports.—The value of the exports of telephone and telegraph apparatus from Sweden increased from 2,600,000 kronen in the first half of 1920 to 8,200,000 kr. in the corresponding period of 1921, and that of electrical machinery from 6,500,000 kr. to 9,400,000 kr. in the same periods respectively.

Price Reduction.—THE BENJAMIN ELECTRIC, LTD., of Tottenham, announce price reductions in respect of various sections of their catalogue.

The International Eight-Hour Day.—Among the conventions adopted at the International Labour Conference, held at Washington in 1919, under the auspices of the International Labour Bureau attached to the League of Nations, were those relating to the limitation of work in industrial establishments to 48 hours per week, the question of unemployment, female and child labour, and night work. It is stated that the only nations which have ratified these conventions are Greece, Czecho-Slovakia, and Rumania! Not even the United States, which inspired the conference at Washington, has fathered its offspring.

New Italian Company.—La Societa Generale di Eletticit  is the name of a new company which has lately been formed in Milan with a capital of 1,000,000 lire.

German Competition in Italy.—Tenders were recently invited in Italy for the supply of hydro-electric plant. A German offer was submitted at 9,622,000 lire, including freight and duty, whereas the lowest Italian tender is stated to have been 12,600,000 lire.

Book Notices.—"Mex Fuel Oil" (210 pp.; 120 figs.). London: George Philip & Son, Ltd. Price 10s. 6d.—The utilisation of oil as fuel in the many directions in which coal is employed has become a question of first-rate importance, and any contribution to the literature of the subject is to be welcomed. This work, which has been produced by the Anglo-Mexican Petroleum Co., Ltd., covers multitudinous applications of oil in the generation of motive power. The first part deals chiefly with production, distribution, and kindred matters. The advantages obtained by the use of oil are then set out, and following this some twenty different kinds of burners are described. The use of oil fuel for naval purposes is given some space, and its application to railway locomotives is dealt with. Chapter VII is devoted to notes on the employment of the fuel in land steam power stations, and the following chapter describes types and uses of oil-fired furnaces. In the course of Chapter IX, which is of considerable length, about 20 heavy oil engines are illustrated and described after some notes on the various classes, such as stationary and marine Diesels and semi-Diesels. In the appendices a great amount of miscellaneous information regarding fuel oil and its employment appears.

"The Henley Telegraph," Vol. I, No. 6 (32 pp.). London: W. T. Henley's Telegraph Works Co., Ltd. Price 6d. net. In the June issue the excellent standard reached previously is maintained, and many articles of interest, both to the firm's staff and to those outside, again appear.

"The Mining Electrical Engineer," Vol. II, No. 10, July, 1921. Manchester: The Association of Mining Electrical Engineers. Price 1s. net.—In this issue are articles on the unwatering of a colliery and an overspeed device for electric winders, as well as notes on new miners' lamps, &c.

The Journal of the South African Institution of Engineers, Vol. XIX, No. 12, July, 1921.—This issue contains the annual report for the 1920-21 session, with a statement of accounts and balance sheet, and the retiring acting president's valedictory address.

Journal of the American Institute of Electrical Engineers, Vol. XL, No. 7, July, 1921 (74 pp.). New York: The Institute. Price \$1.—Including notes on hydro-electric development at Niagara Falls, the magnetic properties of compressed powdered iron, &c.

The Journal of Industrial Welfare, Vol. 3, No. 7, July, 1921 (29 pp.). Price 9d.—The principal article in this issue is "The Enlightened Employer," by Mr. William Graham, LL.B., the Labour M.P. for Central Edinburgh. Miss Lily Dormald contributes an article on canteen service, and there are notes on "Health in the Workshop," works magazines, &c.

For Sale.—F. HUDSON & Co., LTD.—Mr. W. E. Harris, of 88-90, Chancery Lane, London, W.C.2, who was appointed receiver and manager for the debenture holders in February last, has announced to the creditors that the debenture holders, the London Joint City & Midland Bank, Ltd., have now decided to foreclose, and instructions will be given for sale by auction next month, but in the meantime he is open to receive offers for sale by private treaty. Parts of the machinery and stock have been sold for cash.

By direction of the Disposal Board, MESSRS. GEERING AND COLLYER will sell by auction on August 19th at the seaplane shed, Dover, a quantity of machine tools, electric cranes, generating sets, electric motors, &c. For particulars see our advertisement pages to-day.

The Holidays.—The offices and works of MESSRS. WILSON HARTNELL & Co., LTD., of Leeds, are closed for the annual holidays until Monday next, August 8th.

Annual Outings.—On Saturday, July 23rd, THE ELCO ELECTRIC MANUFACTURING CO., LTD., of Bristol, held its annual outing, the staff and employees and a few visitors journeying by charabancs to Minehead. At the dinner, which was served there, Mr. Fifield and Mr. A. C. Wiley, managing director, were the speakers. The latter said that orders for "Elco" manufactures had been recently received from abroad. Sports were engaged in on the Minehead Sports Committee's ground. Tea was partaken of at Greenaleigh Farm on the North Hill, after which Mrs. Fifield presented the sports prizes. Supper was served on the homeward way, at the "Fox and Goose," Brent Knoll.

emphasised by the Town Clerk, and it was stated that the Corporation had been recommended to install a 6,000-kW set and four 25,000-lb. steam boilers. Mr. Blackmore (Stalybridge) calculated that if Accrington obtained the additional electricity from Blackburn at the price quoted by the latter, it would cost Accrington £10,000 a year more than producing it under the present scheme. There was no opposition.

Amesbury.—ELECTRIC LIGHT SCHEME.—Messrs. Edmundsons and the Salisbury Electric Co. have arranged to carry out an electric light scheme for the parish, and to utilise water power from a local mill. Power will be transmitted by overhead wires, and a committee has been formed to secure £2,500, half the capital needed.

Bangor.—LOAN.—The Urban District Council has applied for sanction to borrow £4,630 for the installation of a 100-kW Diesel engine set at the electricity works.

Barrow.—NEGOTIATIONS WITH LARGE CONSUMERS.—At a Town Council meeting on July 25th, the Electricity Committee reported upon the electricity works extensions and proposed new power house. They had considered reports from the electrical engineer and the treasurer, and resolved: "That the deputation appointed by this committee continue their negotiations with Messrs. Vickers, Ltd., with a view to obtaining from them a guarantee of a minimum consumption of electricity in the event of the Corporation purchasing their Cavendish Park Power House, and that the Barrow Hematite Steel Co., Ltd., the Barrow Paper Mills, and other large consumers be approached with a view to securing their custom for an extended number of years."

Brighton.—YEAR'S WORKING.—The statement of accounts of the Corporation electricity undertaking for the year ended March 31st last records a total income of £190,019, as compared with £158,062 in the preceding period. The working expenses totalled £129,719, as against £105,755, leaving a surplus of £60,300 (£52,307). The net financial result, after providing for interest and sinking fund, was a profit of £11,859, as against £13,374 in 1919-20. The number of units sold rose from 11,002,835 to 11,261,408. The plant capacity at the end of the year was 12,500 kW, and the maximum load during the period was 6,236 kW. The amount of coal consumed per unit generated improved from 6.97 lb. to 4.21 lb.

Continental.—FINLAND.—The British Vice-Consul at Wiborg says that the Imatra group of rapids, which constitutes one of the largest water powers in Finland, is capable of giving 150,000 h.p. when fully developed. Very little has been done in this direction up to the present. There is a 1,300-h.p. plant at Linnankoski which is employed upon metal production. There are also other plants at Taimienkoski, Raikelankoski and Imatra; the first two are connected with the wood pulp industry, while the other is a small lighting plant of about 125 h.p. Plans have been drawn up or are projected for the development of a number of other rapids.

ICELAND.—Berlingske Tidende learns from Reykjavik that the new electricity works which have just been opened contain two generators, one developing 1,000 h.p. and the other 500 h.p. These machines are driven by the comparatively small stream of the Ellidaraa, a few kilometres outside the town of Reykjavik. In spite of the cost of the works (nearly Kr. 3,000,000) it has been found possible to supply the town with electricity more cheaply than heretofore. The works can easily be adapted to produce double the power, and it is expected that this extension will soon become necessary. The works at Reykjavik represent but a fraction of the power which could be obtained from the great Icelandic falls. Two water power companies exist on the island at present, one Danish-Icelandic, the other Norwegian-Icelandic.—*Reuter's Trade Service* (Copenhagen)

RUMANIA.—The Financial Times states that arrangements have been completed between the Steaua Romana Co. and the Electricity Supply Co. for the establishment of a new generating station at Baicoi. A company with a capital of 20,000,000 lei is being formed to give effect to the new development. This company, which it is expected will be in working order in the autumn, will supply power for oil wells in the district which require it, and will, it is calculated, prove a great boon to the companies operating both in the Baicoi and Ploesti areas.

RUSSIA.—A Russian paper quotes a decree, signed by Lenin, on the centralisation of electricity in Russia, which affects the various electrical stations and distributing systems, excepting tramways, in order to centralise the management and control which passes into the hands of the Superior Council of Public Economy, which exercises its powers in other parts of Russia than Moscow, through the medium of the local councils. In Moscow all the stations are to be brought under the direct control of one administration.

With regard to provincial electrification, the *Isvestia* says that the Perm Government Union of Councils has appointed a special commission to deal with the electrification of the whole agricultural industry of the Perm Government. A similar step is being taken by the Ughm Government.

In the Yaroslav Government at the central station of the town, the installation of a three-phase turbo-generator, with a capacity of 2,000 kW, is being completed, raising the power of the station to 3,200 kW. A plan is being prepared for the electrification of the whole Government of Yaroslav with a central station of 10,000 kW capacity on the Yaroslav peat-marshes.

LIGHTING AND POWER NOTES.

Accrington.—PROPOSED LOAN.—On July 26th, Col. Elkin held an inquiry into an application of the Corporation for sanction to the borrowing of £150,000 for electricity extensions. It was stated that the debt on the electricity undertaking was £155,835. The importance of the electricity extensions was

The demand for power this year in the district of Nizhni-Novgorod has been about 1,500 kW. To satisfy which, work is proceeding to combine a number of stations which will supply 2,500 kW next year. A similar operation is being undertaken in order to supply the Kolomensk Engineering works with the electricity they require, by joining up several other stations to bring the output up to 3,000 kW.

FRANCE.—As a result of the fall in the price of coal, a reduction in the prices charged by the Compagnie Parisienne de Distribution d'Electricité has been made.

Edinburgh.—**PROPOSED CAPITAL EXPENDITURE.** Capital expenditure amounting to £1,068,000 will be incurred this year by the Corporation electricity department, principally in connection with the new Portobello station.

Erith.—**LOAN.**—The electrical engineer having reported that the cost of the necessary cables, transformers and switchgear in connection with the supply to Messrs. Vickers, Ltd., will be about £10,000, application is being made for sanction to borrow this amount.

Electricity Districts.—**EAST MIDLANDS.**—The Electricity Commissioners give notice that they have extended the time within which objections and representations may be made, or schemes submitted, in connection with the above-named district from the last day of July to October 31st, 1921.

MID-LANCAIRE.—A similar extension of time (until October 31st, 1921) has also been made in the case of the Mid-Lancashire district.

Hoylake.—**NEW SUB-STATION.** After examining a report presented by the electrical engineer, the Electricity Supply Committee of the Hoylake and West Kirby District Council has decided to erect a sub-station at Meols at an approximate cost of £483.

Ipswich.—**YEAR'S WORKING.**—The accounts of the borough electricity undertaking for the year ended March 31st, 1921, show a total income from all sources of £90,854, as compared with £75,311 in the preceding period. The total working expenses were £61,682, as against £51,804, leaving a balance of £29,172 (£23,507). The net result, after payment of all capital charges, &c., was a profit of £7,981, which was transferred to reserve, as against £5,838 in the previous year. The number of units sold increased from 5,812,921, in 1919-20, to 7,174,805.

Joint Electricity Authorities.—**CHESTER AND NORTH WALES.**—The Electricity Commissioners have informed the Electricity Committee of the Chester Corporation that it is preferable for the provisional committee for the North Wales and Chester Electricity District to be constituted locally, and they suggest that the town clerk and the managing director of the North Wales Power & Traction Co., shall issue a joint letter to the parties concerned, and bring about the formation of a committee. Both parties have agreed to the adoption of the recommendation. The Provisional Committee will be constituted of a representative of the North Wales Power & Traction Co., the chairman of the Electricity Committee of each local authority operating under its own Electricity Orders, the district superintendent of the L. & N.W. Rly. Co., the chairman of the North Wales Slate Quarries Association, and the chairman of the North Wales Coal Owners' Association.

Leicester.—**PROPOSED PRICE INCREASE.**—The City Council is asked to sanction an increase of 33½ per cent. in the charges for electricity, making an increase of 133½ per cent. upon pre-war prices. This is necessary to cover a deficiency of £14,540, occasioned by the coal stoppage.

EXTENSIONS.—The Finance Committee has approved the expenditure of £125,000 on transformers, switchgear and cables.

Leek.—**LOAN.**—The Electricity Committee recommends application to the Electricity Commissioners for sanction to borrow £18,500 for the provision of additional plant at the electricity works.

Middlesbrough.—**PROPOSED EXTENSIONS.**—The Electricity Commission has written the Corporation with reference to the Electric Lighting Order of 1898, enclosing formal consent to the extension of the generating station. The Commissioners add that they are of the opinion that the Corporation should negotiate with the Cleveland and Durham County Electric Power Co., with a view to arrangements being made for the company to supply the whole of the energy required by the Corporation for the district. Such an arrangement, they point out, would enable the Corporation to dispose of its steam plant, retaining only the gas engines as stand-by plant. The Commissioners are further of opinion that it would be a mistake on the part of the Corporation to install further plant in its generating station, and, as the demand for electricity in the borough is increasing each year, the Corporation will therefore sooner or later require to arrange with the Power Co., for additional supplies of energy. In these circumstances, the Commissioners suggest that steps should be taken by the Corporation to arrange for further supplies being available from the Company to meet further demands before the existing agreement between the Corporation and the Company expires. The borough electrical engineer says that it would not be in the interest of the department to dispose of the plant as suggested. They had installed to meet the winter peak load 1,500 kW of steam

plant, and to replace this plant by rotary converters would require at least three 700 kW sets. These, complete with switchgear, transformers and cables, &c., would cost approximately £5,000 each, a total of £24,000.

The Corporation has written the Electricity Commissioners pointing out that it has an existing arrangement with the Cleveland and Durham County Electric Power Co. for a period of six years, and that it would be uneconomical to put in rotary converters, and that it does not therefore consider it advisable to dispose of the steam plant.

NEW POWER STATION.—In connection with the development of the north bank of the Tees in the neighbourhood of Middlesbrough and Stockton, the Cleveland & Durham Electric Power Co. is ensuring an adequate supply of power by the erection of a large generating station on a site of about 60 acres. The station is designed for 54,000 h.p., and in the lay-out of the site provision has been made for doubling the capacity.

Northampton.—**PRICE REDUCTION.**—The E.L. & P. Co., Ltd., announces that from the midsummer meter readings the initial price of electricity for power will be reduced by ½d. per unit, and that the additional discount to high-pressure consumers for fully equipping their own transformer chambers will be increased by 6 per cent.

Norwich.—**YEAR'S WORKING.**—The accounts of the city's electricity undertaking for the year ended March, 31st last, record a total revenue of £135,499 as compared with £114,221 in 1919-20. Working expenses amounted to £94,682, as against £71,322, leaving a gross balance of £40,807 (£42,599). After the payment of capital charges the sum of £13,668 was carried to the appropriation account; £20,972 was transferred in the previous year. The number of units sold increased by 4.53 per cent. to 10,943,222. The report states that it will be necessary to install additional boiler plant to meet next winter's load. The erection of a new station has been deferred on account of the depressed state of trade.

Paisley.—**YEAR'S WORKING.**—The total revenue of the burgh electricity department for the past financial year was £86,500 as compared with £64,254 in the preceding year. Working expenses amounted to £51,775, as against £42,699, leaving a gross profit of £34,725 (£21,255). After paying capital charges, &c., a net profit of £7,796 remained. The profit in 1919-20 was £745. This is the second consecutive large increase in net profit as there was a deficit, in 1918-19, of £14,275. The number of units sold during the year was 6,683,088, an increase of 799,113. It was stated at a meeting of the Council that a sum of £5,000 was to be taken from the electricity department's surplus to help to meet a deficiency incurred by the gas department.

Peterborough.—**PROPOSED EXTENSION OF AREA.**—The City Council is considering making an application for an order authorising an extension of the area of supply defined in the Peterborough Electric Lighting Order, 1894. It is proposed to include about twenty additional parishes.

Seaham Harbour.—**OFFER OF SUPPLY.**—The Urban District Council has received a communication from the County of Durham Electrical Power Distribution Co., Ltd., offering to negotiate for the supply of electricity in bulk in the event of the Council carrying out its proposal to apply for Parliamentary powers to provide the area with electricity for lighting and other purposes.

Shrewsbury.—**YEAR'S WORKING.**—The total revenue of the electricity undertaking for the year ended March 31st last, was £20,988, as compared with £16,821 in the previous year. Working expenses amounted to £17,550, as against £12,617, leaving a gross profit of £3,438 (£4,203). The net result was a deficit of £192; there was a net profit of £713 in 1919-20.

South Africa.—**PRETORIA.**—The *South African Mining and Engineering Journal* states that Pretoria has decided to install a new and up-to-date lighting and power plant, costing upwards of £300,000. In accordance with the latest power station practice, a steam pressure of 350 lb. has been adopted, which will ensure very low fuel costs. The power plant will consist of three turbo-alternator sets of 3,000 kW each, the order for which has been placed with the British General Electric Co., Ltd., of Johannesburg. The boiler plant order has been secured by Messrs. Reunert & Lenz for Babcock and Wilcox boilers.

South Shields.—**LOAN SANCTIONED.**—The Electricity Commissioners have sanctioned a loan of £1,890, for boosting plant.

Stoke-on-Trent.—**LOANS.**—Application is being made by the Council for sanction to borrow £200,000 for extensions to the main station previously approved.

The Electricity Commissioners have approved loans of £10,000, for plant at the central station, and £1,400 for building extensions at the Burslem sub-station.

Stafford.—**NEW METHOD OF CHARGING.**—In consequence of a report by a consultant, the Town Council has decided to terminate at the end of the September quarter, the existing methods of charging for electricity and to institute a differential system.

Wolverhampton.—**NEW PLANT.**—The Electricity Committee recommends the provision of an additional 5,000-kW set at the Commercial Road generating station, and the consequent

extension to equipment, alterations to buildings &c., at a total estimated cost (including an amount for contingencies), not exceeding £136,000.

Willesden.—CHARGES ON FUEL BASIS.—At a meeting of the Electricity Committee, the electrical engineer reported that he had agreed with the North Metropolitan Electric Power Supply Company as to the basis to be adopted in calculating the average cost of fuel during the past quarter in view of the circumstances then prevailing, and the substitution of coke and fuel oil for coal. The principle adopted provides for the reduction of coke and fuel oil, in relation to their calorific values, to their equivalent values in tons of coal, and the committee recommends that this method of calculating the amount payable by the Council in respect of fuel during the past quarter be approved.

TRAMWAY AND RAILWAY NOTES.

Australia.—ELECTRIFICATION OF VICTORIAN RAILWAYS.—It is announced that the Victorian Railway Commissioners are about to convert a further 1004 miles of their lines from steam to electric traction and that the work is to be completed by the end of February, 1923. In addition to this electrification, which covers the passenger-carrying routes, a number of lines exclusively used for goods traffic are to be converted and the electric system extended over several of the busier sections of the country lines. This work will entail the overhead wiring and rail bonding of considerably over 100 miles of track, the erection of a number of sub-stations additional to those already in use, the replacement of the existing signalling services, and the construction of several workshops fully equipped with all types of machine tools. It is proposed that Australian materials shall be used to the fullest extent.—*Times Trade Supplement*.

Barnsley.—CHARGING PLANT.—The Town Council has received sanction to a loan of £9,000 for charging plant for the electric collecting vehicles.

Dover.—TIME EXTENSION.—The Light Railway Commissioners have extended the period for carrying out the Dover and St. Margaret's Light Railway Order to October 9th. It is stated that the scheme has been in hand for about twelve years, having been interrupted by the war.

Halifax.—RAILLESS TRACTION REPORT.—The Tramways and Electricity Committee has received from the Director-General, Public Safety and General Purposes Department of the Ministry of Transport, a report by Major A. Mount, R.E., on his inspection of the railless traction route at Vainstalls, authorised by the Halifax Corporation Act, 1915. Attention is drawn to repairs needed in the roadway, and the report suggests that the Corporation will find a good deal more work necessary in the near future if repair charges on the vehicles are to be maintained at an economic level. Attention is drawn also to the fact that at one stretch the road is only from 14 ft. 6 in. to 17 ft. wide, involving passing vehicles using the footpath on the east side, where the property belongs to the Corporation, and it is recommended that the road be widened there to a minimum of 20 ft. The Committee has decided to recommend the Highways and Improvement Committee to carry out these requirements at an early date.

Ipswich.—YEAR'S WORKING.—The total revenue of the Corporation tramways during the year ended March 31st last was £50,341, and working expenses were £51,942, leaving an adverse balance of £1,601. The equivalent figures for the previous year were £47,954, £46,387, and (gross profit) £1,567. The net result, after payment of capital charges, &c., was a deficit of £7,802; last year's deficit amounted to £4,151. The number of car-miles run fell from 667,260 to 652,420, although the number of passengers carried increased slightly.

Japan.—ELEVATED RAILWAY FOR KOBE.—An elevated electric railway, with quadruple lines $7\frac{1}{2}$ miles in length, is being planned for Kobe by the Town Planning Committee of Hyogo Prefecture. In the city proper, beneath the elevated line, a road for vehicles and pedestrians will be built. In the suburbs, embankments and roads will be built parallel to the tracks, and streets varying from 36 to 144 feet wide will be built in all directions from the new track. The rails and other materials for the electric line will be purchased partly in the United States and partly in Europe.—*Reuter's Trade Service* (Kobe).

ELECTRIFICATION OF KOBE RAILWAY.—Orders have been placed with American manufacturers by the Kobe Railway Bureau for 12 electric locomotives at a price of approximately 130,000 yen each, which is from 20,000 to 30,000 yen more than the present steam locomotives are costing the Railway Bureau. These electric locomotives are the first to be ordered in connection with the execution of the plan for electrifying the main line railway between Kobe and Tokio. The first section of the line to be so transformed is that between Akashi and Kyoto. Overhead wires will be erected shortly. The cost of putting up these wires between Osaka and Kobe is estimated at 500,000 yen. The electrification of this section of the rail-

way has been contemplated for some time, but operations have been held in abeyance because of a lack of electricity in this part of the country. This has been remedied, however, and operations will commence at once.—*Reuter's Trade Service* (Osaka).

London.—IMPROVED "UNDERGROUND" ROLLING STOCK.—The Metropolitan Railway Co. has put into service some of the locomotives which are being reconstructed by Messrs. Vickers. These each have four 300-h.p. series-wound traction motors transmitting power to the axles through single reduction gearing and controlled by all-electric automatic multiple units.

North Shields.—ACCIDENT.—A serious accident occurred at North Shields on August 1st. A crowded tramcar was proceeding down Borough Road, a steep incline, and, while rounding a curve, overturned. Five passengers were killed and nine seriously injured; about twenty others also sustained injury. This is the third accident which has occurred at this spot.

Sheffield.—STRIKE AVERTED.—A majority of eight averted a lightning strike of tramway workers on Monday over a dispute which arose about working hours.

TELEGRAPH AND TELEPHONE NOTES.

Brazil.—CHEAP TELEGRAPHIC FACILITIES.—Marconi's Wireless Telegraph Co., Ltd., announces that ordinary and deferred messages can now be accepted for transmission via its trans-Atlantic wireless system to Brazil at rates lower than those charged for transmission by cable.

Italy.—NEW CABLE.—A Bill authorising a concession to lay a cable between Italy, Spain, Brazil, Uruguay, and the Argentine was introduced at Rome on July 23rd.

Russia.—TELEGRAPH CONCESSION.—The *Times* reports that the Russian Soviet Government has granted a concession for telegraphic connection between Russia, Denmark, Japan and China to a Scandinavian company (probably the Great Northern Co., which has been for some time in negotiation with the Russian Government over such a concession).

Sweden.—TELEGRAPH REVENUE.—The Telegraph Board's annual report for 1920 shows an increase in revenue of Kr. 20,000,000, making a total of Kr. 90,000,000. This increase is due to the raised fees, but expenses are also higher. The net profit works out at Kr. 10,500,000.—*Reuter's Trade Service* (Stockholm).

The Telegraph Service.—PRESS MESSAGES.—The Postmaster-General announces that from August 1st, Press telegrams at reduced rates for Belgium, France, Germany, Holland, Norway, and Spain will be accepted at post offices on the usual conditions between the hours of 6 p.m. to 12 noon. Such telegrams for Denmark and Sweden will, on and from the same date, be accepted between 6 p.m. and 11 a.m. The deferred Press service at the rate of 4d. per word was restored on the same date between the U.K. and Australia, New Zealand, and Fiji, "via Imperial and Pacific only."

The Telephone Service.—SELECT COMMITTEE.—The Select Committee appointed by Parliament to inquire into the telephone service concluded its hearing of evidence on July 28th, and agreed to an interim report stating that it had been unable to complete its inquiry, and asked that it should be re-appointed next session. The evidence taken during the 26 meetings of the Committee this session is to be published. The chairman of the Committee (Mr. Evelyn Cecil) accompanied the Committee's expert adviser (Mr. W. W. Cooke) on his visits to Norway, Sweden, and Denmark, where they investigated the systems operated in those countries. They left on July 30th, and Mr. Cooke will afterwards proceed alone to Canada and the U.S.A. The foreign Governments concerned have agreed, through diplomatic channels, that all facilities for investigation shall be given, says the *Financial Times*.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Australia.—MELBOURNE.—Sept. 28th. Victorian Government Railways. Lifting magnet and generating set with control apparatus and accessories. (Contract No. 34,241.)

QUEENSLAND.—P.M.G.'s Department.—November 5th. Bronze wire, Schedule 536. (July 29th.)

Barking.—August 9th. Electric lighting at new Special Subjects Centre. C. J. Dawson, architect, Clock House, Barking.

Belfast.—August 22nd. Electricity Department. One 12,500-kW turbo-alternator, with condensing plant and auxiliaries. Four water-tube boilers, with superheaters and forced-draught fans. Four fuel economisers. Two steel chimneys, with four electrically-driven suction draught fans. One electrically-driven centrifugal pump, capacity 18,000 g.p.m. (July 22nd.)

Bristol.—August 15th. Corporation Electricity Department. One 3,000-kW, single-phase, 36-cycle, 2,200-V turbo-alternator and condensing plant and auxiliaries; one 6,000-kW, three-phase, 50-cycle, 6,600-V ditto. (July 15th.)

Coventry.—September 1st. Electricity Department. Two 10,000-kW, 3-phase turbo-alternators, complete with condensing plant; four water-tube boilers with chimneys, superheaters, mechanical stokers, economisers, and all accessories. (August 29th.)

Edinburgh.—August 29th. Corporation. Open cuttings and tunnel between the power station site and coal sidings site, including the construction of a coal bunker and access, and the earthworks for coal sidings and the laying of permanent way and ballasting for same (Spec. No. 57).—Electrical Engineer, Dewar Place, Edinburgh.

Glasgow.—August 8th. Corporation. Electric lighting installation at Merlands Cattle Wharf, Partick. Burgh Electrical Engineer, 75, Waterloo Street, Glasgow.

London.—L.C.C.—September 5th. H. & L.P. switchgear for sub-station. (See this issue.)

Londonderry.—August 13th. County Council. Electric lighting installation in the County Council Offices in the Courthouse. Mr. T. B. Adams, Secretary to the County Council, County Courthouse, Londonderry.

New Zealand.—WELLINGTON.—November 1st. Public Works Tender Board. One 200/250-h.p. oil engine and one 3-phase, 50-cycle, 190-kW at .8 power factor, alternator, with exciter and switchgear.*

Rawcliffe, near Goole.—August 13th. West Riding Mental Deficiency Act Committee. Overhauling accumulators at Rawcliffe Hall Institution. West Riding Architect, County Hall, Wakefield.

South Africa.—Rand Water Board. September 28th. Contract No. 203. Tenders for supply, delivery, and erection at the Board's Intake Pumping Station, Transvaal Bank of Vaal River at Vereeniging of (1) Two vertical spindle centrifugal pumps, direct-coupled to electric motors, with all accessories, and (2) one 10-ton travelling crane. Also for main pumping station site, Vereeniging, two horizontal spindle centrifugal pumps, direct-coupled to electric motors, with all accessories.*

DURBAN. August 10th. Corporation. Supply and installation of superheaters and motor-driven mechanical stokers to three existing water-tube boilers at the Corporation Power Station, Alice Street, Durban.*

DURBAN. September 28th. Corporation. Two 500-kW rotary converters, switchgear, and automatic controlling devices, also h.p. supply feeders.*

Sale.—Urban District Council. Cables, transformers, switchboards, house meters, and a.c. motors. (See this issue.)

South Africa.—PRETORIA.—October 4th. Electric Light & Power Department. Coal-handling plant, 6,000 V cables, induced draught and ash-handling plant, pumps, piping, &c.—Mr. T. C. Wolley Dod, General Manager, Municipal Electricity Supply, P.O. Box 423, Victoria.

Stockton-on-Tees.—August 31st. District Fund, Gas and Electricity Committees. Articles and stores for six months. (See this issue.)

Uruguay.—September 19th. Board of State Electrical Stations. Generating plant for four electrical groups, consisting of a.c. and d.c. generators, Diesel engines, &c.*

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—Three concerns competed for the recent Belgian Post and Telegraph Department contract for the supply of a quantity of telephonic commutators working in conjunction with a central battery. The lowest quotation was that of the New Antwerp Telephone and Electrical Works Co., of Berghem, Antwerp.

Bury.—Messrs. James Hill & Son have received the contract for installing the electric light in the parish church school.

Glasgow Corporation (Tramways Department). Accepted:

E.H.P. — H. & L.P. Co., Ltd.
V.L.R. cable — Johnson & Co., Ltd.
Lid.; S.R. — Electric Wire Co. and Smiths, Ltd.
D.C. wire — Electric Wire Co. and Smiths, Ltd.
Brake — R. D. L. & Co., Ltd.
Black — R. D. L. & Co., Ltd.
O — Fleming, Birley & Goodall, Ltd.

Grimshy.—Electricity Committee. Accepted:
E.H.P. — Metropolitan-Vickers Electrical Co., Ltd.
Lid.; S.R. — Metropolitan-Vickers Electrical Co., Ltd.

Government Contracts.—The following Government contracts were placed during June, 1921.

AMMUNITION CONTRACT AND PURCHASE DEPARTMENT.

Batteries and spare cells.—Fullers United Electric Works, Ltd.
Ignition cables.—G. E. Taylor & Co., Ltd.
Electric fuses.—L. Weekes, Ltd.
Insulating materials.—Watwater & Sons; Birmingham Mica Co.; Ioco Rubber & Waterproofing Co., Ltd.; Micantite & Insulators Co., Ltd.; J. North, Hardy & Sons; R. Whiffen.
Sheet mica.—Micantite & Insulators Co., Ltd.
Switchgear.—Metropolitan-Vickers Electrical Co., Ltd.
Wireless apparatus, condensers.—Dabbler Condenser Co., Ltd.

WAR OFFICE.

Electric cables.—W. T. Henley's Telegraph Works Co., Ltd.
Ignition cable.—Siemens Bros. & Co., Ltd.
Electric cells.—Ever Ready Co. (Great Britain), Ltd.
Miscellaneous electrical equipment.—Newton Bros., Ltd.
Feeder units (600 K.V.).—Johnson & Phillips, Ltd.

AIR MINISTRY.

Re-erection of batteries.—Hart Accumulator Co., Ltd.
Ignition cable.—Siemens Bros. & Co., Ltd.
Magneto spares.—Lucas Electric Co.
Magneto spares.—E.I.C. Magneto Co., Ltd.
Switchboards.—Erskine, Heap & Co., Ltd.

POST OFFICE.

Protective apparatus.—S. G. Leach & Co., Ltd.; Phoenix Telephone and Electric Works Co., Ltd.; Reed Bros., Engineers, Ltd.; H. W. Sullivan; Western Electric Co., Ltd.
Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.
Telegraph and telephone cable.—Pirelli General Cable Works, Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Compound.—Dussek Bros. & Co., Ltd.
Conduit.—J. McDougall, Ltd.
Ebonite.—North British Rubber Co., Ltd.
Indicator lamps.—A. C. Cross & Co., Ltd.
Laying conduits.—Manchester (High Street area, first section): Chandler Bros., Burdett Road (Baggaley Street, Mile End Road): J. A. Ewart, Ltd., Streatham-Mitcham: G. J. Anderson, Great Yarmouth (H.P.O.).
Fish Wharf Bldg.: R. J. May, Kilmarnock-Hurford: W. Dobson.
Manufacture, supply, drawing-in, and jointing of cable.—London-Uxbridge and Bristol-Newport: W. T. Henley's Telegraph Works Co., Ltd.
Power plants.—Northolt—Medium power wireless station: C. F. Elwell, Ltd.
Subcontractors.—Tudor Accumulator Co., Ltd.; Submersible Motors, Ltd., for motor-generator sets; W. H. Allen, Sons & Co., for oil engine; Allen, West & Co., for switchboard equipment.
Telephone equipment.—Grimshy: Siemens Bros. & Co., Ltd.; Rushmore: Western Electric Co., Ltd.; Northolt: J. A. Ewart, Ltd.; Submersible Motors, Ltd.; Relay Automatic Telephone Co., Ltd. Sub-contractors: D.P. Battery Co., Ltd., for batteries. Penarth: Peel-Conner Telephone Works, Ltd. Sub-contractors: Tudor Accumulator Co., Ltd., for batteries; Crompton & Co., Ltd., for generator charging set.

CROWN AGENTS FOR THE COLONIES.

Cable.—Callenders Cable & Construction Co., Ltd.
Electrical materials.—Callenders Cable & Construction Co., Ltd.
Electric motors and switchgear.—Metropolitan-Vickers Electrical Co., Ltd.
Electric transformers.—English Electric Co., Ltd.
Gram lamps.—General Electric Co., Ltd.
Storage battery.—Fritchett & Gold & Electrical Power Storage Co., Ltd.
Telegraph line material.—Bullers, Ltd.; Siemens Bros. & Co., Ltd.
Telephones.—British L.M. Ericsson Manufacturing Co., Ltd.
Telephone materials.—Western Electric Co., Ltd.
Copper wire.—T. Bolton & Sons, Ltd.; British Insulated & Helsby Cables, Ltd.

H.M. OFFICE OF WORKS.

Engineering services.—Acton Ministry of Pensions. Cable: Pirelli-General Cable Works, Ltd. Electric wiring: J. Clarke & Co., Ltd. Kew, Head Insurance Office.—Switchboard: General Electric Co., Ltd.

London.—L.C.C.—The Council, on the recommendation of the Highways Committee, has accepted the tender of Messrs. Brown, Boveri & Co. for an 8,000-kW turbine in connection with the Greenwich power station extensions; the value of the contract is £45,000. The English firms were asked recently to amend their tenders on the understanding that they could obtain their raw material abroad, and revised tenders were accordingly submitted. It is stated that the difference between the English and Swiss tenders amounted to between £6,000 and £7,000.

Mr. Hirst, of the General Electric Co., Ltd., writing to the *Daily Express*, states that the saving of £7,000 is chimerical, and maintains that the country loses £25,000 by the work going abroad—£15,000 to £18,000 in direct wages to engineering trades and probably another £10,000 in wages spent on raw materials. He says that the only benefit to the British manufacturer will be the prospect of a higher rate of contribution to the unemployment funds.

Stafford.—Town Council.

Supplying and laying 2,700 yards h.p. cable, £3,361.—Siemens Bros. & Co., Ltd.

Electro-division screening apparatus for the Sewage Works, £7,591.—S. S. Stott & Co.

Tramways Committee.

Two ventilated motors, £620.—English Electric Co., Ltd.

Single-deck Leyland motor omnibus, £1,650.—Leyland Motors, Ltd.

St. Marylebone. Recommended:—

Circulating water pipes in connection with the 8,000-kW Orion set, £208.—Davis & Shack, Ltd.
One 10 h.p. oil engine compressor, belt driven, with extended shaft for gearing, £171.—Lacy-Hubert, Ltd.

Salford.—River Irwell Conservancy Committee. Accepted:

Electro-division screening apparatus, Ac., £7,591.—S. S. Stott & Co.

Electrically-propelled Ships.—The electric drive will be a feature of the ss. *Nova Trento*, 3,625 tons, which was launched at Belfast recently by Messrs. Workman, Clark & Co., Ltd., to the order of the Unifruitco Steamship Co., Ltd. The engines, constructed by the British Thomson-Houston Co., Ltd., derive steam from three large cylindrical boilers, supplied and fitted by Workman, Clark & Co.—*Daily Telegraph*.

NOTES.

The "Electrical Review" Index.—The Index to Vol. lxxxviii of the *Electrical Review* is now ready, and will be supplied for 6d. post free on application to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, E.C.4.

Appointments Vacant.—Stocks and stores clerk (£150+) for the Wigan Corporation Tramways and Motors Department; shift officers at the Government wireless station at Abu Zabal, near Cairo (44s. + war bonus, approx. £6 4s. a week). See our advt. pages to-day.

Institution of Electrical Engineers.—MEETING DAYS AND HOURS OF MEETINGS.—The Council has decided that, beginning with next session, the meetings will be held on alternate Thursdays (except at times of public holiday), beginning with the first Thursday in November. The Council has at present under consideration the question whether the meetings should continue to begin at 6 p.m., as has been the case during the last few years, or whether the former hour of 8 p.m. should be reverted to.

Lead-Eating Ants.—Officers of the Australian telephone repair service, seeking a fault which, after the rains, had interfered with 59 telephones on the Young exchange (New South Wales), made the unique discovery of white ants among the wires in an underground cable. A cable buried 18 in. was found to contain a hole the size of a small pea, and indications pointed to the conclusion that white ants had eaten through the lead, causing the leak. When laid down each separate wire was wrapped in paper; the whole of the wires were also wrapped in paper, and encased in lead weighing 7 lb. to the sq. ft. The lead was covered with soft paraffin, and then the whole cable was covered with timber which had been specially treated with arsenic and tar. The paper inside the cable was eaten by white ants. This is believed to be the first occasion upon which white ants have been known to bore through the telephone cables in this State, though a parasite known as "the borer," in Queensland, is said to have often caused similar trouble, and in an article contributed to *The Post Office Electrical Engineers' Journal* in 1913, signed by J. M. C., the initials of Mr. Crawford, State engineer of the Telephone Department, interesting details of other cases are recorded. Mr. Crawford mentions a case in the north where a white ants' nest reached 32 ft. up to the telegraph wires, which they proceeded to enclose, effectively earthing the wire. That the white ant would be able to eat its way through the lead covering of telephone wires was, however, not suspected until a case came to light in Adelaide in 1911. The lead-covered wires were enclosed in an earthenware duct, and it was found that the lead sheathing had been badly eaten away in many places over a distance of 20 ft. The ducts had been laid on a bed of 4 in. of concrete, and both sides and top were protected by concrete 3 in. thick. However, investigation showed that there was a crack in the concrete, and through this crack the ants had apparently worked their way. As the duct was just below the asphalt pavement sufficient heat would penetrate to encourage the ants to multiply. As the termites had been found in more than one manhole, the possibility of other sections of the lead sheathing being similarly pitted necessitated prompt action. The ends of the ducts were sealed with clay, and fumes of carbon bisulphide were pumped through. Even a white ant that lived on a diet of lead could not survive this poison gas. Since then, however, white ants have been found in cable conduit in Perth, and the termites attacked the lead sheathing of a tramway feeder cable enclosed in wood troughing in Sydney.

Why does the white ant like lead as an article of diet? And how does he manage to eat it? The answer to the first question is that it is the white ants' instinct to bore through anything it finds, and the second question is answered in Mr. Crawford's article by the statement of his belief that the termite does not bite the lead at all. It was at first thought that the lead sheathing had been destroyed by the cutting action of the insect's mandibles; but subsequent analysis tended to show that the damage was probably caused by formic acid deposited on the cable sheathing by its operations. One might almost say that the white ant does not bite his lead, but predigests it by sugaring it with formic acid. There is one hopeful aspect of the matter—no white ant will be able to eat the wireless telephone.—*Sun*.

British Engineering Standards Association.—The British Engineering Standards Association held its third annual meeting on July 14th at the Institution of Civil Engineers, when the chairman, Sir Archibald Denny, Bart., presented his annual report and reviewed the position. The meeting was well attended, some 80 members being present, and a number of useful suggestions were made. The accounts, as recently adopted by the main committee, were duly presented and passed, and Messrs. Deloitte, Plender, Griffiths & Co. were re-appointed auditors for the ensuing year. The chairman's address showed that there are now more than 1,500 engineers who give their time and experience to this national work, often at great personal expense and inconvenience. It must, however, be said that the business community is not as impressed as it should be with the commercial value of standardisation, otherwise the Association would not have so much difficulty

each year in raising the comparatively small sum required for this work, which is of such value to the trade and commerce of the country. Last year £15,000 only was expended, of which the industry of the country contributed about £10,000, the remainder being in the nature of grants from H.M. Treasury and the Indian and Dominion Governments.

The Chairman briefly touched on many aspects of the work in its connection both with home and export trade. He emphasised the progress made and the important development in the electrical work. In glancing at the work abroad, he mentioned that there were now eleven local Committees actually at work, continually making valuable suggestions to the Home Committee.

Fatalities.—An inquest was held at Cambridge recently into the death of Daniel Holmes, a G.E.R. wireman. It was stated in evidence that the deceased was replacing telegraph wires and was at the top of a ladder about 20 ft. in height. There was 40 or 50 yards of slack wire on the ground, and this was evidently caught by a moving train, causing Holmes to fall. He was admitted to hospital with fracture of the left leg and right forearm. Septic poisoning affected the leg wound and he died shortly afterwards. A verdict of "Accidental death" was returned, the coroner remarking that no blame attached to the railway company.

On July 26th an inquest was held on Jesse Webb, of Birmingham, who was killed by electric shock. The deceased was employed by the Staveley Coal & Iron Co., and, as he was about to commence work on the day of his death, he came into contact with a fallen cable, receiving a shock at 6,000 volts. The consulting electrical engineer to the company said that the cause of the wire's falling was a faulty insulator causing the wire to fuse and burn through. The insulators were for 11,000-V working. A verdict of "Accidental death" was returned.

A 33,000-volt Cable.—A few weeks ago we published some particulars of a 33,000-volt cable which is being laid at Birmingham. We have now received some information regarding a similar cable which Messrs. Johnson & Phillips, Ltd., are making for the supply of power at 33,000 volts to an important northern steel works. The cable (fig. 1) is designed for a

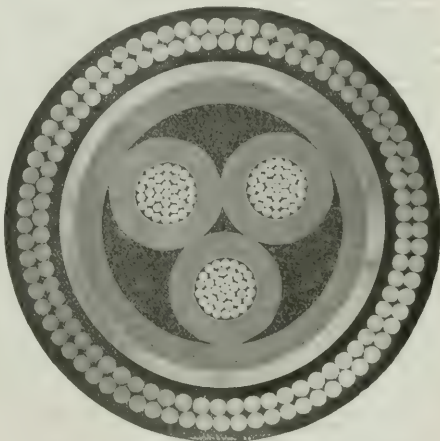


FIG. 1.—A 33,000-V CABLE (about $\frac{1}{2}$ actual size).

3-phase a.c. supply. The conductors are of .2 sq. in. section, the thickness of the paper insulation between cores is .5 in., and between cores and the lead sheath, .5 in. Over the lead is a bedding of compounded jute upon which .16 in. diameter galvanised steel armouring wires are laid. A further layer of jute and another set of wires are then put on, and the whole is finally served with jute yarn and heavily compounded. The weight of the complete cable is 72 lb. per yard.

Ball Lightning in London.—A description of ball lightning seen in the sky at St. John's Wood during the thunderstorm in the early morning of June 26th has recently been received at the Meteorological Office. The phenomenon, a large incandescent mass floating in the air below the clouds, and apparently stationary for some minutes, is of great rarity, and the Director of the Meteorological Office, London, S.W. 7, would be greatly obliged if persons who observed it on this occasion would communicate with him.

U.S. Patents Law.—A Bill has been introduced in the United States Senate requiring foreign patentees to work their inventions in the United States within two years from the date of the issue to them of United States patents. Failure to conform will give the Government the right to license the invention to any person "for manufacture, use, or sale." About 1,200 British inventions are patented in the United States every year. Heretofore no British inventor possessing a United States patent has been required to work it in the States or pay any annual tax upon it during its 17 years' life.

The Federation of British Industries.—The Grand Council held its regular quarterly meeting at Prince's Restaurant, S.W., on July 20th. Sir Peter Rylands occupied the chair, and there was a large gathering of members present. The Fuel Economy Committee presented a report to the Council describing the progress of the scheme since it came into operation in September last. Mr. A. W. Chivers, acting chairman of the Committee, proposed, and Sir Robert Hadfield seconded, the adoption of the report. In the discussion which followed, one or two members raised the question whether this development of the F.B.I. activities might not lead to direct interference with the practice of established consulting engineers, and whether it really came within the normal scope of a body like the Federation.

The President said that this aspect of the question had been considered before the Department was set up. In his view fuel economy was a proper subject to be dealt with by the representatives of industry.

Sir R. Hadfield said the work of the Department was necessary. He felt that if the scheme were given support, it would be to the advantage of industry generally.

The report was unanimously adopted.

During the first six months' operations twenty-five separate inquiries were dealt with—many requiring personal investigation of plant—on behalf of firms consuming over 175,000 tons per annum. It is therefore recommended:—(a) That the activities of the Department should be gradually extended by development on the lines already laid down. (b) That the educational activities of the Department should become a more prominent feature, and the *Fuel Economy Review* should be produced quarterly as part of such development; and (c) As soon as the organisation is on a completely self-supporting basis, any excess revenue should be allocated to development upon lines already indicated.

Scandinavian Power Transmission.—A conference of representatives of Sweden, Norway, and Denmark will be held at Christiania in the third week in August to discuss the question of the proposed transmission of power from Norway to Sweden and Denmark.

Electricity in Medicine.—The so-called new cure for cancer was briefly mentioned during a lecture in the Radiology Section at the final session of the recent meeting of the British Medical Association at Newcastle-on-Tyne. For some time specialists have hoped that they could cure cancer if they could direct certain rays into the particular part of the body and persuade the affected tissues to absorb them. The difficulty was, however, to construct a tube capable of "shooting" such powerful rays without itself collapsing under the bombardment. It is now stated that this point has been largely overcome.

The *Newcastle Daily Chronicle* says that an interesting demonstration of electrical treatment for chronic otorrhoea by zinc ionisation was given at the Electro-Therapeutic Institute, Jesmond, by Dr. Alfred R. Friel, M.A., F.R.C.S.I., aural specialist, Ministry of Pensions (London District), and clinical assistant at the Royal Free Hospital, London. Ionisation is only suitable for specially selected cases of chronic septic conditions of the ear, nose, and throat, and the treatment has proved most beneficial. In the process the zinc solution is electrolysed and by that means penetrates the tissues, the electric current in the case under notice being administered in the ear and passing out of the arm. Dr. Friel expounded in detail what he described as the very simple technique of the apparatus, and with the aid of a boy patient gave a practical exposition of the process. It is mainly an antiseptic procedure, and as a rule causes very little discomfort. In a suitable case, he said, one treatment was sufficient to cure the often-neglected complaint of a running ear, and he instanced a case where one patient had been cured after 20 years' suffering.

A New Theory of Vision.—Prof. J. Joly, of the University of Dublin, has recently proposed a theory of colour vision, says the *Times*. When a ray of light reaches the retina, it sets free "photo-electrons" each of which contains a known quantum of energy determined by the frequency or wavelength of the kind of light to which its liberation is due. The electrons discharged by the red end, where the waves are long, have a small quantum of energy, but there is a continuous increase in the quantum towards the violet end, where the short waves liberate more energetic electrons. "These electrons have an action like the pulling of a trigger on the rods and cones of the retina, releasing a store of energy sufficient to send a stimulus up to the brain. But trigger action is a bit or miss; the energy of the propelled bullet depends on the explosive charge, not on the pull. The rods and cones of the retina are known to be the receptor cells which receive the stimulation of light, and pass it on as a relayed message to the brain. Prof. Joly suggests a function for a known difference in their structure. Each rod is the starting-point of an extremely delicate thread which must be the channel of communication to the brain. Each cone has a stout fibre passing to the brain, possibly consisting of a bundle of fibres, so that what-soever be the quantum of energy in the electron which enters a rod, it can send only one kind of message to the brain. He supposes, therefore, that the rods are the apparatus by which messages of the presence or absence of light are received and transmitted, without distinction as to "colour." But electrons entering the cones can ring up two, three, or four of the fibres, according to their quantum of energy, and so send

different kinds of messages corresponding with different kinds of light. By an elaborate physical argument he shows that quanta of energy would be excited in these proportions by the parts of the spectrum representing the three primary colours, red, green, and blue-violet, of the Young-Helmholtz theory. If he is right, the physical structure of the eye would thus account for the manner in which the sense of vision interprets external objects as displaying sharply marked colours.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

The *Times* states that Mr. EVELYN CECIL, M.P., has left for Bergen, Christiania, Stockholm, and Copenhagen, in connection with the telephone inquiry, accompanied by Mr. W. W. Cook, M.Inst.C.E., the assessor to the Telephone Committee.

Mr. J. W. ROBERTSHAW, foreman of Messrs. W. & D. Wilson, contracting electrical engineers, Bradford, was recently elected from among 40,000 ex-Service men to receive the freedom of the city of Bradford.

Mr. A. S. BLACK, borough electrical engineer of Southport, has been selected by the Electricity Committee of Ipswich Corporation to succeed Mr. F. Ayton as borough electrical engineer there.

Wills.—The late Mr. A. H. KING, a director of Aron Electricity Meter, Ltd., the Aron Taximeter Co., Ltd., and other companies, left £25,741 net personally.

Mr. G. E. TENNANT, a director of Messrs. E. Green & Son, Ltd., left £42,813 gross and £38,952 net personally. £200 is left to the company for the income thereon to be applied to encouraging meritorious work among the staff and work-people.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Tofield & Robinson, Ltd.—Particulars of £8,000 debentures authorised June 17th, 1921: Whole amount issued; charged on company's undertaking and property, present and future, including uncalled capital.

Southern Electric Free Wiring Co., Ltd. (64,550).—Return dated January 14th, 1921. Capital, £5,000 in £1 shares; 1,510 shares taken up and paid for in full. Mortgages and charges: Nil.

Sterling Telephone and Electric Co., Ltd. (101,415).—Return dated April 6th, 1921. Capital, £65,000 in £1 shares (49,650 pref. and 15,350 ord.); 39,500 pref. and 15,350 ord. shares taken up; £24,400 paid; £40,640 considered as paid. Mortgages and charges: Nil.

Shanghai Electric Construction Co., Ltd. (86,795).—Return dated June 14th, 1921. Capital, £400,000 in £10 shares; 36,510 shares taken up; £317,000 paid; £48,100 considered as paid. Mortgages and charges: Nil.

Bath Electric Tramways, Ltd. (74,278).—Return dated May 19th, 1921. Capital, £230,000 in £1 shares (75,000 pref., 125,000 preferred ord., and 30,000 deferred ord.); 75,000 pref., 75,000 preferred ord., and 30,000 deferred ord. shares taken up; £150,600 paid; £30,000 considered as paid. Mortgages and charges: £17,517.

CITY NOTES.

Anglo-Portuguese Telephone Co.
Mr. Herbert Allen (chairman) presided at the annual meeting held on July 26th at Worcester House, E.C. He said that the company had had a serious setback in its fortunes, and for the first time for over 20 years it had to pay as small a dividend as 3 per cent. The year 1920 was one of great disappointments. It was characterised by acute commercial, financial, and political conditions in Portugal; by comparative inelasticity in their business, by a complete collapse of the currency of the country (which recently for exchange purposes had reached only one-tenth of its par value), and arising largely out of this, by an intolerable increase in wages and other working expenses. Innumerable instances could be given of the disastrous effects of the depreciated currency in almost every branch of their business, and when they came to deal with the balance of trading profit there was a disastrous loss on exchange. Another question of outstanding importance was that for all purposes they were entirely in the hands of the Government. They had to put up a hard fight for every concession. Their original tariff of 1901, although nominally in currency was practically on a gold basis, for the milreis or escudo at that time stood at about par. The various increases which they had obtained amounted in the aggregate to close upon 500 per cent., which meant that where they used to get 100 escudos they now got 600. But there was a vast difference—the escudo worth 4s. 6d. and one worth 6d. only, and as between the fall in

the escudo, the rise in their tariff rates in sterling was still only two-thirds of what it was originally. The result was that whilst there was a rise in their receipts from 491,905 escudos to 797,832 escudos, an increase of 60 per cent., there had been an increase of 180 per cent. in their expenses. The expenses went up from 262,848 escudos to 737,074. The result was a trading profit of 60,758 escudos, as against 229,000 escudos in the preceding year, and enabled them to pay a dividend of 3 per cent. There was some small provision for depreciation, but personally he was unable to say whether it fully met the requirements. What the whole situation amounted to, seemingly, was this: For a period of two years their wages had gone up ten to twelvefold, and materials three to fourfold, and any profit they made in currency could only be turned into sterling at about one-tenth its face value. Their only hope seemed to lie in the increased tariff which came into force a few months ago and an improvement in the exchange. So far as the exchange was concerned, there had been a slight recovery, but as to how far that was based on intrinsic value or on reported loans from America, he could not say. Perhaps the most striking feature of the business was the great increase in the expenses. The directors had particularly addressed their engineer on this point, and were assured that it was due to circumstances beyond the control of the company. He could say they were not overstuffed, and he was certain that was so so far as London was concerned. It was a little tantalising to all of them to read of the wave of prosperity on which so many of the telephone companies seemed to be riding, but they were not operating in Portugal, in which respect they were to be congratulated. There was not a single public utility company in that country which at present was paying its way. Railways, tramways, gas and electricity all appeared to be in the same boat, so that their own company was not alone in misfortune, if that was any consolation to the shareholders. The great bugbear was labour, and in most of the services he had mentioned the item of wages absorbed the entire gross income. Perhaps he had said enough about the past and they would like to hear a word or two about the future. Since the opening of the year, when the escudo was 63d., they had had some wide fluctuations in the exchange. They had seen it as low as 43d. and as high as 94d., and the last quotation was something about 74d. In January and for the first few weeks of February they worked under the increased tariff granted in 1920, and since February 21st they had had the benefit of a still higher tariff with wages the same. This should mean that at the present time there was a substantial margin between their revenue and expenses. He spoke with considerable diffidence as to the future, for he had no means personally of forming an opinion which he would care to air in public. He had, however, addressed many inquiries on the subject to the managing director and the technical officers of the company, with the result that some definite figures had been given him as to their trading prospects for the year. He need not trouble them with the details of the estimates, which were based on four separate rates of exchange, viz., 6d., 7d., 8d., and 9d., but he would give the broad conclusions: These were that with the rate of exchange at 6d. they would meet all their charges and have a surplus of about £35,000; at 7d., a surplus of £45,000; at 8d., nearly £60,000; and at 9d., close upon £70,000. He would not offer any opinion on the value of these estimates, but he was assured they had been prepared with the greatest care and on a conservative basis. Mr. Cook went further, and attributed the whole of their trouble (which he believed to be only temporary) to the lapse in the exchange and the interval between the time that the tariffs were increased. They had sufficient accommodation on their switchboards to meet requirements for the next three years, and 4,000 additional subscribers would mean about 80 per cent. of the present business of the company. It was a bitter disappointment to them that after 15 years of prosperous business the fates had turned against them. During those 15 years the lowest dividend they had paid was 6 per cent. in 1918. Once they paid 7½, eight times they had paid 8 per cent., and once 28 per cent. From 1919 they had paid 7 per cent. Thus this was the lowest dividend they had paid in 20 years, and he could only hope that the recovery in their fortunes foreshadowed in the estimates, or a substantial portion of them, would be realised.

Mr. J. E. Kingsbury seconded the motion, and emphasised several of the points in the chairman's speech. The report was adopted without discussion.

Chile Telephone Co., Ltd.

Presiding at the annual meeting, held in London last week, Mr. C. W. PARISH said that owing to the unfavourable exchange, their revenue, collected in Chilean currency, showed a marked shrinkage when converted into sterling, and this adversely influenced the net results. According to the *Times* report, the speaker said that the business purchased in the Antofagasta district last year had been steadily progressing, and was being modernised and extended; and the work of preparing the lines for the new automatic plant about to be erected had been actively continued in Valparaiso. In spite of the set-back in the economic situation, due to stagnation in the nitrate industry and the trade depression throughout the world, Chile was ultimately bound to progress, and the board looked forward to the steady expansion of the company's business. Their concessions had recently been

provisionally renewed for two years, and there was every reason to hope that the Chilean Government would give them such an extension of tenure as would be a sufficient guarantee to justify the directors in asking the shareholders to provide the additional capital required for future developments. In order to enable the company to counteract to some extent the loss on conversion of their currency receipts into sterling, they were arranging to charge a premium on their tariffs from October 1st next until such time as exchange improved to 10d.—a figure which the Government had agreed they were justified in taking as a minimum basis for the dollar. Señor Antonio Huneeus (chairman of the advisory local committee) was present at the meeting, and briefly addressed the shareholders. He believed that the Government would treat the company justly, and, at an early date, renew its concessions on reasonable terms.

Kalgoorlie Electric Tramways, Ltd.

Mr. A. H. P. STONEHAM, presiding at the annual meeting last week, said that the net profits earned before charging depreciation were £8,742, against £7,040 last year. The car mileage had been reduced to 22,592 car miles owing to the heavy running expenses. The new mining development activity at Kalgoorlie had not come up to expectations. Business had been depressed owing to the heavy losses of speculators in the many new companies. It was possible that even now some of the new mines might turn out to be payable. The year had been one of difficulty for the tramways with increased expenses and strikes. The award of the Arbitration Court in regard to back pay did not bring that period of peace to which they looked forward, for as soon as the Arbitration Court granted the miners 16s. a day, the tramway employees applied for an increase to 17s. per day. An award of the local arbitrator had since given the men an increase of 2s. 4d. per day, but the Arbitration Court had reduced it to 1s. 2d., and it remained to be seen what the attitude of the men would be. For the first four months of this year the returns showed a decrease of £4,020 in receipts, and a decrease of £2,066 in operating expenses, the net revenue being £1,266 against £3,230, but for 24 days the tramways were not running.

Yorkshire Electric Power Co.

The directors report that the revenue for the half-year ended June, 1921, shows an increase over the corresponding period in 1920 notwithstanding the set-back caused by the three months' dispute in the coal-mining industry. After payment of interest, the net profits for the three half-years ended June 30th compare as follows:—1919, £19,229; 1920, £30,146; 1921, £28,263. Interim dividends will be paid upon the preference and ordinary shares at the same rate as last year, viz., 3 per cent. for the half-year. The time and thought of the officers of the company have been largely engaged upon the proposals of the Electricity Commissioners for the re-organisation of the area entrusted to the company. A public inquiry has already been held by the Electricity Commissioners at Leeds; a second and possibly a third inquiry is proposed to be held for other portions of the company's area and no decision has yet been announced. These inquiries involve a considerable expenditure of money and an interruption to the regular development of the company's business, but the directors hope that they may result in removing the legislative obstacles which have retarded the development of the company's undertaking. During the half-year considerable extensions have been made to the plant and mains which will enable the company to meet further demands from consumers who have contracted to take supply and will bring increased revenue during the second half of the present year.

Prospectuses.—*Producer Gas Plants, Ltd.*—The list was to close on August 3rd in an issue of 50,000 10 per cent. participating preference shares in this company, which manufactures a portable producer-gas plant, which can be fitted to any standard petrol-driven commercial vehicle without alteration to engine or chassis. The company began experimental work in 1917, but progress was stopped by the war.

British Automobile Traction Co., Ltd.—This Company has been issuing at par 200,000 cumulative 8 per cent. participating preference shares of £1 each. The company has been for many years operating motor omnibuses and motor coaches in various parts of the country. The dividends paid on the issued capital have ranged from 7 per cent. in 1913 to 10 per cent. in 1920, dropping for several years, the lowest being 4 per cent. in 1917. The offices are at the Electrical Federation premises in Kingsway.

Fullers United Electric Works, Ltd.—After deducting £6,678 for loss on realisation of investments and £13,333 for interest on short term notes, the accounts of Fullers United Electric Works for the year ended March 31st, 1921, show a loss of £129,408. £8,642 was brought forward, leaving a debit balance of £121,368. The amount reserved for excess profits duty—namely, £14,000—will not be required, and accordingly the directors propose to use this to provide for the depreciation of plant and machinery, and to apply the balance in writing off the experimental and development expenditure and £4,043 off preliminary expenses. The directors propose (1) to create and issue first mortgage debentures up to £150,000, and (2) to reduce the capital from £500,000 to £378,794 by writing off as lost 16s. per share on the 151,507 issued ordinary shares. —*Financial Times.*

Vickers, Ltd.—The directors announce the following interim dividends for the half-year ended June 30th, 1921:—2½ per cent. on the preferred 5 per cent. stock, less tax; 2½ per cent. on the 5 per cent. preference shares, less tax; and 2½ per cent. on the cumulative preference shares, free of tax. There are still outstanding questions of importance with Government Departments, chiefly the Inland Revenue and Admiralty, but until a settlement has been arrived at the directors are not able to complete the accounts for the year to December 31st, 1920.

Stock Exchange Notices.—Dealings in the following have been specially mentioned by the Committee under Rule 115a:—
Crompton & Co.—£20,000 six per cent. first mortgage debentures (registered), Nos. 1,231 to 1,450 (£1000).
West India & Panama Telegraph Co.—£10,000 five per cent. debentures of £100 each, Nos. 801 to 900.

Hong Kong Tramway Co., Ltd.—Interim dividend on account of 1921, of 1s. per share.

National Boiler & General Insurance Co., Ltd.—Interim dividend of 12s. per share, less tax, on ordinary shares.

Lanarkshire Tramways Co., Ltd.—Interim dividend at 5 per cent. per annum, less tax.

County of London Electric Supply Co., Ltd.—Interim dividend on the ordinary shares for the half-year ended June 30th at the rate of 5 per cent. per annum, less tax.

Electrical Distribution Co. of Yorkshire, Ltd.—Dividend on the ordinary shares for the June half-year at the rate of 6 per cent. per annum, free of tax.

Herbert Morris, Ltd.—Half-yearly dividends on the 6 per cent. (less tax) and 5 per cent. (free of tax) cum. pref. shares are announced.

Hart Accumulator Co., Ltd.—The directors recommend a dividend of 8 per cent., less tax, for 1920. The net profit was £24,022, plus £27,652 brought forward. After paying the dividend, £25,616 is to be carried forward.

Metropolitan Railway Co.—Interim dividend at the rate of 1½ per cent. per annum on the ordinary stock, compared with 1 per cent. in 1920.

STOCKS AND SHARES.

TUESDAY EVENING.

THE quietest season of a quiet Stock Exchange year will be the week in which there fell the August Bank Holiday, and this must prove both excuse and justification for our "dropping into tables." It is inevitable, also, that this week should revive memories of the prices which ruled on the outbreak of war, seven years ago. In drawing up lists of comparative quotations at the present time, it is appropriate, therefore, to include what are available of prices which can still be matched against those of July, 1914. Some of those which would afford the most interesting comparisons do not lend themselves to such treatment, owing to the way in which share-capital has been reorganised and readjusted. However, making what we can of the material at hand, the list of electricity supply shares affords a straightforward group that enables ready comparison:—

Share.	Dec. 31st, 1920.	Now.	Rise or Fall.	July 27th, 1914.
Brompton and Kensington	6	6	—	9½
Charing Cross	32	4	+2	42
Chelsea	34	4	+2	42
City of London	11	1	—	12
County of London	71	3½	+1	71
Kensington	44	1	+1	71
London	24	3½	—	34
Metropolitan	94	9½	—	96
St. James's	24	24	—	24
South London	42	54	—	42
Westminster	10	10	—	10

The Home Railway market is amongst the few departments of the Stock Exchange in which prices have remained comparatively flat over the past seven years. Underground Electric, however, are amongst the stocks which, at times, have risen above their present figures. How they stand now, this is shown in the following table:—

Stock or share.	Dec. 31st, 1920.	Now.	Rise or Fall.	July 27th, 1914.
Central London & Kentish	195	49	—	37
Metropolitan	20	27	—	37
London & North	151	184	8	21
London & North	11	26	+4	31
London & North	6	6	+17	76
London & North	691	771	+17	88

Coming to the market in cable stocks and shares, exact comparison is vitiated in the Eastern issues by the fact that the four chief contractors have passed money by the offer of new stocks at prices that new subscribers a very handsome bonus. It is noteworthy that Marconi (where the capital has been largely increased) stand above their pre-war figure. Our representative list is as follows:—

Stock or share.	Dec. 31st, 1920.	Now.	Rise or Fall.	July 27th, 1914.
Anglo-American Pref.	75½	41	—	108½
Cuba Submarine	7	7½	—	8½
Eastern Extension	17	17	—	12½
Eastern Telegraph	152½	12	—	130
Globe Telegraph Ord.	16	16	—	11
Great Northern	304	23	—	250
Indo-European	80	30	—	82
Marconi	2	2	—	1
United River Plate	54	0	—	6
West India & Panama	1	1	—	1
Western Telegraph	14½	16½	—	13½

Manufacturing shares are difficult of comparison owing to the reasons set out in our first paragraph, and the table must therefore be limited to changes on the year:—

Share.	Dec. 31st, 1920.	Now.	Rise or Fall.	Dec. 31st, 1919.	Rise or Fall.
Babcock & Wilcox	24	24	—	1	—
Brit. Aluminium	14	11½	—	16½	—
Brit. West. Pref.	12	11½	—	15	—
Callenders	14	11½	—	15	—
Elec. Construct.	10	10	—	11	—
Edison Swan	10	10	—	11	—
General Electric	1	1	—	1	—
Crompton	16½	15	—	16	—
Henleys	16	16	—	16	—
India Rubber	1	1	—	1	—
Siemens	1	1	—	1	—
Telegraph Con.	21	20	—	21	—

Brazilian Tractions have fallen about 10 points since the end of last year. Anglo-Argentine 5 per cent. debenture has risen 7. Mexican Utilities proved a very erratic market during the period. Mexican Light & Power First Mortgage bonds at 77½ are 17 points to the good, and Mexico Tramways Firsts at 52½ are 14½ up. Possibly the main feature of the markets dealt with in this weekly survey is the manner in which new issues have been promptly subscribed. Good premiums rule upon most of the stocks and shares offered this year, and the demand is for more stock, owing to the fall of 2 per cent. in the Bank Rate since the year began.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

Share.	Dividend		Price		Yield.
	1919.	1920.	1921.	Rise or Fall.	
Exemption Ordinary	12	12	8	—	210 0 0
Charing Cross Ordinary	7	7	4	—	10 0 0
do. do. 4½ Pref.	4	4	4	—	7 4 0
Chelsea	4	4	4	—	9 4 8
City of London	18	14	1½	—	10 13 4
do. do. 6 per cent. Pref.	8	8	17½	—	9 1 2
County of London	8	8	6	—	9 17 0
do. do. 6 per cent. Pref.	8	8	6	—	7 7 8
Kensington Ordinary	9	9	4	—	10 18 2
London Electric	8	8	2	—	11 10 0
do. do. 6 per cent. Pref.	8	8	2	—	10 19 0
Metropolitan	8	7	3	—	9 13 2
do. 4½ per cent. Pref.	8	8	4	—	7 16 6
St. James's and Pall Mall	12	12	6	—	11 10 0
South London	12	12	7	—	10 13 4
South Metropolitan Pref.	7	7	16½	—	8 12 4
Westminster Ordinary	10	10	8	—	9 6 0

TELEGRAPHS AND TELEPHONES.

Share.	Dec. 31st, 1920.	Now.	Rise or Fall.	July 27th, 1914.
Anglo-Am. Tel. Pref.	6	6	—	7 2 10
do. Def.	11	11	—	8 16 6
Chile Telephone	6	6	—	8 16 6
Cuba Sub. Ord.	7	7	—	8 6 8
Eastern Extension	10	10	—	6 8 0
Eastern Tel. Ord.	10	10	—	6 8 1
Globe Tel. and Tel. Ord.	10	10	—	6 11 6
do. do. Pref.	6	6	—	6 11 6
Great Northern Tel.	23	24	—	10 2 6
Indo-European	10	10	—	6 6 8
Marconi	2	2	—	—
Oriental Telephone Ord.	12	12	—	16 18 8
United R. Plate Tel.	8	8	—	16 18 4
West India and Panama	Nil	Nil	—	Nil.
Western Telegraph	10	10	—	16 1 2

HOME RAILLS.

Share.	Dec. 31st, 1920.	Now.	Rise or Fall.	July 27th, 1914.
Central London Ord. Assented	4	4	—	8 1 8
Metropolitan	12	11	—	5 11 1
do. do. District	Nil	Nil	—	Nil
Underground Electric Ordinary	Nil	Nil	—	Nil
do. do. "A"	Nil	Nil	—	Nil
do. do. Income	4	2	—	6 3 3

FOREIGN TRAMS, & CO.

Share.	Dec. 31st, 1920.	Now.	Rise or Fall.	July 27th, 1914.
Anglo-Arg. Trams, First Pref.	64	124	—	10 0 0
do. do. 2nd Pref.	Nil	54	—	9 11 4
do. do. 5% Deb.	6	6	—	7 16 0
Brazil Tractions	Nil	Nil	—	Nil
British Columbia Elec. Ry. Pfee.	6	6	—	8 12 4
do. do. Preferred	6	6	—	16 18 8
do. do. Deferred	6	6	—	16 18 2
do. do. Deb.	42	42	—	7 2 10
Mexico Trams 5 per cent. Bonds.	Nil	Nil	—	Nil
do. do. 5 per cent. Bonds.	Nil	Nil	—	Nil
Mexican Light Comm.	Nil	Nil	—	Nil
do. Pref.	Nil	Nil	—	Nil
do. 1st Bonds	Nil	Nil	—	Nil

MANUFACTURING COMPANIES.

Share.	Dec. 31st, 1920.	Now.	Rise or Fall.	July 27th, 1914.
Babcock & Wilcox	15	16	—	6 14 8
British Aluminium Ord.	10	10	—	11 18 10
British Insulated Ord.	15	15	—	10 0 0
Callenders	15	15	—	10 8 8
do. 6½ Pref.	64	64	—	7 5 7
Crompton Ord.	10	10	—	13 6 8
Edison-Swan	10	10	—	—
do. do. 5 per cent. Deb.	6	6	—	7 1 1
Electric Construction	10	10	—	12 6 2
English Electric	8	8	—	12 16 6
do. Pref.	6	6	—	8 0 0
Gen. Elec. Pref.	64	64	—	7 13 0
do. Ord.	10	10	—	10 5 4
Henley	15	15	—	10 8 0
do. 4½ Pref.	44	44	—	6 18 6
India-Rubber	10	10	—	8 18 10
Met. Vickers Pref.	10	8	—	8 13 2
Siemens Ord.	20	20	—	16 17 1

* Dividends paid free of Income Tax.

THE ELECTRICAL ENGINEERING TRADE IN SWITZERLAND.

For no less than 15 years prior to the war, the United Kingdom took fifth place in Switzerland's foreign trade. The factors which subsequently disturbed normal relations are described at some length in the report which has recently been issued by the Department of Overseas Trade from the pen of Mr. J. K. Cahill, formerly Commercial Secretary to H.M. Legation, Bern, and now Commercial Counsellor to H.M. Embassy, Paris.

The sound conclusion is drawn that judging even by recent results the Swiss market is worth more attention from the British manufacturer and merchant than it has so far received. A country, although its population be under four millions, whose imports in 1919 and 1920 reached in value $\frac{3}{4}$ and over 4 thousand million francs respectively is important. Of these annual imports manufactured products represented 30 per cent., raw materials 36 per cent., and foodstuffs 34 per cent.

Mr. Cahill criticises British methods of appointing agents. He mentions instances of United Kingdom firms having their Swiss agents in Paris, Hamburg, Cologne, Frankfurt, or Milan.

British products, notably iron and steel goods, enjoy a high reputation in Switzerland, and Mr. Cahill mentions one reason why a good opportunity exists at present to cultivate the market more closely. It is that the Germans are largely out of favour there. Firms which study Swiss requirements and grant liberal credit should profit at this juncture. The new Swiss import tariff, which has been introduced since Mr. Cahill's report was penned, does not hit British goods any more than those of our competitors.

Iron and Steel Trade. The report mentions three special factors which have affected Swiss imports of British iron and steel goods, viz., high prices, the state of the exchanges, high indefinite prices, long or indefinite delivery. For example, there was an exceptionally strong demand for various British steel products required in the Swiss electrotechnical industry (e.g., electrical steel sheets for transformers, steel for turbine blades) which enjoyed and enjoys the greatest prosperity, but requirements could not be met by British makers—in one case in fact only one-fifth part of orders were being supplied. In one or two cases in other Swiss industries the firms which preferred to obtain steel products from England and applied to the English market therefore, were eventually obliged to obtain them from Germany. In the last six months, however, it would seem that, principally owing to the exchange, Belgian, German, French, and Czechoslovakian exporters have been in a position considerably to undersell most British steel and engineering products, which do not happen to be definite British specialities. As regards the latter, Swiss orders are now being fulfilled without difficulty.

Swiss exports of electrical and other machinery showed some remarkable figures in 1920, e.g., dynamos, &c., to Denmark (2½ million francs), Sweden (1 million), Norway (2 millions), Japan (1.1 million); also to Japan hydraulic and wind motors and pumps (2.6 millions), steam engines (2.5 millions), gas and oil engines (1.5 millions), and iron boilers (1.6 millions). Expansion of trade with Spain has taken place, especially in machinery (dynamos, 6 millions; hydraulic and wind motors, 3.2; milling machinery, 2.3; steam engines, 1.3; textile machinery, 1.2).

Water Power. Mr. Cahill gives an interesting statement concerning the outcome of Swiss endeavours to develop her water power—a subject with which readers of the REVIEW are generally familiar. These resources are officially estimated to contain a capacity of four million horse-power. One-fourth of this power is obtainable from her rivers, and the remainder from the lakes and streams in her mountains. At the beginning of 1921 a total of 171 works (of over 500 h.p.) had been erected or were in process of erection, whilst 190 works (of over 1,000 h.p.) had received, or had applied for, the necessary authorisation for construction. The following table supplies certain important data with regard to both groups:—

	Works built or building (of over 500 h.p.).	Works (of over 1,000 h.p.) for which authorisation received or applied for.
Number of works	171	190
Utilisable accumulation (in cubic metres)	447,790,070	2,467,681,000
Minimum power (net)	388,359	1,352,550
Maximum power (net)	1,587,770	4,527,100
Annual energy production in million kWh	352,186	10,986
Accumulation energy capacity in million kWh	315,030	1,877,339

Among the power stations already built, or building, are five with from 60,000 to 68,000 h.p.; one of 52,000; one of 48,600; three of 45,000; one of 42,000; one of 40,800; and ten of from 20,000 to 32,600; among the projected stations are fifteen of from 60,000 to 200,000, and eleven more of 50,000 to 55,000. There are now 18 large (i.e., from 20,000 to 72,000 h.p.) power stations in operation, and the sole obstacle to the

rapid execution of the bulk of the numerous schemes is the dearth of capital. At the present time about 25 per cent. of the estimated water-power resources of Switzerland have been turned to account; on January 1st, 1914, the power utilised was officially estimated at approximately 500,000 (or 12½ per cent.); at the beginning of 1920 there were in course of construction eight works with a total capacity of 400,000 h.p.

The linking up of the principal power stations, so as to provide mutual assistance and compensation in case of dearth or abundance of water power, has recently received serious consideration.

Last year the Swiss Power Transfer Co. (Schweizerische Kraftübertragung A.G.) was formed for the purpose of remedying the inequalities in power production (through shortage or irregularity of water supply) or distribution (through irregularities in demand, whether seasonal or daily). The majority of the works in Central and North-East Switzerland have become members of the concern, and it is hoped that those in French Switzerland also will shortly participate. Energy is already being distributed in many cases over distances up to 100 miles in Switzerland; in emergencies or in the event of unusual strain assistance is immediately obtainable from one or more stations by a system of telephonic control. Energy is also exported to Germany, France, and Italy under Federal licence.

Railway Electrification.

It may be again noted here that the Federal Railways have built or are building their own power stations. One reason generally given for this action is that the current of normal stations is generated as 3-phase, 50 cycles, whereas railway experience in Switzerland finds the single-phase, 16 cycle current is more suitable. At the present time, however, non-railway power stations also supply the railways.

The report closes with the following concise summary of the progress attained at the end of January last in the electrification of the Swiss Federal railways:—

I. Sections whose electrification is completed:

	Km.
Since 1906, Brigue-Iselle	22
Since July, 1918, Brigue-Sion	52
Since July, 1918, Berne-Scherzigen	32
Since Dec., 1920, Erstfeld-Biasca	90

I. Total ... 196 km. 6.9%

II. Section whose electrification is in course of execution:

Date when electrification is expected to be completed:

May, 1921, Biasca-Bellinzona	20
Jan., 1922, Bellinzona-Chiasso	55
Jan., 1922, Erstfeld-Lucerne	60
Jan., 1922, Goldau-Zoug	16
Jan., 1922, Immensee-Rotkreuz	8
Jan., 1923, Zoug-Zurich	29
Jan., 1923, Lucerne-Zoug	28
Jan., 1923, Sion-Lausanne	92

II. Total ... 308 km. 10.8%

III. Sections whose electrification will follow on above:

By July, 1923, Lucerne-Olten	56
By July, 1924, Olten-Basle	39
By July, 1924, Lausanne-Vallorbe	46

III. Total ... 141 km. 5.0%

SUM TOTAL ... 645 km. 22.7%

Total length of the Swiss Federal Railway System ... 2,843 km. 100%

Employers and Leadership.—Mr. William Graham, M.P. for Central Edinburgh, writing in the *Journal of Industrial Welfare*, is of opinion that there is substantial ground for the statement that the extremist suggestions which were true of the war period in industry and of the days immediately following the armistice, are being steadily discarded by the groups of workers to whom for a time they apparently appealed. In the midst of crisis there is recognition of the fact that only by strictly constitutional methods are far-reaching changes of a beneficial nature possible in industry and commerce. This being the case, it is exceedingly important that British employers should not lose so great an opportunity. There are many problems in which their leadership would be invaluable. Questions of working hours, wasteful methods, improved machinery, scientific management, and payment by results would be received far more favourably by the workers if it were shown that there is no system which does not lay down a minimum, that there is no reason why rate-fixing should not be a joint operation of employer and employee, and that even in a collectivist state, efficient methods would be essential to the popular welfare.

THE ENGINEERING CONFERENCE, 1921.

(Continued from page 130.)

Mechanical Advantages of Electric Locomotives compared with Steam Engines.

By Sir V. L. R. RAVEN, K.B.E., M.Inst.C.E. (Abstract.)

The mechanical limitations and disadvantages which exist in the steam locomotive and which are overcome to a very considerable extent by the adoption of electric traction may be briefly summarized as follows:—

The locomotive being a complete independent unit, its power cannot be greater than the capacity of its boiler. To increase the boiler capacity implies increased dimensions and weight, both of which offer grave difficulties with regard to clearances and strengthening of bridge structures. On many railways in Britain the limit of weight has been reached, and further development of power is only possible at enormous expense.

The boiler, cylinders, valve gear, crankshafts, and all reciprocating parts are costly to maintain. Turntables, fuelling plant, and water supply appliances must be provided. The cab is small and open to the weather, involving discomfort to the locomotive crew. The locomotive radiates heat and uses coal during many hours when it is doing no work, and the wear and tear of the locomotive on the track is considerably increased by the impossibility of accurately balancing the reciprocating parts.

The case for the electric locomotive may be set out by the brief statement that it is not hampered by any of the above-mentioned objections. In addition, it possesses other important qualifications such as:—

Simplicity of mechanical construction and operation. Increased power of acceleration. Higher scheduled speed due to the possibility of heavy short-period overloads resulting in more frequent service and increased use of existing tracks. Uniform turning effort resulting in better factor of adhesion at starting and on gradients.

Absence of all reciprocating movement and accurate balance of all rotating parts. Facilities for driving from either end of a locomotive. Accessibility of mechanical and electrical parts. Better accommodation for locomotive crew by reason of increased cab area and by closing in and heating the cab. Possibility of coupling two or more locomotives together under the control of a single driver.

The production of energy in a power station rather than on the locomotive leads to a very substantial economy of fuel. On a steam locomotive fitted with all modern improvements, it is not practicable to work at less than about 2½ lb. of best quality coal per b.h.p.-hour, and very few engines are capable of doing this for any length of time; the average consumption is more like 3½ lb. per b.h.p.-hour for passenger engines, and 5 lb. for goods engines.

With electric locomotives, whether passenger or goods, it is possible to reduce the consumption of fuel to 1½ lb. per hour, or even less, of low quality coal per b.h.p. produced on the locomotives. In other words, electrification enables the fuel consumption to be reduced to one-half or one-third, the fuel employed being of a quality unsuitable for steam locomotives.

Experience with regard to the cost of repairs of electric locomotives working between Shildon and Newport, shows that this cost is approximately one-third that of maintaining the steam locomotives which worked this traffic previous to 1915. The difference in America is much greater, as Mr. Armstrong, chairman of the Electrification Committee of the General Electric Co., shows the cost of repairs per mile of three American railways varying from 6.3 to 14.6 cents, as compared with a cost of 60 cents per mile for a 2-8-2 Mallet steam engine, which is the class of engine that would have to be used to haul a similar train to that taken by the electric locomotive, the cost of repairs of which is 14.6 cents, or one-fourth that of the steam engine.

The following methods of driving are used:—

(a) Motor with reduction gear is the widely used method of transmitting the torque to the driving wheels; it is the ordinary double bogie articulated type, is widely used for freight traffic, and is the same as that used on the Shildon-Newport electrification, North-Eastern Railway, and others in the States and on the Continent.

(b) Quill drive secures all the advantages of a flexible gear in cushioning the transmission of torque, and lessens the vibration more effectively than the usual flexible gear construction and mounting. This drive is employed on the geared locomotives of the New York, New Haven, and Hartford Railway, also on the Chicago, Milwaukee & St. Paul line. Advantages of the quill drive are: (1) The driving wheels are large. (2) The centre of gravity of the locomotive is high. (3) The dead weight on the track is reduced to a minimum, consisting only of the wheels and axles, without the addition of any portion of the motors.

(c) Gearless motor as used on the Chicago, Milwaukee and St. Paul and the New York Central Railways, and are giving every satisfaction. The advantages claimed for this design are: Simplicity of electric motor owing to the absence of motor bearings and gear. Facility for examination of motor and removal of armature for repairs if required. The

mechanical arrangement of the complete locomotive is said to possess the required flexibility and balance to enable it to run at any speed equally well in either direction without tendency to oscillate or spread the track.

(d) The principal advantage of the connecting-rod drive is that the exact position of the motor in relation to the driving wheels is at the disposal of the designer, and he is therefore free from the restrictions imposed upon him by the necessity for getting the motors into the space between the flanges of a pair of wheels, and is, therefore, enabled to use large motors and place them in the most convenient position in the locomotive. This method of driving has not been employed at all in this country, except for experimental purposes. In the United States there are a few examples, but on the Continent the connecting-rod drive is almost universal. Up to the present electrification in these countries has been carried out mainly on the single phase or 3-phase system, and Continental engineers consider that the additional complications caused by the introduction of cranks and coupling rods are more than compensated for by the advantage of having a free hand with the motor design. A large number of designs have been worked out. Some have proved quite satisfactory, others have given rise to a good deal of trouble. In most cases the trouble has been eliminated by strengthening up special parts such as crankpins, Scotch yokes, &c., and by introducing a certain amount of flexibility into the connections between the motors and the crankshafts.

DISCUSSION.

Sir Vincent Raven's paper was discussed jointly by Sections VII and III on July 1st, Capt. H. Riall Sankey being in the chair.

Sir JOHN ASPINALL, in opening the discussion, said they had yet to learn which was the best type of electric locomotive for main line use, and he could not view with satisfaction the prospect of adopting the Continental design in which rotary motion was converted into reciprocating motion, and the latter was converted again into rotary motion; some form of direct drive through gear wheels was wanted. They must not expect to obtain results too rapidly; until all steam engines had gone they would not see the full advantage of electrical operation. He paid little attention to comparisons of coal consumptions; the figure to watch was the average consumption on the whole of the railways of the country. He looked forward to the use of electric locomotives on all the main lines of the country, and hoped to see one electric locomotive running from Aberdeen to Dover without a change. The problem of lubrication would need much attention, because engines would make long runs without a change, and it was essential that they should get the utmost mileage out of a locomotive before having to send it into the shops for repairs. The motors, &c., should be kept as high up in the cab as possible, above the bogies, dust, and dirt. Development had been retarded by the uncertainty about which system to adopt, but the Electric Railway Advisory Committee had recommended, and the Minister of Transport had approved, that there should be a uniform d.c. 1,500-V system with a third rail throughout the country.

Sir P. NASH was of the opinion that, while the advantages and economies of electric traction were striking and could not be ignored by the railway companies, at the same time wholesale electrification was neither desirable nor practicable. The time had come for serious deliberation before undertaking the conversion of main lines from steam to electrical operation. The electric locomotive had considerable advantages over the steam engine for the haulage of heavy loads, and it should be particularly useful in shunting yards by reason of its low stand-by charges. Experiments had indicated that 73 per cent. of a shunting engine's time was lost; it was standing for 43 and running for 57 per cent. of its time, but it only did useful work during 23 per cent. of its time. For yards which were not electrified a battery locomotive or tender would be applicable.

Mr. C. H. MERZ explained that railway electrification had been delayed by the heavy capital expenditure it involved. Nevertheless, he was strongly of opinion that that would be compensated for by the economies that would thereby be brought about, i.e., the saving in coal alone would be enough to pay for the electrification and, therefore, efficiency was of real importance. The great advantage of electric locomotives was that they were continuously available for service; they would run long distances, and for long periods, without needing to be overhauled. The delay in this country was due to the uncertainty about which system to adopt, but that had now been settled. While they had not yet reached finality there was certain standard equipment which could be adopted without fear with regard to financial or other results. At present the electric locomotive was a perfectly practicable machine, and he hoped railway engineers would not wait till they had produced a perfect machine before making a start, because it was only by experience with a variety of types over long distances that any great degree of perfection could be reached. The control equipment was not, however, what it might be; it was not creditable to electrical engineers and compared badly with the simple single-lever control of the steam engine.

Sir PHILIP DAWSON pointed out that the author being a steam man, his advocacy of electric traction was all the more significant. He agreed that in a good many instances electrification could be undertaken now; nevertheless, Sir John Aspinall's vision of electric locomotives running from Aberdeen to Dover without change was optimistic. At the present time electric locomotives were by no means standardised, and he failed to appreciate the reason for introducing into them the difficulties that had been experienced with steam engines, i.e., those involved by the use of connecting rods, the conversion of rotary into reciprocating motion, &c. Undoubtedly there was a great opening for electric locomotives in shunting yards where at present there was an enormous waste of time and money.

Mr. R. T. SMITH explained that the international limits of industrial motors would have to be largely exceeded in the case of traction motors on account of the limited space into which the latter motors had to be placed. A traction motor should embody the latest advances made in the design of industrial motors, and for that reason they should be purchased in the open market, not built by the railway companies themselves. The locomotive industry of this country had been hampered by the railway companies building their own engines, with the result that British firms had no incentive to take up the manufacture of either steam or electric locomotives. Had the policy been different, he believed England would have made an equal position in the world in locomotive building as it had done in shipping. He hoped the same thing would not happen with regard to electric locomotives.

Mr. J. DALZIEL said that a comparison of the tractive effort curves was strikingly in favour of the electric locomotive, and regeneration provided mechanical advantages which were greater than the electrical disadvantages. The Midland Railway was specially interested in the development of electric locomotives, because it had heavier gradients on its line than any other railway. The quill drive was good, and would suffice for the largest locomotives that would be needed in England. He regretted the possibility of the third-rail system becoming standardised in this country, because he believed overhead equipment could be put up at certainly no greater cost, it was specially suitable for sidings, and was the only means whereby a continuous system could be obtained so far as the equipment was concerned.

Sir HENRY FOWLER was convinced that main lines would be electrified considerably as soon as the financial position permitted, the reason being perfectly clear, namely, a higher efficiency could be obtained with electric than with steam trac-

tion. Some engineers had been frightened by the weight of electric locomotives that were used in the U.S.A., and it was true that a good part of the system might be put out of action by a breakdown at the generating station, but, generally speaking, finance was the deciding factor, for, however ingeniously steam locomotive engineers might go to work, they could never surpass the great fuel economies that were obtainable in a central power station. He would like to see the gearless type of locomotive adopted.

Sir PHILIP NASH could not allow it to be assumed that the third-rail system had been standardised by the Ministry of Transport. The fact was that the Electric Railway Advisory Committee had standardised direct current as being most suitable for this country, and it had suggested a pressure of 1,500 volts. The committee had not standardised—and it did not propose to standardise—the third-rail system for all purposes.

Lieut.-Col. F. A. CORTEZ LEIGH thought that so long as shunting engines stood for 40 per cent. of their time, it was obvious that a large field existed for the use of electric locomotives. The latter engines had been known to run for ten days with hardly any attention at all, whereas he doubted whether a steam engine spent more than one-third of its twenty-four hours in actual running. Messrs. Armstrong had constructed a steam turbo-electric locomotive, which would shortly be on trial, which was expected to show very real economies.

Sir VINCENT RAVEN, in reply to the discussion, explained that financial and economical considerations led him to believe in electric traction. Wages could not be reduced, but costs must be, and electric traction would assist them to do so, for they could cover the same mileage with 30 per cent. less locomotives, and so reduce both skilled and unskilled labour, and not consume any fuel when the engines were not doing useful work. They would have to do something of that sort if they intended to pay any dividends at all in the future. He fully appreciated Mr. Roger Smith's point, but his company had built its own electric locomotives for the simple reason that it could not purchase them anywhere outside. The necessary speed could not be got out of a single reduction gear. A steam engine could not be driven "all out," and its boiler needed careful nursing, whereas an electric locomotive could be driven for all it was worth, and on reaching the top of the gradient it was still as good as ever. They could build an electric locomotive 100 per cent. better than the present steam ones, and yet run it on the same permanent way.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

ANNUAL MEETING.

(Continued from page 164.)

Steam Raising.

By DAVID WILSON, O.B.E., A.M.I.E.E.

(Abstract)

The author divided his paper into three sections: "The Past, Present, and Future," and appealed for an endeavour to be made to put aside all self-interest and form an unbiased opinion of the true position; he well knows that progress in boiler design has been to a certain extent stifled by camouflaged reports. With all the experience available it should be possible for power station engineers to reach common ground on the more important points of boiler design and operation, and clear this ground for a real and effective advance, and a bureau of information should be established which would investigate differences of opinion and establish some definite lead. The contractor has to legislate for all, and owing to the lack of agreement on essentials, it is difficult to produce a standard boiler.

Efficiency.—It is necessary to consider efficiency in two sections: (1) Test efficiency, (2) operating efficiency. Regarding No. 1, it is established to the satisfaction of the author that when using a high-grade coal on a modern boiler constructed with a suitable proportion of heating and recuperating surface, a combined efficiency of boiler, stoker, superheater, and economiser equal to 85 per cent. of the net calorific value of the fuel can be obtained on test. Apparently quite reliable tests are on record showing an even higher efficiency.

Regarding No. 2, the big difference between test efficiency and operating efficiency is much greater than it need be, and the day is fast approaching when operating efficiency will approximate very closely to test conditions.

Load factor, with its resultant loss in "banked" fires, &c., is a serious difficulty, but we are perhaps inclined to attribute too big a drop in efficiency to poor load factor. With a good-quality free-burning coal it is quite possible to work boilers at very light loads and obtain high efficiency.

The good results obtained on test are not so much due to any expert knowledge possessed by the man in charge, as to the fact that he has facilities for maintaining absolute control over combustion. It means different staff arrangements and expenditure on instruments, but there can be no question as

to the commercial possibilities in this direction, and there is already sufficient evidence from America, where college graduates are now employed in some stations in place of firemen, to show that it will pay to completely alter the status of the boiler house staff and supply all the scientific gear necessary.

With high-grade free-burning coal the results mentioned above are easily obtainable, but with low-grade coal they present difficulty.

Hence the selection and grading of coal should receive the utmost consideration from the station engineer.

Furnaces.—Furnace efficiency is the dominating factor at the present time. Hand-fired furnaces are still used, and when using high-grade low-volatile coal the furnace efficiency is not much less than in the case of mechanical stokers, but for bituminous coal mechanical firing is essential. Improvement in design of mechanical stokers has been such that they will burn practically any class of coal due to the more general application of "balanced draught," which is not a distinctive system, but simply means the intelligent use of forced draught. It means that with a given pressure under the grate the suction draught is reduced to the minimum amount necessary to lift the gases of combustion through the boiler flues—so that there is practically a balance in the furnace—the forced draught overcoming the resistance of the grate and firebed and completing combustion in the furnace. Whilst on the modern boiler there is no advantage in forced draught when using coal of average quality, it is often a necessity when burning very low-grade coals.

Regarding the best type of mechanical stoker to adopt, variable opinion is very often much more due to difference in conditions than to difference in design, and the variations in the coal are in turn due more to physical characteristics than to any difference in proximate analysis.

Concerning the talk about maximum combustion per square foot of grate, what we have to decide is the economical limit in this direction, irrespective of design—the range of fuel being a very important point, in view of the fact that engineers often now specify a stoker which will efficiently consume a variety of coals from coke breeze to the highly bituminous.

Maintenance costs go up in some proportion to the consump-

1000 per square foot of grate. There is a limit to the maximum amount you can burn per square foot of grate, and if you make stronger or reduced size for such high consumptions, at least that probably you have to run the plant under forced conditions, leaving little margin for "boosting" in case of emergency. Again, it is very difficult to control efficiency at high rates of combustion. The station engineer should buy heating surface and grate area, but his specification requires very serious consideration, as engineers too often suggest conditions which never arise, and to meet such conditions the contractor will put forward plant which is not best suited for the average conditions. The engineer should have some fairly close idea as to the most suitable class of coal available for his station before deciding on grate area, and in order to cover different qualities of coal, it would be better to consider coal consumption on a basis of the B.t.u.'s liberated per sq. ft. of grate, rather than on the basis of lb. per sq. ft., and a figure of 50,000 B.t.u.'s per sq. ft. should be taken as a maximum for normal duty.

Modern boilers in this country are designed with sufficient combustion space for mechanical firing. The most prominent combustion expert in America does not attach very much importance to increased cubic capacity of furnaces, but attaches some importance to increased height. In reverberatory furnaces the height need not be so great as in the case of a hand-fired or other archless furnace.

It is difficult to imagine that any appreciable gain in efficiency will arise from adopting higher combustion chambers. The American Bureau of Mines determined, when burning Pocahontas, Pittsburg, and Illinois coals, that the combustion space worked out at 3.2, 3.9, and 5.8 cu. ft. of space per sq. ft. of grate respectively, when burning 40 lb. of coal per sq. ft. of grate per hour, which is equivalent to 12.5, 10.2, and 6.9 lb. per cu. ft. respectively. In the modern boilers installed in this country the combustion space under the tubes, excluding the combustion chamber proper under the arch, works out at about 6.1 cu. ft. of space per sq. ft. of grate area, and with a reasonable consumption of 25 lb. of coal per sq. ft. of grate, the consumption is 4 lb. of coal per cu. ft. of combustion space under the tubes.

Liquid Fuel.—The three main systems used for burning oil fuel are those in which (1) steam is used as a spraying or atomising agent; (2) air is used for this purpose; (3) the oil is atomised mechanically by pressure.

In practice, the first and third systems are those most generally adopted, the first on account of the greater simplicity of arrangement, and the last on account of its higher efficiency and greater applicability to higher rates of evaporation. Most burners designed to use steam will work equally well with air. The compressed air system is not more frequently used on account of the initial expense entailed in the installation of air compressors. Steam is frequently adopted on account of the low first cost of the equipment, and of its ready application to small furnaces. However, it is not an economical system from the output point of view, as usually about 5 per cent. of the steam produced from the boiler has to be used in atomising the oil, and this, in most cases, means a heavy cost for the make-up feed water. The actual efficiency obtainable with the steam burner is considerably lower than that obtained with compressed air, as a considerable amount of latent heat is wasted when steam is used. It is not suitable for large and important installations because of its want of efficiency and economy.

At present the system which takes the lead is that in which centrifugal force is the spraying agent, by delivering the oil through suitable orifices at a high velocity. This system is the most economical in actual working, and gives the highest efficiency of any, but its first cost is somewhat high, as it involves pressure pumps, heating the oil, and also filters are required to prevent any foreign matter choking the small orifices in the burners. There is no waste of feed water, and, as there is a closed circuit, oils can be used which are heavy and which cannot be dealt with in any other way, owing to the greater temperature to which the oil can be heated in a closed system.

Comparing the use of oil and coal is not purely a question of price per ton and the corresponding calorific values, as there is a considerable reduction in the cost of handling the fuel, and there are no ashes or clinkers to be carried away. Further, it is possible to work boilers at higher rates—that is, more steam per square foot of heating surface—with oil than with coal, although in relation to this point the draught conditions have to be most carefully watched in the design of the plant. Another important point is that the boilers are not so much overworked as when coal is used.

Of course, there are not here there might be advantages in converting at least a few boilers from coal to purely oil firing, as with an oil-fired boiler peak loads can be met with ease, and in view of the possible reduction in the price of oil and its certainty of supply and constant quality, it is felt that the use of oil is a commercial saving.

Pulverised Fuel.—Seven systems have been tried in the past, and the subject must certainly be kept open for consideration, but it will be some time before we can form a really definite opinion as to the value of pulverised fuel for our power stations.

At the present time, however, to such an extent that many coals hitherto considered as refuse can now be used efficiently, and from a unit thermal efficiency point of view, it

is not clear how it is going to pay to dry and pulverise high-grade coal, but the overall operating daily efficiency may be higher with pulverised fuel, owing to its lexterity; it should be possible to reduce standing losses, and it may be easier for the fireman to control combustion with varying grades of coal.

Size of Boilers.—The size of boiler has very little effect on unit thermal efficiency—in fact it is easier to control maximum efficiency on a boiler of moderate size than on one of the super-boilers now manufactured—and the selection of very large units is influenced chiefly by capital cost considerations and the possible improvement in overall daily working efficiency due to the reduction in the number of units and consequent lower radiation losses.

Steam Pressure.—In this direction Britain is ahead of America; 250 lb. pressure is quite common—several boilers are working at 350 lb., and at one installation boilers are now working at 475 lb. There is no difficulty in constructing boilers for any pressure likely to be demanded by the turbine contractor, and high pressures have little effect on the efficiency or operation of boilers. The evidence so far collected is that the maintenance on boilers of 350 lb. is no greater than on boilers of less pressure.

With first-class construction safety is not a matter of pressure, but of the general design of the whole plant.

Boiler Rating.—There is no difficulty in constructing boilers to work at high rating, but on account of increased maintenance charges American engineers are showing a decided tendency to lower the rating. It is quite misleading to talk of rating based on lb. of water evaporated per sq. ft. of heating surface, as this factor is influenced by different steam pressures and superheat, &c.; we must consider boiler rating on the heat transmission basis, and so put all comparisons on a common basis irrespective of different working conditions. The limit of the average rate of heat transmission through the heating surface of a water-tube boiler has not been arrived at, the practical difficulty of burning the fuel being reached long before there is any detrimental effect on the heating surface.

Air Heaters.—These are receiving a good deal of attention, but they are not going to make, by themselves, any serious reduction on the 7½ million tons of coal used per annum by the electric power and lighting undertakings. There is very little, if any, reliable data on air heaters to indicate their real value, but by next year we may be in a position to give final judgment. The author is strongly of opinion that so far as boiler unit thermal efficiency is concerned, the air heater in lieu of a water economiser will not be a success.

Surplus and Waste Heat.—In future there will be considerable utilisation of surplus and waste heat for central power station work. This covers the supply of surplus gas from coke ovens and blast furnaces. In the Newcastle district the gas is brought some distance, and is burnt under water-tube boilers with an average efficiency for boiler, superheater, and economiser of about 79 per cent.

The Future.—The literal to-morrow indicates much more efficient results if scientific control of boiler plant is fully recognised and undertaken—not merely the buying of a few gauges, but the allocation of the best brains to the boiler house and orderly design. The margin between the best possible results and what may ultimately be obtained is very small. Final gas temperatures can now be reduced to a very low figure, and whilst further reduction is theoretically possible by, say, the adoption of a secondary economiser constructed of some material not liable to corrosion resulting from low temperatures and extended use of air heaters, capital cost considerations and other difficulties may prove that it is not worth the candle. Furnace design will continue to improve, and we shall be able to efficiently tackle any fuel which policy may decree to be the best from a national point of view.

On the day after to-morrow it may be forbidden to use raw coal for steam raising, and steps must be taken to recover the by-products before using the carbon residue. There is no difficulty in designing furnaces to utilise coke fuel, and many are in use to-day. Hot coke may even be discharged direct to the boiler furnaces, and experiments are being already started in this direction.

Boiler pressures may advance still further if turbine contractors call for it. Boilers are being constructed in this country for 1,000 lb. pressure now, but these are for process work abroad, and do not include drums in the ordinary sense of the term—the most difficult section to manufacture in large sizes. Superheat is not likely to advance much beyond the present maximum of 750 deg. F. final temperature. It is not expedient to subject the steel of which the superheater is constructed to higher temperatures.

In the future some effort will be made to obtain coal of at least more uniform quality, if not higher average quality, and station engineers should bring pressure to bear in this direction. With better coal selection, perfect supervision on the boiler house, complete equipment of all apparatus for controlling combustion, and the further possible small improvements in design, we can foresee the bulk of our electricity being generated at an efficiency of 18 per cent. instead of the present miserable average of about 10 per cent., but beyond that our vision fails so far as the steam generating plant as we know it to-day is concerned. As we scan the horizon we do not see anything which would suggest the dawn of any very radical departure in boiler design.

Boiler House Practice.

By W. M. MILES, A.I.Mech.E., F.C.S.

(Abstract.)

In the States and on the Continent attempts have been made with more or less success to purchase coal on a calorific contents basis, but consumers in this country have not fully realised the importance of this matter. The author holds that the usual method of selecting the most suitable fuel cannot be termed adequate, and even when a contract has been drawn up on a selected sample, the steps taken to ensure that subsequent deliveries are of equal quality are in many cases inefficient. Special attention is given to the subject of coal sizes, and in addition to the proximate or ultimate analysis, it is essential that the weights of each size should be given as a percentage, and all the slate should be picked out and also given as a percentage of the total weight of coal as shown in the original paper. Provided shale and slate are absent, the quality of coal deteriorates as the size diminishes, the greatest variation being with unashed fuel, which, in the very small sizes, becomes more or less useless as a free burning coal.

Could a reasonable basis be established on analysis, size and suitability, between supplier and consumer, there is no doubt that a definite step towards economical generation of steam will have been accomplished. A standard method of analysis, taking calorific values, size of sieves for sampling, &c., should be drawn up.

There has been no general attempt to establish a penalised system of purchasing fuel in this country. The author has found the following method very suitable in this direction. In determining the net B.th.u.'s per penny, the calorific value of the coal as fired is multiplied by 2,240, and the product is divided by the contract price in pence per ton, plus one penny for each one per cent. of ash present.

For example, take a coal specified to contain six per cent. of moisture, seven per cent. of ash; B.th.u.'s dry, 13,000, and as fired, 12,220, price 25s. per ton delivered. Then one penny will purchase $(12,220 \times 2,240) / (300 \text{ plus } 7)$ equals 89,162 B.th.u.'s.

After finding the standard value in net B.th.u.'s per penny, future deliveries can be checked and allowed for as follows: Multiply the calorific value as fired by 2,240 and divide the product by the net B.th.u.'s standard, and from the quotient subtract one penny for each one per cent. of ash found to nearest unit. Assume that in future deliveries the calorific value as received was 11,900 and 12,500, and the ash 8% and 5.8% respectively, then the relative value of the coal would be as follows:—

- (a) $(11,900 \times 2,240) / 89,162 = 8.0 - 2.90 = 5.10$
 (b) $(12,500 \times 2,240) / 89,162 = 5.8 = 3.14 - 6 = 2.5$

The point aimed at is that the number of heat units purchased for one penny should always be the same.

The sampling and storage of coal, firebricks and refractories, feed-water treatment, corrosion in boilers, and condenser leakage are all dealt with briefly to indicate the best lines along which to work, and the author, being a Fellow of the Chemical Society, lays special stress upon the importance of providing sufficient instruments for testing purposes in the boiler house. He next takes up the subject of boiler-house management, and explains that during the recent coal economy campaign he gave a series of lectures to the firemen and firewomen employed in the various boiler houses, which led to an increase in the boiler efficiency, which averaged at the commencement 68.01 per cent. and gradually increased to between 73 and 74 per cent.

In America, special courses in fuel technology and practical firing are arranged for men who intend to take up this trade. Efficient results from these men should receive reasonable recognition.

To obtain and maintain efficiency it is essential to have reliable instruments, and also men trained to record their indications in a proper manner, and the author advocates the drawing up of standard sheets of requirements for tests.

With high-grade fuel, under normal working conditions, boiler efficiencies of 75% should easily be obtained, and where suitable instruments are installed and expert supervision given, possibly 77.5% for the combined efficiency of boiler and economiser without the effect of load factor being taken into consideration. Under test conditions efficiencies of from 80% to 83% varying with the grade of coal should not be hard to obtain, but if 82.5% is taken as standard when using high-grade fuel, the efficiency during normal running conditions with a good load factor should not be less than 77.5%, and with a poor load factor 75%. Comparatively good results can also be obtained by using inferior grades of coal under supervision, but as the losses in the ash and exit gases are greater than with high-grade fuel, a combined efficiency of 80% must be regarded as a satisfactory test figure. Too much must not be expected of the operating engineer, who already has his hands full. Investigations necessary for effecting any improvement should be undertaken by the staff of the testing department.

Provision should also be made, either by marine telegraph or other suitable system, for interpreting the various changes of load and plant in the engine room to the boiler house staff. A board showing maximum load in kilowatts, number of boilers steaming and banking, average kilowatts per boiler, &c., should be kept fully posted in the boiler house, to enable the engineer to give definite instructions.

The author has not put forward any opinion regarding different types of boilers, stokers, &c., but has confined his

remarks to definite methods of effecting economy and efficiency in boiler-house working, and he gives many valuable practical hints.

Discussion.

Messrs. Wilson's and Miles's papers were read and discussed jointly on the second day of the meeting, when a hearty welcome to the home of the "Mechanics" was offered to the Association by Mr. W. H. PATELL, vice-president of the Institution of Mechanical Engineers, who opened the discussion by advocating the use of large boilers. They received too many reports, and were afraid to speak the truth, whereas in the U.S.A. the working records were published week by week. He agreed with Mr. Wilson's remarks about power factor, but they must have large boilers which could be efficiently controlled. Heavy ash needed forced draught, and that encouraged air leakage in the boiler setting. Some of the latest American boilers had very large combustion chambers, and their lower drums were 21 or 22 ft. above the floor line. It was important to differentiate between the height of a combustion chamber and its mere radiation capacity; they must provide plenty of space so that complete combustion could take place before the gases reached the tubes. The amount of combustion per sq. ft. of grate area per hour was not taken into account in the U.S.A. The Ford Co.'s Ladd boilers stood 35 ft. above the floor line, and burned pulverised fuel, tar, oil, coke or blast-furnace gas; but, generally speaking, it was best to keep to one kind of fuel because the many variables prevented the best results being obtained with all. Harm would be done by burning oil in boilers which were not suitable for it. Pulverising plant required an enormous amount of space, but in some cases in the U.S.A. local grinders were placed above the boilers; the fuel was also highly explosive. Higher pressures seemed to be coming, but they would limit the size of boilers; it was time they adopted a uniform boiler test. Regarding Mr. Miles's paper, fusibility of the ash was the real thing, and small coals were not broken up large coal. It would do coal merchants much good if they would read the paper.

Mr. R. A. CHATTOCK explained that he had been driven to burn oil at Birmingham to aid the poor coal which they had had to use, and which had reduced the boiler capacity by about one-third. The burners consumed about 100 gals. of oil per hour, but they damped down the poor coal, and it became difficult to ignite it. He then had small burners fitted on either side of the grate, consuming about 15 gals. per hour, so as to maintain incandescence and allow the poor coal to ignite. That example of the use of liquid fuel in an emergency might possibly be developed later on in cases where there was plenty of boiler capacity. The analysis of the fuel was of importance, because if there was more than 2 per cent. of sulphur in the oil, it would have a bad effect on the outside of the tubes. The use of oil in ordinary boiler settings might not do, as an ample combustion chamber was necessary to allow all the oil to burn before the gases reached the tubes.

Mr. S. E. FEDDEN pointed out that at Sheffield they ran at a boiler efficiency of from 73 to 75 per cent., including banked fires and week-ends. Automatic control apparatus cost money and needed skilled attention. Although at Sheffield it had paid, it would not always do to strain after the last degree of efficiency if coal became cheaper. As regarded pulverised fuel, trouble might be experienced by reason of the fine dust that was discharged from the chimney, although in France it had been suggested to him that such dust was beneficial as a fertiliser. So far he had only been able to ascertain that the saving resulting from the use of pulverised fuel was 1.44 per cent. as against mechanical stokers, a small enough figure compared with the large capital expenditure involved in installing crushing and drying plant. He welcomed Mr. Wilson's warning about high total temperatures because from the point of view of the materials it was unsafe to go too high. Regarding Mr. Miles's paper, half their troubles would vanish if they could buy coal and not dirt. It was a crying shame that coal was the only commodity that could not be purchased on quality, and the Association should be powerful enough to influence the coal owners. During the miners' strike he had used all sorts of rubbish, including coke dust and poor outcrop coal mixed with tar, at a cost of between £15,000 and £20,000 more than would otherwise have been the case, whilst the demand on his plant was halved. Oil could be burnt quite well in an ordinary furnace if the grate was covered with fire bricks, and the latter could be quickly removed when changing back to coal.

Mr. W. B. WOODHOUSE, in referring to the purchase of coal by specification and on a heat unit basis, said it was worth while to look at the subject from the coal owners' point of view. They were not buying a manufactured article, and if anything beyond a certain seam, size, and ash content was specified, the owners would have to safeguard themselves by increasing the price. One per cent. of ash meant a loss of 2 per cent. of the heat value in the coal; as the coal became smaller, the ash content increased up to a point, and then decreased as the coal became smaller still. He agreed that the fusibility of the ash was the important thing, and lamented the horrible practice of transporting dirt about the country.

Mr. W. M. SELVEY endorsed what the previous speaker had said, and thought that the purchase of coal on a calorific value basis could not be enforced because of the knowledge, from the result of research, that coal was not a permanent substance; it was always oxidising and changing. Perhaps, how-

ever, the I.M.E.A. could try and arrange with the coal owners for fuel to be supplied in, say, three grades, to be known as power-station smalls, good washed, and good unwashed. Small coal was not big coal broken up; it was inferior and was cut from under the seam to facilitate the extraction of coal proper. The control of the boiler house was becoming so important that it was necessary to train men specially for it. He was not impressed with powdered fuel as a general solution of their difficulties.

Mr. EVANS read some notes prepared by his managing director (Mr. Wood, of the Underfeed Stoker Co.), which pointed out that efficiencies of 85 per cent. had been exceeded; they were obtained now, but unknown to the operators of the plant. It did not follow, however, that a combination which gave high results under special test conditions would give the best results under ordinary working conditions, and in the hands of the ordinary operating staff. Therefore, their aim should be to provide equipment that would give the highest possible results under ordinary working conditions. Mr. Evans added on his own account that trouble was experienced in America from chimney dust; it might be of some value as a fertiliser, but he thought they could not use pulverised fuel in a residential area without encountering serious snags. The burning of coke breeze (made possible in London by the flexibility of mechanical stokers) and low-grade fuels generally would make a very great difference to the whole system of boiler-house economy.

Major URRING dealt with the subject of forced and balanced draught, showing that the maintenance of a correct balance was essential, but it was not always realised what that condition was. So far as the available scanty information went, it was difficult to justify the use of air heating on commercial grounds, because so much depended on the layout and design of other parts of the station than the boiler house. There was no need to dispute the author's figures, but at what cost would they be obtained? Could the use of heated air be advocated seriously? The direct saving resulting from air heating (between 4.7 and 5.2 per cent., as shown in a recent paper by Mr. Patchell) was not enough to guide them in the adoption or otherwise of the method. Combustion when pulverised fuel was used was assisted, however, by heated air.

Baillie SMITH referred to the nuisance caused by chimney dust in the neighbourhood of plant burning pulverised fuel, and suggested that before engineers adopted new methods they should consider what their effects would be outside the generating stations. Why could not the dust be collected by means of electrical precipitation or some other method?

Mr. C. SMITH said that the largest boilers in the world were now being erected in Paris; they were French made, and produced 132,000 lb. of steam per hour; the furnace capacity was roughly double that of the large Detroit boilers. The largest single-ended boilers had been constructed in England, and were now being shipped to the Shanghai municipal electricity works; they would burn Chinese slack dust, a very low-grade fuel.

Mr. WINDLE explained that engineers understood, but committee members did not, that small stations did not receive the amount of skilled attention that large ones did. It was, therefore, all the more necessary to provide gauges and recording instruments; at Doncaster last year an expenditure of £300 on instruments had enabled a saving of about 1,900 tons of coal, representing £3,000, to be made.

Mr. MITCHELL was of the opinion that boiler-house instruments were justified, and boiler makers had erred in the past in not being in a position to advise their clients which were the best instruments to use. The Dalmarnock, Glasgow, boilers compared very favourably as regarded combustion space with large modern American boilers. Large combustion chambers helped to eliminate smoke, but little could be done in that direction in many of the Glasgow stations because the combustion chambers were much too small and the fuel varied so much. Glasgow drew its coal from 75 different collieries, and he had paid 2s. 6d. per ton extra for washed coal. It was questionable whether that expense was justified, but he thought it was. Large boilers gave better satisfaction in every way, and mechanical soot-blowers could be dispensed with in modern stations. Oil fuel had not been successful in many cases during the coal miners' strike because the conversion had been made in a hurried manner, and local heating resulted. He had used steam-flow meters for many years, and had found their accuracy good.

The authors replied briefly to some of the points raised, but reserved their full replies to the discussion for publication in the *Proceedings of the Association*.

(To be concluded.)

Gravesend Tunnel.—Mr. Alexander Richardson, M.P. for the division, arranged for the Minister of Transport to receive a deputation of local authorities with regard to the Gravesend tunnel scheme. The scheme is being supported by numerous firms along the line of the proposed connecting railway. The London Chamber of Commerce has the matter under consideration in committee, while the Baltic and the Port of London Authority have granted their approval of the construction of the tunnel. *The Times*.

ELECTRICITY IN FACTORIES.

REPORT OF H.M. ELECTRICAL INSPECTOR.

THE annual report of the Chief Inspector of Factories and Workshops for the year 1920 was issued last week.* The use of electricity in factories is reported on by Mr. G. Scott Ram, M.I.E.E., who records that the number of accidents reported during the year (334, of which 25 were fatal) was practically identical with that of the previous year; 18 out of the 25 fatal cases were due to shock from a.c. at low pressures, which is entirely in accordance with the experience of previous years. Although in most of these cases the systems were 3-phase, up to 440 volts between phases (the neutral point being earthed), the pressure of the shock would not exceed about 250 volts, as the contact was with one phase only, the victim being in connection with earth. In three of the cases the shocks were from lighting circuits taken from one phase and the neutral. The one fatality from d.c. at low pressure was not a case of electric shock, but was due to burns from an arc caused by a short-circuit at a switchboard. Of 20 high-pressure (2,000 volts to 11,000 volts) accidents reported, it is remarkable that only four had fatal results. The injuries in a number of the others were, however, very severe, some involving permanent incapacity. In 16 of the cases (11 of them in public supply stations) the injured persons were engaged in cleaning or other work on switchboards. Six were due to mistakes in switching, the sections of the switchboards on which work was to be done having been supposed to have been made dead. In five, work was deliberately undertaken close to unscreened conductors known to be live; one was due to a faulty arrangement of an interlocking device, and others were due to carelessness or forgetfulness.

The low and medium-pressure accidents were due to the usual varied causes, e.g., non-earthing of metal work (four fatalities), handling of fuses of the non-protected type (two fatalities), contact with bare conductors, including trolley wires of cranes and furnace chargers (six fatalities). Many were due to faulty types of apparatus or inadequate protection and others to carelessness or ignorance on the part of the injured persons. Some accidents involving several fatalities were indirectly due to electricity, i.e., failure of crane control and lifting magnets and the bursting of emery wheels of portable motor-driven grinders, due to excessive speed caused by failure of the shunt winding of the field circuit of the motor.

Amongst the "dangerous occurrences" reported, i.e., accidents to plant not causing personal injury, were several breakdowns of turbo-generators. In one case both the turbine and generator of a 6,000-kW set were completely wrecked.

During his visits Mr. Ram found, as usual, numerous examples of bad work, such as have proved fruitful sources of accidents in the past.

Amongst the public supply generating stations visited were several which have been in operation for from 20 to 30 years and which have always been in an unsatisfactory condition. Badly located and badly designed in the first instance, without due regard to probable developments, when extensions of plant have become imperative, they have been put in from time to time without adequate extensions of buildings, thereby being unduly cramped. Old and out-of-date switchgear remains in use with extension panels added in inconvenient places, some at a distance from the original switchboards at which there was no room for extension and blocking access to other plant. The various cables are mixed up in a hopeless tangle. High pressure has been added in some, the switchgear being placed in most unsuitable positions. The plant is neglected, and everything is very dirty, with steam joints blowing. Naturally these stations are running at a loss, and they are very unsatisfactory from the safety point of view, and it has been difficult to get even small improvements carried out. The answer has been either that there is no money available or that it would be useless to spend money on patchwork improvements, seeing that a large scheme of alterations is in contemplation or even that it is expected shortly to substitute a new station. In one case the new station has been "in contemplation" for over 12 years, but appears to be as far from realisation as ever. It is to be hoped that under the new electricity supply schemes such stations as these will be scrapped and made into up-to-date sub-stations taking a bulk supply from elsewhere.

During the year Mr. Ram had the assistance of Mr. Lowe in the N.E. Division for the greater part of his time, and he has accomplished much useful work. The following are some extracts from Mr. Lowe's report:—

"Inspections during the past year throughout the division have revealed how great a contrast there is in the quality and safety of electrical plant in different works; much very poor and slovenly work is still being installed. In some cases it has been a question of cost, but not in all, and probably in the majority of cases lack of thought and care in the initial planning, and want of careful supervision and inspection during execution, are responsible. Frequently where the highest grade and most expensive apparatus has been purchased, the lay-out has been badly conceived and poorly executed, resulting in inefficient, inconvenient and dangerous plant. Among electrical contractors the requirements of the regulations still appear to be far from well known, and much

* H.M. Stationery Office, Kingsway, W.C. 2. Cmd. 1403; price 1s. 6d. net.

electrical plant which does not comply with the requirements of the regulations is being installed at the present time.

"Many firms, which have changed from steam driving to electrical driving, have placed their electrical plant in the sole charge of promoted millwrights and engine tenters, and appear to have implicit faith in the knowledge and judgment of such men regarding electrical matters, and allow them to carry out alterations and extensions. Although such men may be qualified to carry out routine operation duties, they have not the knowledge necessary for the detection and rectification of faults.

"As time passes it is easy to note the improvements, as regards reliability and safety, which are being effected in the use of electricity for different purposes. During the last year most excellent arrangements for the use of temporary electric lighting on board ships in course of construction have been noted.

Other inspectors have also done useful electrical work so far as their ordinary duties have permitted, notably Mr. Topham in the N.W. Division, Mr. Law (Sheffield), Mr. Lauder (Newcastle), and Mr. Bennett (Stockton).

Referring to Mr. Lowe's observations on unqualified persons being in charge of important installations, this practice is by no means uncommon. At a large engineering works which Mr. Ram recently visited in Scotland, and where over two hundred motors of various sizes up to 50 h.p. were in use on a 440-volt 3-phase supply, no electrical engineer was employed. The manager stated that he "did not believe in electricians," as he had tried them and found that they "really had nothing to do and were always messing about with the plant." Repairs, of course, had to be sent out. There was strong evidence in this case of the need of a proper electrical staff; in fact, the visit was paid on account of an accident which proved to have been due to the want of skilled supervision.

With regard to the practice of applying artificial respiration in cases of electric shock where the victim is rendered unconscious, there is still much ignorance on the matter on the part not only of factory employes and occupiers, but also of ambulance men and doctors who are called in. The importance of commencing the treatment at once and keeping it up for at least two hours, if the patient does not recover before that time, is not generally realised. During the year there were several cases where it was applied very soon after the accident and proved successful. In two cases of shock from 6,600-volt systems the patients came round in 20 minutes and two minutes respectively; in a 3,000-volt case, in 20 minutes; in a 2,000-volt case, in three minutes; in a 250-volt case, in 10 minutes. On the other hand, amongst the fatal cases, artificial respiration was continued in one case for over two hours, and in two others for over an hour unavailingly. In these cases, however, it was not commenced until several minutes after the accident. In some other cases it was continued for over half an hour. In three cases it was applied for less than half an hour "until the doctor arrived," and pronounced the patient dead, thus showing that the doctors in these cases were not aware of the necessity for continued efforts. In two cases no attempt was made to revive the victim, although one of them occurred in a large shipyard where an ambulance department was provided and one of the ambulance men was on the spot shortly after the accident. In order to bring the importance of this matter to the notice of the medical profession, a memorandum on the subject was issued by the Department in April and sent to all lecturers on forensic medicine in medical schools.

During the year nine prosecutions under Section 136, for breaches of the regulations, were taken. Two cases were dismissed and in others penalties varying up to £50 were imposed.

LEGAL.

J. HOLBROOK & Co. v. COURT.

In the Mayor's and City of London Court, on July 26th, before Judge Jackson, a test case was tried in which plaintiffs, electrical engineers, 1, Foster Lane, Cheapside, E.C., claimed £69 3s. against Mr. H. J. Court, purveyor of meat and fish dealer, Whyteleaf, Surrey, for installing the electric light at his fish depot, butcher's shop, &c.

Mr. R. J. Sutcliffe appeared for the plaintiffs and Mr. Pocock for the defendant.

Mr. SUTCLIFFE said that the defence was that to induce the defendant to give the order, plaintiffs' representative, Martin, warranted that they had made the necessary arrangements with the Electric Supply Co. to put the cables in the road, and that they would be laid down within two or three weeks. Defendant gave the order on the faith of that representation which he said plaintiffs' representative fraudulently or recklessly made, and he had lost the whole value of the work. He counter-claimed for the sum claimed and £10 damages for the misrepresentation. Plaintiffs' case was that defendant gave the order for installing the electric light, and the work was done. Plaintiffs did not represent that the supply company would put in the mains either in two or three weeks or any definite time. Plaintiffs agreed to wire the defendant's fish depot for £9 15s., the butcher's shop for £24, the refrigerator and sausage-making machine, &c. The work was com-

pleted and plaintiffs did their best to get the supply company to supply energy to the village, but that had not yet been done. That was no reason why they should not be paid their account.

Defendant said that the plaintiffs' services were useless to him as the supply was not yet in the village because plaintiffs never got 15 consumers as arranged. Plaintiffs said three backed out.

The further hearing was adjourned until after the long vacation, Judge Jackson suggesting that the parties had better settle the case in the meantime. Plaintiffs' work might yet be very useful.

BROOKS-VOS v. PURDEN, LTD.

In the King's Bench Division on July 30th, Mr. Justice Bailhache had before him for further consideration an action in which Mr. Eugene Cornelius Brooks-Vos, of 147, Corporation Street, Birmingham, sued Charles Purden, Ltd., machinery and machine tools makers, of Lancaster Street, Birmingham, for the price of certain electric motors sold and delivered to the defendants. The case was partly heard at Birmingham Assizes in March. It appeared that defendants had refused to complete the contract or take further instalments of the goods on the ground that they were not of the horse power specified in the contract, and this was the main point at issue. His Lordship referred the matter to an expert, who now reported in the plaintiff's favour.

His LORDSHIP, in giving judgment, said the goods had been wrongly returned by the defendant. The plaintiff would have judgment for the price of the instalment delivered, £573, but on the issue as to damages he found no damage had been suffered by the refusal of the defendant to take the balance of the contract quantity, and defendants would have the costs of that issue. The counter-claim would be dismissed.

HAZELL v. L.C.C.

In the King's Bench Division on July 29th, Mr. Justice Bailhache heard this action, in which the plaintiff, a railway carman, sued for damages for personal injuries sustained in an accident at St. George's Circus, S.E. According to the plaintiff's case, while he was in charge of his van a tramcar belonging to the L.C.C., which had just been levered off a dead portion of the track, began running backwards, the controller having been left on, and the plaintiff suffered an injury to his foot.

Counsel for the L.C.C. took a point under Section 3 of the Public Authorities Protection Act, providing that in actions against public authorities arising out of matters done in the execution of their duty, proceedings must be begun within six months of the occurrence complained of. In this case, it was stated, the plaintiff was out of time in issuing his writ. Counsel, however, said that no doubt any representation of the Judge would be conveyed to the L.C.C., whose legal advisers, however, were bound to take the point.

Counsel for the plaintiff said he admitted the difficulty. His clients did not know the L.C.C. was relying on the point.

His LORDSHIP said he thought the L.C.C. would be acting fairly if it allowed the plaintiff £120 in respect of his injury. He must, however, enter judgment for the L.C.C., with costs.

OBTAINING LAMPS BY FALSE PRETENCES.

At Bradford, on Friday last, James Edward Tatham (35), an electrician, was given six months' hard labour for obtaining by false pretences 183 electric lamps, twelve switches, and a "Plexim" iron, valued in total at £42, the property of Mr. J. Dyson, electrical engineer, Bradford. It was stated that the prisoner went to Mr. Dyson, on various dates, and obtained the goods, saying they were for Mr. C. F. Metcalf, electrical engineer, of Halifax, who was a regular customer of Mr. Dyson's. On each occasion an invoice was given, but when a total invoice was sent to Mr. Metcalf ultimately it was found that the prisoner had no authority to get the goods. He had been employed by Mr. Metcalf, but was dismissed last March. It transpired in evidence that certain of the goods were sold by prisoner to a hardware dealer named Jowett, in the local market, Tatham representing himself to have just started business on his own account. It was stated that the prisoner was well-connected, but had lost two situations through drink.

A Big Norwegian Loan.—The Norwegian Hydro-Electric Nitrogen Co. (Norsk Hydro-Elektrisk Kvalstof A.S.) and its subsidiary hydro-electric works—the A.S. Rjukanfos—have concluded a loan for 50,000,000 kr. with a syndicate of Scandinavian and French banks, which are now offering the bonds for subscription up to August 20th at the price of 98 per cent. At present the plant in operation represents 345,000 h.p., and a further 100,000 h.p. is available for future use. The proceeds of the loan are for the purpose of increasing the working capital, which has become inadequate partly on account of the great increase in wages and the depreciation in money, and partly as a consequence of the production being devoted to a growing extent to the output of Norwegian nitrate.

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ASSETS TAKEN ON TRUST.

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It has been established, and in our opinion well established, that the business of an auditor is to ascertain the true financial position of a company and to see that it is stated in the accounts submitted to its members; and that his duty ends there.

He is to ascertain such position not merely by examination of the books and documents constituting direct and indirect evidence, but also by due inquiry, and by seeing that the books themselves indicate the true position. He is not in any respect a final guarantor of the accuracy of the accounts, but what is most important, he is to exercise reasonable care and skill in the performance of his duties, and what is reasonable care and skill is a matter depending on the particular circumstances of any given case. He is not liable for not tracking out ingenious and carefully-laid schemes of fraud when there is nothing to arouse suspicion, and when such frauds are perpetrated by tried servants of the company and are undetected for years by the directors. To hold the contrary would make the position of an auditor intolerable.

An auditor is not bound to be a detective or to approach his work with suspicion or with the foregone conclusion that there is something wrong. He is a watchdog, but not a blood-hound. He is justified in believing tried servants of the company in whom confidence is placed by the company. If, however, there is anything to arouse suspicion he is to probe it to the bottom.

Such are some of the delivered legal *obiter dicta* with regard to the duty and responsibility of the auditor of a company.

In an article in *The Times*, a writer, who evidently takes as his text the recent bank failure, and who would convert most of the foregoing negatives into positives, and thus create a kind of prescient and omniscient man, states *inter alia* that "the directors have to show cash balances; assets other than cash balances and liabilities. The audit as regards cash is invariably real and searching and the balances are traced and vouched. But the statutory audit as regards assets is a farce, because the auditors are allowed to take from the directors any figures the latter choose to give them." The first part of the quotation indicates the mind of an amateur, and the concluding part is worse than gross hyperbole. He continues: "It is no part of an auditor's duty to take stock, indeed in the ordinary case he would not be qualified to do so." Here he is on safe ground, and he ought to have added, among other things, that an auditor was not necessarily an expert or an authority on matters involving depreciation and valuation. A varying degree of trust is inherent in the audit of large undertakings. Particularly is this dependence unavoidable in manufacturing undertakings producing and carrying a large and varied assortment of stock-in-trade and conversion stocks, and all that can be demanded of the auditor is the exercise of reasonable care and skill in spite of the fulminations of the *Times* correspondent. In such cases the stock is taken, checked, and valued by the staff, under the instructions of the executive head. Everything in the record that can be authenticated is similarly performed, adequately certified, and approved by the board. The auditor's duty is to examine such record as far as he thinks it necessary in the circumstances. He ascertains the principle or mode of valuation adopted; he may refer to the cost accounts and in voices of the business, and take other steps which it is impossible for us to observe here in the course of a short comment. The writing-up of assets, whether fixed or

hoating, is not difficult to trace, and the nature or composition of additions to such specific assets as plant, machinery, and buildings, is readily ascertainable by the auditor. Where, in so far as they can be or are installed, there may be found varying systems of internal check and internal audit necessarily conducted by special members of the staff of the company, the auditor may not be so rigorous in the procedure of his work as he would be in cases where such safeguards are absent, yet he will not fail to apply all reasonable and necessary tests. All auditors have their limitations. The velocity of human evolution, however, is so marked that before long we may arrive at the type of superman required, who will not be able to make an error even if he works to do so, and whose opinions of a business, which he does not know how to conduct, will be more valuable than the knowledge and ability of those who administer it.

So far as the duty of the directors and of the staff of trading and manufacturing companies is concerned, the valuation of electrical goods stocks is a matter of supreme importance in these days of changing prices. During periods of manufacturing inactivity stocks may be disposed of profitably, but with full production in progress and prices on the down-grade, it is possible to leave sources of serious weakness for later balance sheets, unless goods in store are written down to a reasonable figure, governed by actual costs, current suitability of the articles themselves, the state of the trade or market, and so forth. These are matters falling within the purview of staffs and officials with more or less specialised technical knowledge of the trade with which they are concerned. The peculiar times through which we are now passing throw a heavy duty and responsibility upon such men. They must know quite well that companies or firms which fail to reduce book values to figures corresponding to actual market values, may repeat, with disastrous consequences, the mistakes, which have been some of the outstanding causes of downfall in trade and industry in the past.

The Electro-Harmonic Society.

MEMBERS of the Electro-Harmonic Society who read the report recently issued by the Executive Committee will be aware that the statement of accounts for the 1920-21 season showed a deficiency of £23 11s., the expenses having exceeded the receipts by that amount. To reduce expenses in these days so as to bring them within the limits of the income is impossible if the high standard of the past is to be maintained. The only alternative, therefore, is to raise the annual subscription, which as the Executive points out in the report, has until now remained at its pre-war level of 10s. 6d. It is our belief that members will at once recognise the necessity for an increase. Certainly we feel that many of them will learn with astonishment that 10s. 6d. was the subscription rate for the first season of the Society thirty-five years ago, and that it has remained unchanged until now! When the half-guinea was first introduced it was only intended to cover the cost of four concerts held between January and April. The Society was then able to carry on at small expense, for there were many amateurs among the members who gladly rendered most acceptable service. We well recall that their number included Messrs. T. E. Gatehouse, James Swinburne, E. C. de Segundo, Alexander Siemens, J. E. Kingsbury, and several ladies, notably Mrs. Alexander Siemens. Some of these have passed beyond the call of the Committee, or prefer the less prominent place desired by those of a retiring disposition. In addition to this, as years passed by, the "entertainment" became more elaborate, artists' fees were higher, larger fees had to be paid for the concert hall, the cost of printing increased, and all these things have combined to make formidable the advance which is now proposed, it may be said, the musical entertainment is to be maintained at a high standard and is to be as enjoyable as in the past.

It may be feared that some members will withdraw from membership, but there will be few who will so fail to see the value of fraternising under E.H. conditions six times in the season, as to retire because an extra half-guinea has to be paid. But if there should be withdrawals, that fact alone is a reason for making the increase sufficient to cover any loss of revenue due thereto. That there must be some increase is undisputed; members will not desire the Society to run at a loss; and in all probability those who withdraw for 10s. 6d. would do so if the advance were less than that sum. It is very desirable, in order to give the general body of the membership a series of really good concerts in future seasons, that the Society should be put on to a stable financial basis. The new subscription rate (21s.) should bring about that result.

THE statement issued by the directors of Fuller's United Electric Works, Ltd., which we publish in our financial pages to-day, will be read with regret, and may we add, sympathy. A year ago the directors were able to recommend dividends of 10 per cent. on both the ordinary and the preference shares. Extended manufacturing facilities had only just been completed, and the capital laid out thereon was expected to yield results in the then approaching year; indeed, the "rapidly increasing business and the higher cost of stocks" made it necessary to proceed to raise further capital which the directors were of opinion could be "profitably employed." The report to this effect appeared in the ELECTRICAL REVIEW for July 16th, 1920. In addressing the annual meeting on July 14th, the chairman said he was "filled with optimism," and he foresaw that the demand for electrical material would increase by leaps and bounds and fortunes would be made. The limit to the company's output would be fixed only by the amount they could produce. They had more orders than ever before in their history, and their output of manufactured goods was more than double what it was a year earlier. On July 26th the issue of £200,000 short term notes was made for the purpose of repaying the bankers' loan (£165,320) and providing further working capital. The profit for the year ended March, 1920, was £48,045. A year later the accounts show a loss of £129,048. There is not within our memory a case of any electrical manufacturing company suffering either so rapid a change in its fortunes or so great a loss in any one year. But during the last few years we have become accustomed to large turnovers, high prices, big capital, and big profits. Operations have been on an unprecedented scale, and great opportunities have appeared to be opening out for those who were prepared to show a spirit of enterprise in taking advantage of them. But while all these things have been on the grand scale, we have also been up against the most serious conditions that have ever faced industry, and the company now under consideration has, by reason of the special class and character of its products and the materials employed therein, as well as by "unrestricted competition" (carbons), been heavily beaten about by the tempest that has raged. The hopes of July, 1920, were followed almost immediately by the motor trade slump of August, and the effect of that and the series of adverse influences all became concentrated in the brief period of the following seven months, with the unfortunate result now reported.

Happily, we are writing at a time when some of the depressing conditions have passed away, leaving occasion to anticipate a much better state of things. It may be that even while the return to normal conditions is in progress other concerns may have to divulge unfortunate experiences, but this need not mean that there is any reason for being pessimistic in regard to the future of British electrical industry. We live in times when it is very easy indeed for conditions to get beyond control, especially in an expanding business. The directors of Fuller's have been wise to write down stocks to meet changing prices and conditions and to

write down capital to meet the loss so far incurred. This has been done by reducing the value of the ordinary shares from £1 to 4s. each, and the desire to do the right thing is indicated by the circumstance that this class of share is held mainly (as to two-thirds of the whole) in the family circle. The company has been passing through an industrial and trade storm of unprecedented violence, and we wish it well in the efforts it is making to weather the gale.

THE attitude recently taken up by the The E.T.U. and E.T.U. with regard to the connecting-up Non-union of installations carried out by non-union Labour. labour has entered upon a new phase which opens up possibilities of a startling character. Not content with the original policy, which at least had its limits, the London branch of the E.T.U. has decreed that, even if an electrical installation at a cinema or theatre is executed by members of the Union, that installation shall not be connected to the supply mains if the men employed in the building are not trade unionists. As a result, the Stepney Corporation is threatened with legal proceedings for non-compliance with the terms of its electricity Order, and all it can do is to instruct its engineer to give orders for the connections to be made. Unless the members of the E.T.U. concerned ignore the orders of their Executive, it would appear that the result of such an instruction will be nothing. The Union maintains that a fundamental principle of trade unionism is involved, but this is very unlikely to succeed as a plea in the Council's defence.

It is an avowed object of the E.T.U. to secure control of the industry, but if this means the control of everything connected with the industry in any way whatever, the success of the Union's policy would bring an "electrical era" of a kind very different from that usually implied by the term. It seems to be a cardinal feature of that policy to meddle with someone else's affairs, and to produce discord where harmony reigns. But sooner or later the meddler burns his fingers—or gets an electric shock—and the E.T.U. London Executive will one day have its lesson.

Representation of Labour on London Joint Electricity Authority. THE Electricity Commissioners at the London inquiry gave very full opportunity for the E.T.U. to put forward its views as to representation on the Joint Electricity Authority for London, if formed. As we have already indicated in our columns, the question of

giving representation is not one which should be lightly entered into. This need of serious consideration is especially important seeing that the constitution of the various Joint Electricity Authorities in different parts of the country will probably vary very much, and include very varying powers. In some cases the Authorities will probably have very few direct employees and very limited scope of operation. In other cases the Electricity Authorities' operations may cover "control" of existing undertakings in their areas. Labour representation on an Authority such as the latter would therefore mean introducing quite a new feature into the Joint Electricity Authority's operations, since the control would obviously, in a sense, extend to the domestic labour arrangements of the individual undertakings. If the labour representation were limited to representing merely the workers who were directly employed by the Joint Electricity Authority, this would be one thing, but if they are to represent all the workers in the industry in the area, this is another matter altogether. The latter would mean that all labour grievances of the area could be brought before the Joint Electricity Authority, and it is difficult to see how in such case the Joint Electricity Authority can avoid becoming a general arbiter for the settlement of all the labour troubles of the dis-

trict. That this would be the case was, we think, indicated by the evidence given by Mr. Webb before the Commissioners. One of the chief reasons why the Electrical Trades Union wished to be represented on the Joint Electricity Authority was that at present there are no statutory powers enforcing the decisions of the Whitley Councils on the employers. It is evident, therefore, that from the Trade Union point of view the Joint Electricity Authority would be looked upon as a body whose task it would be to enforce all wages agreements upon the undertakings in its area. The complexity and difficulty of such a function is obvious. It is in no antagonistic spirit to the claims of labour that we make these criticisms. We have always strongly supported the Whitley Councils as giving labour a proper voice in the industry, and we have nothing but condemnation for undertakings which do not carry out the decisions of District Councils. We are at one with Mr. Webb in his depreciation of agreements not being carried out, but we do consider that a Joint Electricity Authority, by its constitution and functions, is not a proper body to have to deal with such matters.

THE imperative need for prompt and Imperial Com- easy communication between all parts munications. of the Empire, but above all between the Home Country and the Dominions, has often been emphasised in our columns; we have urged that rates should be lowered and facilities increased as fully as possible, not only in the interests of trade, important as those are, but also in the interests of the Empire as an organic whole. The sea which separates the component parts of the Empire is at the same time the most effective bond between them, for it facilitates the direct transport of goods and persons, and affords a safe shelter for that wonderful network of submarine cables which has so magnificently served the needs of speedy communication in the past, and will continue to do so in the future. But these ways and means are still inadequate to fill unaided all requirements, and while the airship has been invoked to accelerate oversea transit, the wireless telegraph is needed to supplement the cable service. We look upon the development of the Imperial wireless chain, therefore, with the greatest interest and solicitude, earnestly hoping that the time will soon come when all parts of the Empire will be provided with efficient long-distance wireless stations.

The subject necessarily came up for discussion at the recent Conference of Prime Ministers, which adopted a scheme proposed by the Imperial Wireless Telegraphy Committee. It is reported that the Australian Commonwealth has withdrawn from participation in the Imperial Wireless Chain, on the ground that there is no need for intermediate repeating stations, and that direct communication with the Antipodes is feasible; that may be the case, but whether it is commercially practicable is another question, and surely Australia would benefit more by the immediate extension of her means of communication through the Chain than by waiting until antipodal transmission is established on a sound workaday basis. Canada, South Africa, and New Zealand are also omitted from the scheme, which therefore is only nominally "Imperial." In the meantime, other countries are going ahead with their own systems, while the British Imperial Chain has made but little progress—not even the Home stations have as yet been completed by the Post Office, which is in charge of the system. It was recently stated in the Press that even in China a Marconi temporary station was receiving almost daily messages from the Marconi station in Cornwall—yet the British Government, which tackled the subject ten years ago, has not yet a single commercial wireless service overseas. The fact is that the Government is the very last authority that should be permitted by the nation to embark upon an undertaking of this kind, which, if it had been left to private enterprise, would probably have been in operation before the war.

AUTOMATIC LIGHTING SETS.

By H. R. TAUNTON.

ONE of the most striking features of post-war electric lighting development has been the large and ever-increasing number of electric lighting sets put upon the market, as witness the advertising pages of the REVIEW. Practically all embody automatic features; and they can be divided into two classes—full-automatic, and semi-automatic, the latter largely preponderating.

The essential principle of the full-automatic set is that it starts up automatically under certain pre-determined conditions, and shuts down in the same way when it is no longer required—an admirable object lesson to Government departments! Probably the best example of this class, and the best known—a pre-war pioneer—is the . . . But it will be better to avoid names, as otherwise it may prove difficult to steer between the Scylla of gratuitous advertisement, and the Charybdis of libellous criticism. Besides, one would have to mention them all, in fairness, and that would fill an issue of the REVIEW. The example referred to is standardised in a large range of sizes, up to comparatively large capacities, in both direct-coupled and belt-driven sets. It has an independent switchboard, and a battery of small capacity, floating across the mains. This supplies current when only a few lamps are in use. When the number of lamps alight reaches the limit for which the relay on the switchboard is set, the battery supplies the necessary current, through a special controller, to the suitably wound generator, motoring it to start up the engine. Compression is released by valve lifters actuated from the controller, until the engine picks up the load. When, later, the number of lights is again reduced to the limit, the relay comes out, the generator is cut out of circuit, and the battery again takes up the supply. The same general features are common to all full-automatic sets.

The champions of this type of lighting set claim, of course, as an outstanding advantage, that nothing is required of the attendant (who may be as ignorant and unskilled as you please) while the set is in actual operation. It can in theory be left to its own devices for days together, starting and stopping according to the number of lamps in use in the distant house. And this advantage is the only one they *can* claim over the semi-automatic sets, which need the presence of the attendant at starting up. Against this one advantage at best a very unsubstantial one must be set a number of inherent disadvantages.

The supposed advantage we will analyse later—now for the disadvantages. Unless running on town's gas, they have to run continuously on petrol, as an automatic change over to paraffin is difficult—almost impossible. This, even in a small set, is a consideration; and in large sets it is a serious one. Using a battery of small capacity, the sets must be adjusted to start up whenever a relatively small number of lamps are in circuit, which means that they are running most of the time at low efficiency. As the batteries are at approximately the same voltage as the generators during normal running, they have to receive a topping-up charge periodically. This is apt to be neglected, the attendant—by hypothesis, ignorant and unskilled—being instinctively biased in his neglect by the words "fully automatic." As a result, the batteries generally get into very poor condition. If, through some slight mischance or defect, the engine refuses to fire, or is stiff or difficult, excessive current is taken from the battery. Flickering is apt to occur unless the engines are in perfect condition. Finally, to obtain the full-automatic features entails a complex switchgear with relays and controllers, solenoids and resistances galore. Hence trouble and trouble necessarily beyond the competence of the poor, ignorant attendant.

If the set is well designed and made, as in the example referred to above, the possibility of trouble may be

minimised, but it is obviously more apt to occur than with the simpler semi-automatics; and when it does, it is, for the same reason, more apt to be beyond the powers of the attendant, or even the local plumber.

In one American set, still almost unknown in this country, the switchboard, although fully automatic, has been simplified practically down to the level of the usual semi-automatic control. As the makers claim, too, that they have—they certainly have experimentally—overcome the difficulty of changing over from petrol to paraffin at starting, they would appear to have a set which may prove a serious competitor of the semi-automatics.

These undoubtedly hold the market at present. There are a dozen different makes available for every one of the full-automatics. Compact, simple, and economical, they meet a general want, and their field becomes wider every day, as their advantages become known. It is no exaggeration to say that thousands of householders who have had these sets installed during the last few years would still have been using oil and candles if their only alternative had been the apparent complication of an ordinary electric lighting plant, and the seeming necessity of an expensive skilled man to run it.

Although they vary considerably in detail, all embody the same principle—of taking the normal supply from the battery, and charging up whenever it is convenient to run the engine; the automatic feature being that the engine is shut down, in the absence of the attendant, as soon as the battery is fully charged, generally through the medium of an ampere-hour meter. All of them, too, are arranged to start up, when the battery needs charging, by the movement of a switch, the specially wound generator taking current from the battery, and motoring the engine.

At present there are more American automatic sets on the market than British. Generally speaking, they are smaller— $\frac{3}{4}$ kW is a favourite size—and less substantially built than their British competitors. There are exceptions on both sides, of course, but the average American set is obviously built on the same principle as their cars—good service for a short time at a low first cost—then the scrap heap, to make way for an improved model. One very widely advertised model has a cylinder about the size of a half-pint tumbler, and is claimed to be capable of dealing with a 50-light installation. According to the makers, it has done it by the thousand in the States, so there is no obvious reason why it should not do it here. The average Englishman, however, likes to see plenty of metal for his money, even if it means his great-grandson being landed with a white elephant, and our makers usually cater for his taste.

The battery sold with American sets is also on the small side, judged by our standards. Their rating is certainly not the ten-hour rating, down to 1.83 volts per cell, usually adopted here. Their average 160-Ah battery is something more like what we would call 110 or 120 Ah. Some of the cheaper sets, indeed, have batteries which can only be rated on their "ignition" capacity.

Another feature of the American sets is that the almost always standardised at 32 volts—a real drawback for the British market. Not only is it difficult to get 32-volt lamps from stock, but 32-volt accessories—irons, kettles, and so on—are almost impossible. Again, the low voltage entails increased wiring costs, a disadvantage even more marked in the case of the 25-volt sets marketed by some English makers.

One of the earliest of the American sets has its engine of $1\frac{1}{2}$ b.h.p. air-cooled, the radiating fins of the cylinder being enclosed in a sleeve through which air is forced by the flywheel fan, a principle which has several imitators. It does away with the slight complications of water cooling, and makes an efficient and compact ar-

range where small horse-powers only are concerned. The engine runs on paraffin, starting on petrol. Ignition is from the lighting battery. The dynamo—the usual 32-volt machine—is built up as an extension of the crank case. The switchboard is simple, and provides the standard features of semi-automatic control. The battery, of either 80 or 160 ampere-hour capacity, is generally supplied with sealed tops. The whole constitutes a workmanlike, and, within its limits, efficient set, at a very reasonable cost.

But it is rather like attempting to compare a "Ford" with a "Rolls-Royce" to compare such a set with a representative British example—with, for instance, the set associated with the names of two firms of aeroplane builders. As this particular set is typical of the best British standards, it will be interesting to describe it in detail.

To begin with, the engine is of 3 b.h.p., double the usual American size. This, while somewhat increasing its cost, widens the field of application enormously. Moreover, as it is fitted with a pulley in addition to an outside flywheel, it can be used—and the switchgear is arranged for its use—as a power unit to drive small domestic and farm machinery within its scope, such as a pump, a small saw for firewood, churn, chaff-cutter, pulper, and so on. It runs on paraffin, and is fitted with a simple but effective petrol starting device, with an automatic change-over, which effectually prevents crude paraffin being drawn into the combustion chamber, a source of much trouble in other sets. Water-cooling is adopted, with plenty of jacketing, and a detachable cylinder head. Ignition is by magneto, and it is by earthing the magneto by a contact on the ampere-hour meter when the battery is fully charged, that the set is automatically stopped. The magneto is also earthed, and the set stopped, if the lubricating oil in the sump falls below the minimum. For the rest, the engine is of standard four-cycle type, medium speed, vertical pattern, with the clean, simple lines and massive construction that characterise British-made internal-combustion engines.

The dynamo, which is built up on an extension of the main shaft, with an outer bearing, is of the usual series shunt wound type, $1\frac{1}{2}$ kW, 50 volts, with a normal maximum output of 22 amperes at 70 volts when charging.

It is in the switchboard that this particular set outstrips its American competitors and, indeed, shows the way to its British ones. In the first place, it is totally enclosed, and this, combined with the fact that it has no porcelain parts—all insulation is mica on iron—and no copper strip contacts to work loose, makes it immune from accidental damage, and proof against vibration. The only external features are the dial of the ampere-hour meter and the two levers operating the rotary switches. These switches are of the lift-controller type, with shaped segments mounted on a cylinder and making contact, in different positions of the levers, for the various operations of starting, charging, running to lights, and so on. A valuable feature, and one that appears to be unique, is the provision made for cutting out the end cells of the battery if lights are in use while the battery is being charged. In most automatic sets there is no alternative to charging during daylight only, or over-running the lamps. In a 25 or 32-volt set, the over-running is perhaps not a serious matter, but in the standard 50-volt set it becomes an expensive drawback.

A battery of any make or capacity between about 75 Ah and 200 Ah can be used with this set, the engine governor being set for the normal charging rate.

Such a semi-automatic set—and the best of its competitors only differ from it in degree—has every advantage claimed for the full-automatic sets with the one exception that it will not start up automatically. And that advantage is, at best, a very shadowy one. The owner or attendant of a full-automatic set has to visit it from time to time to clean it, to oil it, to fill up the petrol tank. While he is doing that, is it so much trouble to press a switch, and start up the engine for

a battery charge? Even if he does not visit the engine room for these purposes as often as is necessary to charge the battery, yet there are few who have sufficient faith in their full-automatic sets to keep them comfortable without a visit to the engine room either just before or immediately after starting up. So again, why not press a switch on the set, instead of in the house, and have done with it? For that is all it amounts to. So much for the claimed advantage. The attendant disadvantages we have already considered.

If one could have an automatic set with all the features of the almost ideal semi-automatic set alluded to above, with the following further advantages:—(a) Automatic starting, controlled not by the number of lights in use, but by the state of the battery. (b) Automatic change over from petrol to paraffin. (c) Automatic replenishment of the running supplies from large storage tanks of fuel and lubricant. And finally, complete enclosure from dust and dirt—then, indeed, we would have a really fully-automatic set, which could be left to its own devices for months at a time; until, in fact, it was necessary to decarbonise it. And if it could be produced at a price not exceeding that of the best semi-automatics, it would sweep the market.

At present, considering the types actually available, the verdict of this article, as between full-automatic and semi-automatic sets, is all in favour of the latter; a verdict which, to judge by the comparative numbers available and actually installed, is emphatically endorsed by the buying public.

THE DUTY OF THOSE WHO SUPPLY ELECTRICAL FITTINGS.

By A LEGAL CONTRIBUTOR.

AN electrical contractor who sells and installs a fitting in the house of a private consumer is sometimes troubled to know the precise extent of his liability. A piece of electrical apparatus is not like a table or a chair which can be taken into and used in any house without any risk of danger to the house or its occupants. It can only be used in connection with and by means of the system already installed, which may consist in part of the mains of the supply company and in part of apparatus belonging to the consumer. The consumer probably knows very little about electricity. He has heard that an electric stove is *the* thing to have, and rushes off to buy one out of hand. What is the duty of the contractor who supplies it? There are, of course, certain obvious matters with regard to which he must be completely satisfied before he installs it and makes the necessary connections. But is it any part of his duty to inquire whether all the apparatus on the consumer's premises is in proper order and of sufficient capacity properly to work the stove?

The following is a type of case which will often occur in practice. A consumer buys a radiator, saying that he has a heating circuit in his house. All he asks is that an instrument of a stated kW capacity shall be supplied and connected up. The firm from which he buys makes no inquiry as to the capacity of the transformer. It turns out that the transformer (which belongs to the supply authority) is of insufficient capacity and is damaged. This painful fact is discovered by an inspector of the supply authority on his next visit. He reports the matter, and a bill for repairs is sent in to the consumer. Is he liable? Can he shift any part of his liability on to the electrical contractor? We have put the case of a radiator, but it is obvious that a similar question might arise in relation to other forms of electrical apparatus, e.g., a carpet sweeper, a washing machine, or any other labour-saving device which the modern housewife, worried by the servant problem, is so eager to buy.

As to the liability of the consumer in the case above quoted, it may well be that the installation of a new

machine will necessarily involve an increased demand upon the mains of which due notice should be given to the supply authority. The consumer's contract usually provides that such notice shall be given, and failure to comply with this provision may entail the supply being cut off. In these circumstances it will obviously be prudent for an electrical contractor to inquire of his customer whether such notice has been given; but we do not think that he is under any duty to make such inquiry, particularly in a case where (as in that above suggested) the premises are already provided with a heating circuit.

Whether notice be given or not it is conceived that if damage is done to apparatus of the supply authority, the consumer will be liable unless he can show that the damage arose through some defect in that apparatus for which he was not responsible. In the case suggested the overloading of a transformer would be a matter for which the consumer might be held responsible, and this although he had taken over that transformer, together with other apparatus of the supply authority, from a former tenant of the house. He could only escape liability by showing that the transformer was already damaged when he entered the premises.

It remains to consider whether he can pass on the liability to the electrical contractor. If it is the duty of an electrical contractor to examine *all* the existing

apparatus on a consumer's premises in order to see whether it is sufficient and in good order, and, through his failure to discharge this duty, damage occurs, then he will be liable.

That he is under *some* duty to the consumer is reasonably plain. He is called in as an expert, and it is an implied term of his contract of sale that he shall supply apparatus which will work properly in the surroundings in which it is to be placed. He must do what is reasonably necessary in order to ensure that the article which he supplies is adapted to its purpose, and that the heating circuit is sufficient for the purpose. It is not easy to lay down definite rules as to what he should do in order to test the heating circuit. He might do enough if he were to satisfy himself, by looking at the ampere meter controlling the wall sockets, that it was safe to connect the radiator on that circuit. On the other hand, if it were considered by men of experience to be necessary to examine the transformer, it would be the duty of the contractor to examine that instrument in order to see that it would not be overstrained. As was indicated at the beginning of these notes, it must never be assumed that the consumer knows very much about electrical matters, and when he employs an electrical contractor he is entitled to rely on his skill and knowledge of the conditions under which any particular machine will work properly.

ELECTRICITY DISTRICT INQUIRY PROCEDURE.

INEVITABLY there will be—it is already beginning—an outcry that the expenditure for London only of seven weeks of the time of the Electricity Commissioners, a bevy of electrical engineers of the foremost rank and scale of fees, an even larger group of counsel and solicitors, and a number of other people who are mostly not at the inquiry for health or amusement, is an extravagant and wasteful expenditure of energy and cash. It may be admitted that the cash value of the inquiry will total up to some few tens of thousands of pounds. Whether the expenditure can be rightly classed as wasteful depends upon the result. *Prima facie*, the achievement of the object of the inquiry, the provision of a cheaper and more abundant supply of electrical energy for the seven-odd million inhabitants of the delimited London district, approximately 20 per cent. of the population of the United Kingdom, is well worth a considerable expenditure in the preliminary survey. Such a survey should show the right way in which to solve the problem, and is likely to cost less than a method of trial and error which may result in much heavier fruitless expenditure, or equally expensive delays in arriving at the right solution. It seems to show some lack of a sense of proportion to condemn the proceeding simply because it costs a sum which, while large in itself, is a small fraction of the financial value of the possible benefits which may result.

But making full allowance for this view, it is a fair question whether the actual procedure adopted is either that best calculated to achieve the desired result, or the most economical way of arriving at it.

The Ministry of Transport and the Electricity Commissioners have not, so far, seen fit to exercise the powers to make rules for the holding of these Electricity District inquiries which are given them by Section 34 of the Electricity (Supply) Act, 1919. Before the first inquiry was held, no one had any official guidance as to the form or procedure to be followed. Even now there is only the guidance of former inquiries, and if any dispute arises on a question of procedure it falls to the Commissioners then and there to settle it.

The disadvantage of this lack of guidance was shown in the very first inquiry, when Mr. Faraday Proctor, as the exponent of the only scheme put forward, was told by the Commissioners that he was at a great disadvantage in not having the assistance of counsel,

though nothing in the Act or in any notice issued by the Commissioners requires that there shall be such assistance.

Apparently the Commissioners have preferred to allow procedure to develop under their guidance, rather than to give it a considered pre-determined form. They have, however, shown by their actions and utterances the kind of procedure which they consider desirable, and it is a fair criticism to say that to some onlookers the particular forms which they are shaping seem to be based on some misconceptions of their own position, of the position of parties who either submit or oppose schemes, and of the spirit of the Act.

Taking the course of the London inquiry, it may be said that the procedure adopted is modelled on that of Parliamentary Committees on Private Bills, with some reminders of that of civil courts.

The Commissioners are particularly solicitous to maintain a judicial attitude. On several occasions it has been said from the chair that the Commissioners have before them evidence to a certain effect, and that unless such evidence is countered by some on the other side they are bound to regard that evidence as a correct statement on the point at issue.

That, of course, is the correct attitude for a civil court, but not quite that for a Parliamentary Committee, which is entitled and bound to consider broad issues of public interest and policy, as well as the evidence tendered by the promoters and opponents of a private Bill.

But the Electricity Commissioners are not in the position either of a civil court or of a Parliamentary Committee. A civil court usually has to decide some dispute between litigants, on the facts established by the evidence tendered by the parties, applying to those facts and the arguments drawn from them by counsel, established principles of common and statutory law. In general the evidence it has to deal with is evidence of fact. There may be in some cases evidence of opinion and estimate, but this is always secondary to evidence of fact. The practice of cross-examination as developed in British courts of law is eminently successful in testing evidence of facts, including the memory and prepossessed notions of witnesses. It is not so satisfactory in testing evidence of opinion and estimates or forecasts of future events, in which the reputation and experience of the witnesses are important factors. Clearly the

Commissioners are not in the position of judges who have to decide a dispute between litigants.

Neither are they in the position of a Parliamentary Committee considering a private Bill, or a group of competitive Bills. A Parliamentary Committee has to decide in the first place whether or no the "preamble is proved." That is to say, whether the promoters of the Bill have made out a sufficiently good case in the public interests to justify Parliament in conferring upon them the statutory powers necessary to carry out their proposals. After deciding that the preamble is proved they have to consider whether and how interests that may be affected, private or public, have to be safeguarded by compensation and in other ways.

The Commissioners are not in that position. They have already by their notices under the Act decided that a certain area should be delimited as an electricity district, and that it is necessary that the organisation of electricity supply in that area should be improved. That is, they have declared the preamble proved. Further, they are not limited, as a Parliamentary Committee is limited, to considering the definite schemes put before them. They need adopt no such scheme. There may be no scheme put before them. They may themselves formulate a scheme, which may or may not embody the proposals of the schemes submitted. No Parliamentary Committee does this. It may, indeed, delete some physical features or some of the powers sought for in a private Bill, and to that extent may modify the promoters' proposals, but it cannot, or at least does not, turn the Bill presented for its consideration into an essentially different measure.

A Parliamentary Committee is a more or less expert body on the "practice of Parliament" on the extent and limitations of the powers which can be properly given to various classes of promoters, and it has available the expert advice of Speaker's counsel, other officers of Parliament, and reports from the Government Departments concerned. It is strong on questions of precedent and the public interest. But it is not expected to be, and generally is not a body of experts on the technical features of the particular Bill which it is considering. For this reason alone—and there are others—it does not attempt to turn a promoter's Bill into its own Bill, though it may modify its details.

The Electricity Commission, on the other hand, is a body of men highly qualified by special knowledge and experience not only to judge the merits of schemes submitted to it, but to prepare schemes itself, and it is its duty to do that in certain circumstances. It is hardly necessary to say that these qualifications cover the engineering, legal, financial, and administrative aspects of schemes for the better organisation of electricity supply. The Commission is so constituted as to be fully competent to exercise its own judgment as to the general form of such an organisation, the constitution and powers of the body which is to administer it, and the relationship which is to exist between that body and those already engaged in the electricity supply industry within the particular area under consideration. It has open to it all the official and published records relevant to the subject. It can obtain other information and evidence. Hence it is not correct to say that the Commission can only act on evidence formally laid before it. It is an expert body empowered to put before Parliament for confirmation the scheme it considers most likely to achieve the desired object in each case. It is bound to utilise the knowledge and experience of its own members in the formulation of these schemes.

It seems, therefore, that the procedure at the inquiries should be modelled to fit these facts. The question is what alterations should be made which are calculated to save time and money without any sacrifice of the clearness and fullness with which the cases of promoters and opponents of schemes are put before the Commissioners.

In the first place, it must be remembered that the necessity of some improvement in the organisation of electricity supply has already been decided upon by the Commissioners, who presumably will consider any

schemes submitted to them from that point of view. Logically this would cut out any objections or proposals of a purely negative character, such as proposals from particular authorised undertakers that their areas of supply should be omitted from the operation of any scheme *because* they at least in their own territory have done and are prepared to do everything necessary. But as the inquiries cover proposals to vary the provisionally delimited area by either deletion or accretion, it may be difficult entirely to exclude pleas of this kind. The issues raised should, however, be narrowed. Pleas for exclusion from the delimited district because none of the schemes submitted promise any benefit to a particular area, are clearly misconceived. It is the duty of the Commissioners to formulate schemes which will benefit the whole of the areas included in the delimited district. It therefore seems that there should be some definition of the grounds upon which objections to the area of the district will be taken into consideration.

It would perhaps be too drastic to suggest that there should be any limitation to the representation of promoters and objectors by counsel and solicitors. Some counsel, it may be fully admitted, do help the Commissioners in various ways. Others seem to waste time. But it may be suggested that a great deal more would be gained than lost by a severe limitation of cross-examination by counsel. The Commissioners, it has been abundantly proved at the London inquiry, are very well able to examine witnesses themselves, and the demeanour and answers of witnesses to questions from the tribunal are markedly different from the answers given and demeanour shown towards "hostile" counsel. Much more helpful to the object of the inquiry too.

The fact is that there ought to be no question of hostility at all, and it seems to lie in the powers and rights of the Commissioners to make this clear at the outset.

There is, or there should be, only one object of all the parties, *i.e.*, to assist the Commissioners in devising a scheme which will improve the organisation for the supply of electricity in the district. Merely obstructive or negative utterances are out of place, and should not be allowed to take up much time. Discussions as to whether certain proposals in a scheme are *ultra vires* of the Act of 1919, or any other Act, seem particularly out of place. First, because the Commissioners with the legal and official advice open to them are most unlikely to submit, and Parliament is most unlikely to approve any scheme which conflicts with the 1919 Act, or the general and special law. Secondly, because any scheme approved by Parliament will "have effect as if enacted in" the Act of 1919 (Section 7 (2) E. (S.) Act, 1919). So that if it becomes virtually part of that Act, it cannot be *ultra vires* of it. There are quite a number of people, including the Commissioners, and the two Houses of Parliament, who will look out sharply that the Orders approved do not conflict with the main provisions of that Act, and such points should be left to them.

There is, however, another consideration which gives powerful support to the general plea for shortening the procedure and limiting the issues at these inquiries.

When the Commissioners have approved or themselves formulated a scheme, they have to publish it, and to hold a local inquiry thereon (E. (S.) Act, 1919, S. 5 (4)). So there will then be an opportunity for everyone concerned to offer his views upon one definite considered scheme, the outcome of the Commissioners' consideration of what they have heard in the preliminary inquiry, all other sources of information open to them, and their own expert judgment. Criticism and discussion of such a single concrete scheme will be much better directed and more fruitful than the somewhat confused encounter which has been going on for the last seven weeks, in which the promoters of every scheme have been opponents—more or less—of every other, and all have had to encounter objections from many other quarters. One advantage will be that there is a single scheme, not subject to alteration from day to day, until no one can say that he stands for any scheme as submitted,

and no one can be quite certain what the schemes under consideration are. Nothing has been more confusing than these sudden alterations, and one may suggest that the Commissioners will save time in future inquiries if they tighten up procedure in respect of alterations after schemes have been submitted. It is the fact that no scheme for London submitted to the Commissioners on March 31st is that they are now asked to consider. Even the "supplementary particulars" asked for by the Commissioners made material alterations in the schemes as submitted. The original "technical scheme" agreed on by three of the promoters has gone. The area to which it is to be applied, in two of these three cases at least, is not that of the delimited district, which these three promoters originally accepted. Most embarrassing of all—to the said promoters—the ostensible grounds for the alteration to the original technical scheme have vanished in view of the declarations of other parties. It may be suggested that the Commissioners already feel the necessity of making some rules of procedure for future use which will minimise such confusing changes.

For positive suggestions to save time and expense it seems as though the procedure might be made rather that of a Conference of promoters of and objectors to schemes, that each party, by counsel if desired, and by at least one witness, should explain its schemes and objections, that examination by the Commissioners should take the place of cross-examination (counsel having the right to suggest questions which the Commissioners might or might not put), and that the closing speeches of counsel or other representatives of the parties should be limited to specific points to be indicated by the Commissioners.

It may be recalled that the Commissioners have powers to require the attendance of witnesses and the production of documents, also to take evidence on oath, which powers they have not so far seen fit to exercise.

Some recognition in the rules of procedure and the conduct of the inquiries, that the Commissioners are neither a Court of Law nor a Parliamentary Committee, but an expert tribunal, would further tend to shorten the proceedings.

ELECTRIC ARC WELDING IN THE MANUFACTURE OF NEW BOILERS.

As will be well known to our readers, a great deal of work has been carried out in the repair of boilers by electric welding. During the last ten years its application has been gradually extended until now there is no doubt that whenever wasted parts have to be made good this method is preferable to any other, being more efficient, cheaper, and taking much less time than any other method of repair.

When the best methods are employed, and when the work is put in the hands of those who have specialised

Hawthorn-Wyber welded boiler, and a photograph of the first of this type is reproduced in fig. 1. The boiler was specially designed, and the design has been protected by letters patent. From the details shown in fig. 2 the methods employed will be perfectly clear, and it will be seen that the construction is very much simplified by employing welded in place of riveted joints. It will be noted that the flanging of the end plates, a difficult and expensive operation, is altogether dispensed with, as is also the flanging for the combustion chamber joints. The saving in coal consumption alone in the plate-heating furnace for levelling and annealing the flanged end plates, is estimated at about 20 tons. In the size of boiler illustrated when riveted joints are used there are 290 rivet holes, 1.312 in. diameter, to be

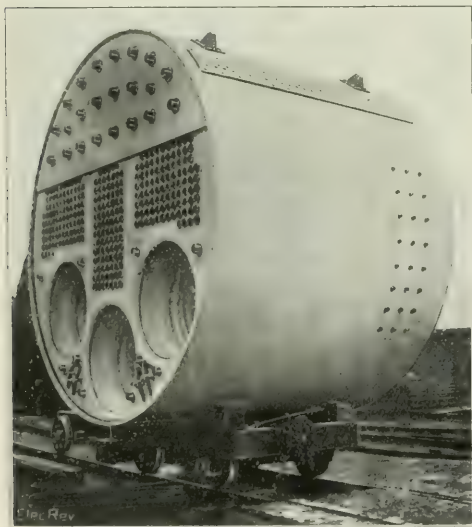


FIG. 1. HAWTHORN-WYBER WELDED BOILER.

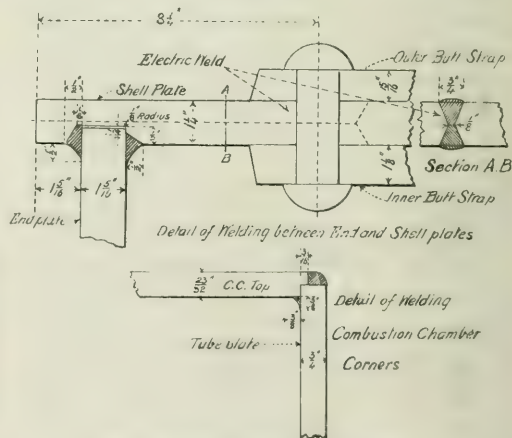


FIG. 2. DETAILS OF WELDED JOINTS.

in it, excellent results are obtained and repairs can in many cases be made in such a manner that the boiler is as good as new. We have been informed of one case where new furnaces were ordered for a boiler in 1913, in case certain electric welding repairs should not be found reliable. Up to the end of 1920 there had been no necessity to fit the new furnaces.

In view of the success with repair work it was decided some 18 months ago by Messrs. R. & W. Hawthorn Leslie & Co., Newcastle-on-Tyne, to construct a new marine boiler with most of the joints welded in place of being riveted. This boiler is now known as the

drilled through the double ply of plate at each end of the boiler, and at the front end of the shell the holes have to be counter-sunk and the riveting done by hand. All this work is, of course, dispensed with in the welded boiler. The following are the main particulars of this boiler:—

- 15 ft. 6 in. internal diameter.
- 11 ft. 6 in. mean length.
- Three corrugated furnaces, outside diameter 4 ft. 2 1/2 in.
- Working pressure, 180 lb. per sq. in.
- Hydraulic test pressure, 360 lb. per sq. in.

Referring to the joint between the shell and the end plates, the width at the bottom of the groove in the shell plate is $\frac{1}{2}$ in. wider than the thickness of the end plate with a $\frac{1}{2}$ -in. bevel at the top of the groove. This enables the welder to get a solid body of metal which is in compression. The welding inside the boiler is only intended to prevent water getting between the end plate and the shell plate and causing corrosion. These grooves are machined on a planing machine while the shell plate is in the flat, the shell plate being afterwards bent ready for the end plates. The end plates are turned $1/16$ in. less in diameter than the bottom of the groove. It will be seen that the combustion chamber plates having pressure on the outside are recessed into one another and welded outside and inside.

A careful study of the methods of construction will clearly show the saving of time and labour possible in the manufacture of a welded boiler.

As regards the actual welding of the first of these boilers, preliminary trials were carried out in the first place, and after these trials it was decided to use the Kjellberg system as likely to give the most satisfactory results. The work was accordingly entrusted to the Anglo-Swedish Electric Welding Co., Ltd. There was in all a total length of about 500 feet of welding, and this was carried out so successfully that the boiler was absolutely tight the first time it was tested to 360 lb. per sq. in., i.e., double the working pressure, without touching up of any kind being required either during the tests or after prolonged steaming. The boiler has now been under steam at Messrs. R. & W. Hawthorn Leslie's St. Peter's Works for about 12 months, and has never given the slightest trouble. It has further been approved by Lloyd's Register of Shipping, the British Corporation, and Bureau Veritas.

We are informed that Messrs. Hawthorn Leslie are prepared to grant licences for the use of the design covered by their patent.

CONDITIONS IN SPAIN.

In our issue of July 1st ("City Notes," p. 23) we made brief reference to the financial results of the operations of the Barcelona Traction, Light & Power Co. We return to the subject now because the directors' report, a copy of which has reached us (it was issued in Canada at the end of June), deals in fuller detail with the conditions which prevailed in Spain during the year ended December, 1920, and expressed the hope that the worst period has passed, and that slow recovery is probable.

The report shows that there was an increase of Pts. 6,128,683.25 in the gross earnings of the combined enterprises of the companies operating in Spain over those for the year 1919, and in the net earnings an increase of Pts. 5,044,321.95. These increases must be considered very satisfactory in view of the unfavourable political and labour conditions prevailing during the year, and are accounted for chiefly by the prices for energy, under many long-dated contracts, being raised by consent of the customers, and partly by the increase in the private lighting tariff which took place towards the end of the year, and also by the very large increase in the earnings from the operation of the Cataluña Railway.

The year under review was in many respects one of difficulty and anxiety. The conditions of unrest described in the previous annual report continued until February, 1920, necessarily involving heavy loss of revenue—the consumption of power in the areas served by the Ebro Co. falling as low as 58.5 per cent. of the normal demand. Drastic action by the local authorities in suppressing the syndicalist organisations led to a marked improvement, and business revived appreciably during the spring and summer, though sporadic unrest continued until November.

Apart from the temporary paralysis of local industrial activity, there was a great shortage of unskilled labour, due to emigration in search of the inflated wages being paid, in France and the United States, so that all constructional operations were seriously interfered with, and such work as could not be postponed was necessarily carried out at an increased expense.

In December of 1920 the Bank of Barcelona suspended operations, with the result that industrial and commercial enterprises throughout the province of Cataluña were seriously affected.

The rate of exchange throughout 1920 was also an adverse factor, having risen from 19.57 pesetas to the £ in January to 23.92 at June, and 26.99 in December.

Notwithstanding the unfavourable conditions referred to, the City of Barcelona and the surrounding districts are full of vitality. In its directions building is in progress, and traffic increases in intensity. Given only a cessation from labour unrest and political agitation, with a relaxation in general economic conditions, development would move rapidly forward, involving growing demands upon the services of light, power, and transit.

With the completion of the new hydro-electric installation at Camarasa, ranking among the most important in Europe, the major construction projects of the Ebro Co. may be regarded as realised. Two sets of 17,500 h.p. each are in operation, and by the addition of this plant, as and when required, of three further sets the company will have electrical power available to meet all demands for some years. Considerable extensions have been made to the distribution system during the year, but as the demand for power grows the system will have to be greatly extended.

The result of the year's operation of the Cataluña Railway Co. (Ferrocarriles de Cataluña) was highly satisfactory. The popularity of its services is undoubted. Work upon the extension to Sabadell, commenced in November, 1920, is now well advanced, and there is every indication that the volume of traffic on this branch will equal that already attained on the Tarrasa section.

For the purpose of financing this extension, a contract was made for the sale of Pts. 10,000,000 of the 5 per cent. 50-year mortgage bonds of the Ferrocarriles de Cataluña, of which Pts. 5,750,000 had at June 1st, 1921, been taken up and paid for in accordance with the terms of the contract.

The operating results of the Tramway Co. (Les Tramways de Barcelona) showed an increase in gross earnings of nearly 25 per cent. over those of the previous year, but, owing to a large increase in operating costs, the increase in net earnings was only about 14 per cent.

Towards the end of 1920 the sharp fall in wholesale values of raw materials, and especially cotton and wool, had the same paralysing effect upon industry in Barcelona as in other parts of the world, and this was intensified by the financial stringency caused by the failure of the Bank of Barcelona already referred to. As a result, since the beginning of 1921 numerous textile mills have closed and many others are working on short time. This has had its effect on the operating companies, directly, through the reduction in the amount of power consumed, and indirectly, in other ways. It is hoped that the worst period has been passed, but it is probable that the recovery will come slowly.

ELECTRICITY SUPPLY ADMINISTRATION.

A REPORT has been published by the Minister of Transport respecting the applications to, and proceedings of, the Ministry under the Electricity (Supply) Acts, from June 27th, 1920, to March 31st, 1921. (158. Price 1d. net.)

It states that the estimated net expenditure of the Electricity Commissioners for the period from the date of their appointment to March 31st, 1921, was £43,500. The fund out of which the expenses of the Commissioners are defrayed will be provided by contributions levied upon the electricity supply industry, although temporarily financed by advances from the Exchequer for the first two years. The repayment of the advances, together with interest, will fall to commence in the financial year beginning April 1st, 1922.

The Electricity Commissioners have submitted to the Minister for confirmation Special Orders made by them relating to the Urban District of Panteg and the Rural District of St. Mellons (South Wales Electrical Power Distribution Co.), and the Urban District of Mynyddislwyn (Urban District Council).

The Minister made Orders under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, in some 90 cases, and under Section 32 of the Schedule to the Electric Lighting (Clauses) Act, 1899, or corresponding provisions, in 69 cases (two of which come under both heads).

The Minister made Orders extending the time for carrying out the compulsory electricity works scheduled to the Orders or Acts for Bradford-on-Avon, Lurgan, Portrush, Rickmansworth and Chorley Wood, Yeovil, Crowborough, Ormskirk, Sidmouth, Sidmouth (U.D.C.), Skegness, and Yorktown and Blackwater.

The Minister gave consent to the erection of overhead lines by the undertakers under 29 Acts and Orders, and under Section 22 of the Electricity (Supply) Act, 1919, to an application by the undertakers under the Woking Electric Lighting Orders for a wayleave for part of the route of an overhead line.

Under Section 18 of the Electricity (Supply) Act, 1919, four applications were made to the Minister for the construction by him of generating stations or main transmission lines pending the establishment of joint electricity authorities in certain districts provisionally determined by the Electricity Commissioners. After consultation with the Commissioners

one of the applications was not entertained. In two cases, however, the Minister decided to proceed with the construction of the works subject to certain conditions. In one of these cases the application was subsequently withdrawn, and in the other the interested parties were unable to give the required guarantees, and the application therefore lapsed. The fourth application is under consideration.

In addition to advising the Minister in the exercise of his powers and duties under the Electricity (Supply) Acts, 1882 to 1919, the Electricity Commissioners also exercise certain statutory powers and duties vested in them by the Electricity (Supply) Act, 1919, and certain other powers and duties delegated to them by the Minister. With the concurrence of the Minister the Commissioners have prepared, for separate publication, a report dealing fully with their proceedings for the information of the electricity supply industry and the public generally. The report covers the period from the appointment of the Commissioners (January, 1920) to March 31st, 1921, and relates to the following matters:—

Under the provisions of Section 5 of the Electricity (Supply) Act, 1919, the Commissioners provisionally determined 13 electricity districts. Local inquiries were held by the Commissioners in respect of three of the districts, namely, the Lower Severn, the Mersey and West Lancashire, and the North Wales and Chester Electricity Districts. The first-named inquiry was adjourned and has not yet been resumed, but the other two inquiries were carried to completion.

Subsequent to the date to which the report is made, the Commissioners issued their decisions in respect of the two districts and the schemes submitted in connection therewith. Draft Orders embodying the decisions are in course of preparation by the Commissioners.

The Commissioners issued their formal consent in the case of eight applications relating to the establishment of new generating stations, in the case of four applications relating to the establishment of main transmission lines, and in upwards of 120 cases relating to the extension of existing gene-

rating stations. The new generating stations sanctioned represent the initial installation of approximately 150,000 kW of generating plant, with the possibility of further extensions at a later stage. The authorised extensions of existing stations represent approximately 550,000 kW of generating plant.

Over 500 applications were received by the Commissioners for sanction to the borrowing of money by local authorities for the purposes of their electricity supply undertakings. Sanction to borrowing was granted in the case of 432 applications, the total amount of the loans sanctioned being £15,181,298, which included (*inter alia*) £9,805,990 in respect of plant, and £3,428,161 in respect of mains and services. The Commissioners in every case satisfied themselves that the proposed expenditure was necessary for enabling the undertakers to carry out their statutory obligations and that the cost of the proposed works was reasonable.

The Commissioners made Statutory Rules with regard to applications for Special Orders under Section 26 of the Act of 1919 on August 10th, 1920, which were laid before Parliament as required. The Commissioners received 28 applications for Special Orders, and four applications for Provisional Orders lodged with the Board of Trade prior to the appointment of the Commissioners were subsequently transferred to the Commissioners by the Board. Of the 32 applications under consideration, the Commissioners refused two, and made Special Orders in respect of three. The remaining applications were under consideration at the date to which this report is made (five further Special Orders have since been made).

The Commissioners approved in ten cases of agreements being entered into between authorised undertakers for mutual assistance or for the taking of bulk supplies, and made 71 Fringe Orders permitting various authorised undertakers to supply electricity to specific premises situated outside their authorised areas of supply. They approved the adoption of special systems of supply in the cases of 15 undertakings.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Gescha" Cable Connector.

The new invention illustrated in fig. 1, the importers of which are MESSRS. R. MAY & Co., of 27, Oliver Grove, S.E. 25, permits reliable contacts to be made in cable thimbles, connection sockets, T-pieces, and branch terminals, without the use of screws and soldering tin.

The novelty of this, which is a German invention (British provisional patent No. 35,734 for sale), is centred in the reciprocal conical tension which results, after the introduction of the cable, from driving the semi-cylindrical, conical-shaped extension of one part into the corresponding recess of the

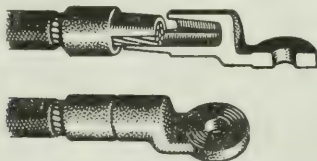


FIG. 1.—THE GESCHA CABLE CONNECTOR.

other part. The contact surface is perfectly cylindrical and drilled to template and therefore absolutely metallic. The pressure is so strong that the outer wires of the cable are flattened. All loosening is impossible even under constant vibration, because the angle of inclination (5 deg.) is far below the frictional angle (13 deg.). The work of installation will only occupy a few seconds. It is also of great advantage that complete independence is obtained from the skill and attention of the workman, as the position of the terminal when once fitted must always be such as calculated for the cable in question.

Service Cut-outs for Housing Schemes.

There are many ways of cutting down the cost of house services—always an important item in the cost of distribution—and especially nowadays with high-priced materials and labour. A method now finding an increasing number of adherents is that of grouping together blocks of two, three, or four houses, and serving each block by one service cable only, thus cutting down the length of cable and the number of joint boxes required. This method necessitates the use of a special service cut-out, and to meet the increasing demand for this economical arrangement, MESSRS. W. T. HENLEY & THE TELEGRAPH WORKS CO., LTD., of Blomfield Street, London Wall, E.C., have placed upon the market a new range of cut-outs for groups of houses.

We reproduce a drawing (fig. 2) of the four-way d.p. cut-out with four bridge type fuses and a four-way neutral connector. The fuse units are connected by a special adjustable busbar fitting which ensures correct alignment of the contacts and simplifies connecting up the service cable. A service to each house is taken off each pole through the top of the

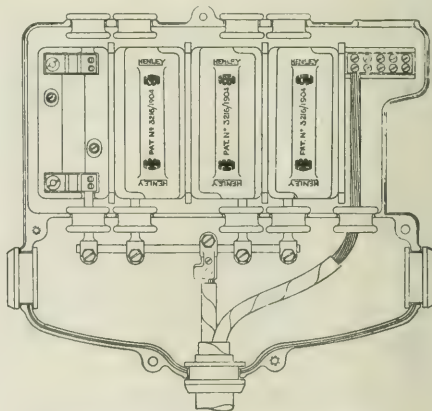


FIG. 2.—A FOUR-WAY SERVICE CUT-OUT

cut-out in the usual way. The range covers circuits up to 50 amps., 250 volts, two, three, or four-way. Where required, armour grips can be fitted for the incoming cable.

These cut-outs are also specially suitable for blocks of flats as the service cable can be brought up to the block and in individual services taken off to each flat.

A Smoke Detector.

A mechanical device which automatically records the presence of smoke in the surrounding air was recently demonstrated at The Studio, 5, Great Newport Street, W.C.2. It is claimed to be an advance on the principle of the existing fire detectors, as it does not wait for the outburst of flame, but gives the alarm with the appearance of smoke merely.

The instrument is extremely sensitive, but its sensitiveness can be adjusted to any degree.

The detector is open top and bottom to allow of free circulation of the atmosphere through the instrument. It is fitted internally with a pair of very sensitive expansion chambers, which act in unison under normal conditions. These expansion chambers are somewhat similar in action to the vacuum chamber of an aneroid barometer, and are geared in such a manner that when they move in unison they keep the electric circuit open and no signal is given. If smoke enters the instrument it will destroy the balance of the two expansion chambers, thereby completing the circuit through a relay, which can actuate any warning signals or fire extinguishing apparatus desired. In cases where heat detectors are at present installed, the addition of a smoke detector, which can readily be looped into the circuit, will greatly enhance the protection from fire.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Oil Consumption and Prices.

Re the note in your issue of July 29th by Mr. E. F. Butler, the 1,000-kW set he quotes has certainly set up a record, and seeing that the notes in your and other engineering papers are often taken as correct, I should be very grateful if Mr. Butler would confirm the figure of 350 gallons, which equals 0.00004 gallon per kWh generated.

Below I give several sets of figures for various stations using large turbines, Diesel engines, and gas engines, which have been under my charge, the figures being taken from actual costs sheets:—

Type of station.	Capacity kW.	Units generated per week.	Oil consumption per kWh generated.
Turbines	48,000	3,179,792	0.00005
Turbines and engines	3,500	33,610	0.0003
Diesel	300	15,074	0.0009
Gas engines	8,000	500,000	0.00009
Mr. Butler's quotation—Turbine	1,000	164,640	0.00004

It will be noted from the above that the 1,000-kW set is able to show a lower oil consumption than the 48,000-kW station, and it would be very interesting to hear from Mr. Butler how this is carried out.

I have done a lot of work in connection with oil filtration and the lowering of costs, so much so that I have obtained the Diesel figure given above, and with a 1,000-kW Diesel a figure much lower would be obtained, which would be in the neighbourhood of 0.00008 gallons per kWh generated, and would be a very close competitor of the large turbine.

It will be seen from the above figures that a great deal of difference does not occur in the oil consumptions of internal combustion engines *versus* turbines.

Dealing with the fuel used and costs per kW generated of turbines *versus* Diesel engines, a very useful article will be found in this month's issue of *Gas and Oil Power*.

I shall be glad to receive Mr. Butler's remarks on this matter, as I assume his informant must have a very efficient method of filtering and reclaiming the oil used.

S. H. Fowles, A.M.I.E.E., A.M.I.Mech.E.

Jarrow-on-Tyne.

August 1st, 1921.

Testing and Repairing Magnetos.

"Repairer's" letter in your last issue gives (just as he states) the usual method of testing for a complete breakdown of primary, secondary, or condenser, but it will not determine a partial breakdown, which, although it may not be serious enough to cause an appreciable diminution of spark length at the moment, yet will eventually develop into a complete breakdown. Such faults are: Earth in bottom layer of primary; short between two or three layers of secondary; condenser short which has burned itself clear, but started charring of insulation, which will cause further trouble. I cannot agree with "Repairer" that a broken-down slipping will always be indicated by a smell of burning ebonite (though such is usually the case); it would be a serious mistake to condemn the secondary and strip and rewind it because there was no smell of burnt ebonite when testing. This method of testing with an interrupted current is quite common in repair shops (although the idea of using the magnetism in the magneto core to actuate the break is new to me).

With regard to removing ball-races, the various devices made like miniature pinion-pullers are all failures when they come to a really tight ball-race; they either slip out of the groove, bend, or break.

To come to the matter of practical repairing, it would be interesting to have the opinions of "Repairer" and others on winding machines; there are two great classes of these, namely, purchased and "home-made." Of the former there are only two or three makes, but the "home-made" types are legion, and in my experience usually far more satisfactory

than the bought machines. The commonest fault is wire breaking; next comes overshooting margin at ends of layers; not stepping quickly enough (in case of hand-stopped machines); or stopping too early or too late (in case of automatically-stopped machines). The most successful magneto-repairer I know is a man in a very small way of business, who does all his winding with a small lathe, with a crank handle fixed to the headstock spindle and the wire guided on by hand; this method may seem very crude, and it is certainly very tedious and comparatively slow, but by practice he has attained marvellous speed, and such things as breaks, over-running, &c., are unknown. Another matter on which considerable diversity of opinion exists is that of testing the strength of magnets. The two usual methods are: spring-balance and keeper; and distance which magnet will lift a small iron bar. Both of these methods should be all right if there were standard weights which each magnet should pull, or standard distances through which a bar of certain dimensions and weight should be lifted, but when one shop passes as O.K. a magnet which pulls 5 lb. before parting, while another must get a 10-lb. pull from the same size magnet, it is fairly obvious that clear knowledge and standardisation is badly needed.

Mag.

August 7th, 1921.

Re "Mag's" letter, surely there are many ex-Service electricians who were engaged during the war on the upkeep of magneto and various ignition systems, and could effect improvements on these firms' methods.

J. H. Owen.

Ruabon.

July 30th, 1921.

Leeds Electrical Training Centre.

I have pleasure in supplying the following further information on the subject which is referred to in the letter from your correspondent "Rotary."

The transformer was one of a variety of special orders which are accepted in our electrical department in order to give trainees practice in actual construction, after they have acquired sufficient knowledge and skill by carrying out the graduated exercises which occupy the earlier part of the course of training. Such exercises are necessary in order to provide a general all-round training in the time available, but they need to be supplemented by a certain amount of complete construction to maintain the learner's interest, and to give him confidence in his work.

The 20,000-volt transformer was one of these orders, and in this sense only was it special. The whole of the work was done by the trainees themselves, the skilled instructor merely directing and supervising their work. It should be understood that the necessary skill in manipulation had been gained by the repetition of similar steps in the course of exercises. In this preliminary training each process has to be repeated by the learner until he can execute it to the satisfaction of the instructor. It is only then that he is allowed to proceed to the next step in the course.

The result of this systematic instruction is that a complete job can be undertaken with a reasonable prospect of success on the first test, as in the present instance. It was not until the pressure reached 100,000 volts that discharge took place across the terminals of a coil. The pressure was again run up and reached over 100,000 volts before a breakdown occurred, this time at a coil terminal. When it is borne in mind that the tests were made on the unfinished transformer, and in air instead of in oil, as is intended, it will be agreed that the work was a credit to the trainees and a proof of the thoroughness of the instruction.

This department of the school is run as nearly on business lines as is consistent with the exigencies of training. If "Rotary" or any other of your readers would like to see the methods of instruction for themselves, they might call here, and Mr. H. J. Fuller, who is in charge of the electrical training workshops, will be pleased to show them over the same any day (except Saturdays) after the 15th inst.

R. E. Barnett,
Principal.

Central Technical School,
Leeds.

August 3rd, 1921.

Battery Explosions.

The lack of detail in "Denze's" letter in your last issue makes it a little difficult to visualise the exact conditions under which the explosions occurred.

It is to be presumed that the storage cells in question are of the small portable type, having lids which enclose the tops, and as the charging of the three cells was almost complete, it is quite likely a quantity of hydrogen and oxygen gases had accumulated in the top of the cells, thus forming an explosive mixture, which, if ignited, would explode with a loud report.

In connecting the fourth cell in series with the other three, it is possible that at the point of interconnection a spark occurred, and as the atmosphere in the neighbourhood of the terminal of cell No. 3 might very easily be charged with the explosive mixture of gases extending from the cell vent, this would account for the explosion occurring. I have known

similar instances to occur on many occasions, and as there is a tendency on the part of some battery users to-day to prefer an "enclosed" type of cell, even in a medium size, as used for house lighting and stationary purposes where portability does not necessarily enter into the question, it is perhaps advisable to sound a note of warning and remind such users that wherever there is any chance of battery gases accumulating, whether in the cell itself or in a larger space, such as a battery room, the utmost care should be taken to avoid a light or spark being brought into the vicinity where the gases are.

It is true that with an "enclosed" type of cell, an explosion of the kind reported by your correspondent usually results in the cell suffering some damage, but as no mention is made of any such damage in this instance, it points to the possibility of the cells not being of the "enclosed" type. If such is the case, and the cells have their tops open to the air, it is still possible that the surrounding atmosphere contained sufficient battery gases to form an explosive mixture, and even a small spark would suffice to cause the necessary ignition.

With cells contained in celluloid boxes, the danger is still worse. The white froth which appears in some types of celluloid cells during charging is highly explosive, and I am not sure whether your correspondent may not be referring to such froth when he refers to the "milky-white" appearance of the electrolyte.

I am also not clear what is meant by the electrolyte being "greatly disturbed," but possibly the concussion caused by the explosion was sufficient to liberate some of the occluded gas from the plates, and the passage of the gas bubbles through the electrolyte might have given the latter the appearance which your correspondent describes as "greatly disturbed."

F. J. Holmes.

Hart Accumulator Co., Ltd.

London.

August 6th, 1921.

With reference to the above matter, the explanation is as follows: During charging the water in the electrolyte is decomposed and split up into its constituents H_2O , i.e., two parts of hydrogen and one part of oxygen—a most explosive mixture, and easily ignited by a defective contact or the fusing of connecting wires on the charging cells. Some people are careless enough to use 5-amp. fuse wire to connect one cell to another, and the result is, in many cases, that the wire fuses, and coming in contact with the celluloid casing, sets fire to it, as well as causing an explosion that wrecks the whole cell.

A friend of mine was nearly blinded some years ago by a similar experience, the electrolyte being shot into his eye when bending over and disconnecting some charged cells.

Should any of your readers have the misfortune to experience such a painful accident, the remedy is immediately to dash the face in a bowl of clean water and open the eyes wide whilst under water.

J. Thain.

Gloucester.

August 6th, 1921.

[Dilute ammonia should always be kept handy where acids are used.—EDS. *ELEC. REV.*]

THE FARADAY SOCIETY.

PIEZO-ELECTRIC EFFECTS IN ROCHELLE SALT CRYSTALS.

THE feature of the June meeting of the Faraday Society was a demonstration by Mr. E. KILBURN SCOTT of the remarkable piezo-electric properties of Rochelle salt crystals. The experiments were originally carried out on behalf of the American Telegraph & Telephone Co., by Mr. A. McLean Nicolson, and they promise important applications in telephone practice. The effect is based on the well-known fact that many crystals will become electrically polarised when subject to changes of stress and conversely they will dilate or vibrate when electric forces are applied to them. The effect takes place in crystals which are optically active because of their asymmetrical structure, and it has been found particularly in Rochelle salt crystals (sodium potassium tartrate) prepared in a certain way described in detail in the paper, which, on account of the rapidity of growth, develops internal stresses in the crystals.

The finished crystal after drying, baking, and other suitable treatment, is varnished and waxed tinfoil electrodes are pressed on it. It is then placed between two aluminium disks held together by small steel springs, which can be tightened by thumb screws after the crystal has been inserted. Any part of the metal structure will readily convey vibrations to the crystal, which in turn may be converted into telephonic currents. A crystal used on a phonograph record, and adjusted so as to be subject to torsional vibrations, will generate several volts, and can operate a large number of telephone receivers. As many as 200 receivers have been operated from one crystal.

With the aid of a vacuum tube amplifier very good transmission of speech and music may be obtained by using these crystals at both ends of a long line as the sole transmitting and receiving apparatus.

HIGH TEMPERATURE PHENOMENA OF TUNGSTEN FILAMENTS.

At the same meeting, Mr. C. J. SMITHELLS, on behalf of the research staff of the General Electric Co., gave an account of recent experiments on the above subject.

It is well known that nitrogen or argon at about one atmosphere pressure is now introduced into tungsten filament lamps in order to suppress volatilisation of the filament and permit of a higher temperature being employed, and hence higher efficiency. This higher temperature has introduced new problems in the behaviour of the filament, and the experiments described were carried out in order to study causes of failures in filaments due to:—

1. Alteration in the crystalline structure giving rise to brittleness and deformation.

2. Reactions between the filament and gases existing in the lamp.

(1) In gasfilled lamps the filament reaches a temperature of 2,500 deg. K., and considerable changes take place in the structure of the filament. Two types have to be considered, the pure tungsten filament and one containing up to about 1 per cent. of a refractory oxide, usually thoria. The pure filament before burning has a fibrous structure, but on incandescence the fibres break up into crystals. In a gasfilled lamp the crystal growth takes place very rapidly, and continues until the diameter of the crystals is about equal to that of the wire. Mr. SmitHELLS showed some striking lantern slides illustrating these changes, and it was interesting to note that a filament burning 600 hours was not substantially different from one which had burnt some 20 hours. The increase in grain size brings about deformation in the filament, and hence lessens its mechanical strength.

In the so-called "thoriated" filaments crystal growth is restrained, and the filament is composed of relatively small grains even after 600 hours' burning. Hence these filaments deform very little.

In some cases red phosphorus and other reducing agents are introduced to remove traces of oxidising gases, and the effect of these on the crystal growth has also been studied. It was found that the grain size obtained with a thoriated filament and excess of phosphorus had the same value as that obtained with pure tungsten.

(2) The second part of the paper dealt with chemical reactions which occur in gasfilled lamps when traces of impurities are in the gas. In the case of hydrogen there is no reaction. A small quantity of oxygen rapidly attacks the filament, and is probably the cause of the frequent blackening of bulbs. The presence of water vapour has the effect of thinning the filament at points adjacent to the supporting wires and the filament ultimately fails. This action is due to formation of tungsten oxide at the hotter points of the filament and subsequent reduction at the colder points.

The action of carbon dioxide is similar to that of oxygen. In the case of carbon monoxide this gas is broken down to carbon, which is deposited, and carbon dioxide which slowly attacks the filament. Hydrocarbons attack the filament very vigorously, and it becomes brittle and soon breaks.

The following papers were also presented: "The potential of the iodine electrode, and the activity of the iodine ion at 25 deg. C.," by A. McKeown; "The influence of the solvent upon ionisation and the accompanying heat effect," by Sidney Maurice Neale; "A simple apparatus for determining the coagulation velocity of gold sols," by Emil Hatschek.

The Demand in China.—According to a statement said to be based upon the report for 1920 of the Chinese Marine Customs Administration, the demand for electrical plant is greater than the supply. Towns of a population of 30,000 persons in South China were equipped with installations years ago, and this development has constantly increased.

Cleaning Condensers.—The use of hydrochloric acid for cleaning condensers was described by Mr. N. G. Hardy in the *Electrical World* of July 9th. The tubes are first washed out with water and the scale is removed from the water boxes; after cleaning and thoroughly drying, the water boxes, heads, and tube sheets are painted with two coats of roofing cement, and the water inlet and outlet are blanked off. After replacing the heads, the water box is connected to a steel tank at a higher elevation, vent pipes about 12 ft. long are connected to the water compartments, and a brass centrifugal pump to circulate the solution is coupled up to the water box. Commercial acid containing about 24 per cent. HCl is used, 1,000 lb. of acid being mixed with 7,800 lb. of water, which gives a strength of about 3 per cent. The pump is run for four or five hours, when the acid is entirely neutralised. The solution is allowed to stand for a day; it is then drained out, and the tubes are individually washed and brushed with a wire brush. The great advantage of acid treatment is that the scale is softened and loosened, so that it can be easily removed. It is better to treat a very dirty condenser several times with weak acid than to use a stronger solution. The cost of the acid is an objection to the method where the tubes are in good condition and the scale is not too hard for mechanical cleaning; but no serious damage is done to the tubes by the use of acid, and the loss due to breakage of old tubes in the course of mechanical cleaning is avoided.

BUSINESS NOTES.

Company Liquidations.—**WHOLESALE ELECTRICAL CO., LTD.**, Oxford Street, London, W., and Dunsmore Road, Stoke Newington, London, N.—The statutory meeting of the creditors of the above was held on August 5th at the Institute of Chartered Accountants, Moorgate Street, E.C. Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C., one of the liquidators of the company, presided. The statement of affairs presented showed liabilities of £10,602, of which £9,675 was due to the trade, while the bank was interested for £219, and there were sundry creditors for £307. A sum of £300 was set down as owing in respect of E.P.D., but it was pointed out that owing to the losses latterly made by the company that claim would probably be withdrawn, while it might also be possible to obtain the repayment of a similar sum. The assets were estimated to realise £7,600, from which had to be deducted £883 for preferential claims, leaving net assets of £6,717. The assets were as follows: Book debts £1,692, estimated to realise £1,500; Stock-in-trade £9,142, expected to produce £5,000; fixtures and fittings £577, valued at £100; machinery and plant at Dunsmore Road £2,447, expected to produce £1,000. About 50 per cent. of the stock represented partly made goods, and at a forced realisation would not realise anything like their value. The liquidators were of the opinion that it would be best to finish the manufacture of the stock, and there would be no difficulty in disposing of it. The leasehold factory at Dunsmore Road was held on a long lease at £800 per annum. The company, in June of last year, paid a premium of £1,500 for the lease, but its present value was doubtful. Mr. Hawkins reported that the company was registered in July, 1915, with a nominal capital of £2,000. The capital was increased to £10,000 in January of last year. The company was formed and acquired an existing business, and allotted to the vendor 835 fully-paid shares of £1 each for the goodwill of the business. The company carried on business successfully up to last year. During the year ended June 1917, the turnover was £25,600, with a gross profit of £2,600 and a net profit of £957. In the following 12 months the turnover increased to £41,935, the gross profit being £3,790 with a net profit of £640. During the year ended June, 1920, the turnover rose to £71,475, with a gross profit of £14,607 and a net profit of £1,262. In the following 12 months the sales dropped to £54,400, the gross profit being £7,250, and there was a net loss on the trading of £3,960. The present position of the company was attributed to the general depression in trade, strikes and the delay in receiving deliveries from manufacturers. In answer to questions, Mr. Hawkins stated that there were no debentures or any charges on the assets. The matter was a straightforward one, and there was practically nothing to call for comment. A resolution was unanimously passed confirming the appointment of Mr. E. H. Hawkins and Mr. T. W. Greaves as the joint liquidators of the company, while an informal committee of the principal creditors was also elected. The following are creditors:—

Allen, E. P.	15	Johnston, R., & Co.	13
Armstrong, Stevens & Co.	27	Kent, W.	214
Adair, George	45	Lilly & Son	237
Accessories Electrical Co.	66	Lofthouse, Crosbie & Co.	239
Burrows & Dunnis	62	Leach, S. G., & Co., Ltd.	28
Buck & Hickman	23	Lowe, M.	13
Bonella Bros.	237	L.W.C. Electrical Construction Co.	49
Butlers, Ltd.	1,256	Lawton & Son	108
Bray, G., & Co., Ltd.	26	Manifolds, Ltd.	18
Cranfield Rubber Co.	270	Metal Tubes & Fittings Co., Ltd.	28
Camper, C.	230	Makin, W., & Co.	15
Cheadle & Walther, Ltd.	158	Malleable Fittings Co.	17
Cakebread, C.	11	Marbro, Ltd.	15
Chapman, H. W., Ltd.	30	McKechnie Bros., Ltd.	31
Chubb, J.	10	Norris, T. G.	127
Corke, C. E., & Co.	15	Newman Electric Co.	16
Dale Fort & Co., Ltd.	137	Partridge, H. A.	10
Dellagana, B., & Co., Ltd.	11	Seapham & Wood	41
Diamond Co., Ltd.	33	Reliance Electric Wire Co., Ltd.	15
Durand, Sedgwick & Bird	31	Seale, A., & Co.	15
Dorman & Smith, Ltd.	10	Sells, Ltd.	121
"Electrical Review"	50	Sydenham & McQuistrie, Ltd.	319
"Electrical & Ordnance Accessories Co., Ltd.	67	Sweeney & Bouldridge	176
"Electrical Contractor" Co., Ltd.	49	Stott, James, & Co.	17
Food Engineering Co., Ltd.	47	Shaw's Glazed Brick Co., Ltd.	11
Farmer & Co.	22	Shannon, John, Ltd.	23
Forester & Fox, Ltd.	28	General Accessories Co.	514
Gilson, D., & Co., Ltd.	396	Ward & Goldstone, Ltd.	10
Geipel, W., & Co.	10	Ward & Goldstone, Ltd.	10
Hawkins Bros. & Co., Ltd.	59	Singleton, Bendis & Co.	170
Hewkins Bros. & Co., Ltd.	15	Taylor, Tunncliffe & Co.	80
Houston & Dugard	474	Watshams	10
Harper, Sons & Co.	141	Wilson, John, Ltd.	23
Herr, L.	193	"Z" Electric Lamp & Supplies	14
Henry, A.	29	Co., Ltd.	14
Hand, C., & Co.	25	Moir, Matthes & Co.	507
Imperial Lighting Co.	13	Davis Gas Stove Co.	17
Ironclad Switchgear Mfg. Co.	15		

GRATZE, LTD., Whitfield Street, London, W., mechanical and electrical engineers.—The statutory meeting of creditors was held on August 4th at the Institute of Chartered Accountants, Moorgate Street, E.C. Mr. R. B. Gray, C.A., of 44, Gresham Street, E.C., the receiver for the debenture holders and the liquidator in the voluntary liquidation of the company, presided. He stated that the present company was registered last year and was formed to take over as from March 31st, 1920, the assets and liabilities of the old company, which

traded under a similar name. The purchase consideration payable to Mr. Gratze, the liquidator of the old company, was £25,000, which was to be discharged by the payment of £20,000 in shares and £5,000 in cash. The assets taken over by the company were valued at £33,615, but there were liabilities of £8,675 which had to be discharged. The assets taken over consisted of stock and work in progress, £7,201; plant, machinery, furniture, &c., £18,117; book debts, £2,237; leasehold premises, £2,300; and goodwill and patents, £4,099. The 20,000 fully-paid £1 shares were duly allotted to Mr. Gratze, but he only received £3,500 in cash, of which £700 came back to the company. Under those circumstances Mr. Gratze as the liquidator of the old company was now a creditor for £2,200. To provide funds for the new company £10,000 was obtained on debentures, while in April of the present year a further £2,000 was raised on debentures. The company took over a number of contracts, but finally the trade depression set in, and orders were cancelled, while no fresh inquiries came along. The unsecured liabilities of the company, the chairman stated, amounted to £8,419, made up as follows: Trade creditors, £2,600; directors' fees, &c., £1,471; cash creditors, £1,700; bank overdraft, £151; and liquidator of old company £2,486. The assets were set down at £26,536, but they were only estimated to realise £8,663, from which had to be deducted £538 for preferential claims, leaving net assets of £8,125. Those assets were not sufficient to discharge the claims of the debenture holders, and there was nothing available for the creditors. The deficiency as regards the creditors was £12,308, and as regarded the shareholders it amounted to £32,310. In answer to a question, the liquidator said he did not think there was any chance of the unsecured creditors ever receiving a dividend. No resolutions were passed and, therefore, the voluntary liquidation of the company will be continued with Mr. Gray as the liquidator.

ORIZABA TRAMWAYS SYNDICATE, LTD.—Meeting called for September 12th at Sardinia House, Sardinia Street, W.O., to hear an account of the winding-up from the liquidator, Mr. A. F. Dickin.

SUTTON-IN-ASHFIELD MOTOR & ELECTRICAL ENGINEERING CO., LTD.—Meeting of creditors called for August 16th, at 3, King John's Chambers, Brindlesmith's Gate, Nottingham. Liquidator, Mr. J. Keetley.

Bankruptcy Proceedings.—**HARRY MICHAEL WOLLMAN, 9, Greensboro' Road, Parkgate, near Rotherham, Yorkshire, electrical factor.**—The public examination of this debtor was held recently at the County Court Hall, Bank Street, Sheffield. The statement of affairs showed liabilities amounting to £184, against assets £34. Debtor attributed his failure to trade depression, the coal strike, and losses through damage to goods. The examination was closed. The following are creditors herein:—

Marsh Bros. (Electricians), Ltd., £100; Phoenix Supply Co., Ltd., £79. **EDWARD STANLEY TAYLOR, electrical engineer, Wilson's Buildings, Stenhousemuir, Stirlingshire.**—At Falkirk, on the 8th inst., this examination in bankruptcy took place, after which the statutory oath was administered. Bankrupt stated that he started business in January, 1920, without any capital; he borrowed £50 in June of the same year. His statement of affairs showed that he was owing trade accounts to the extent of £384, and that between his stock and book debts his assets amounted to between £80 and £90. He calculated that he had lost £430 in under-estimating contracts, and that his expenses were generally bigger than his income. When asked if he attributed his bankruptcy entirely to losing on the various contracts, he said that he became insolvent in the first place through under-estimating; in the second place, owing to his high expenses in running the business, and, lastly, his position was due to what he described as victimisation by other contractors.

ROBERT CHAS. JONES, electrical engineer, lately trading as Elect. Ma. Engineering Co., 10, Gledonia Street, King's Cross, N.—This debtor again attended before Mr. Registrar Mellor at the London Bankruptcy Court on Tuesday in relation to his public examination. Particulars of the failure recently appeared in these columns. Mr. F. T. Garton, Official Receiver, reported that the debtor had furnished the further particulars required, and he accordingly had no more questions to ask him. The examination was concluded.

Dissolution of Partnership.—**HALLINAN & FLETCHER, taxicab proprietors, electrical engineers, &c., Halfway Garage, Cathedral Road, Cardiff.**—Mr. B. P. Hallinan and Mr. T. J. Fletcher have dissolved partnership.

Trade Announcements.—**THE JACKSON ELECTRIC STOVE CO., LTD.**, has appointed Messrs. Witty & Wyatt (Cardiff), Ltd., of 5, Burt Street, Clarence Road, Docks, Cardiff, as its agents for Wales and the West of England, and Mr. Blogg is not now its agent. The firm will hold a showroom stock.

THE BRITISH CENTRAL ELECTRICAL CO., LTD., has recently been appointed sole selling agent for Messrs. Richardson, Westgarth & Co., Ltd., for the sale of their productions, comprising steam turbines, condensers, boilers, &c.

The publicity organisation of the **GENERAL ELECTRIC CO., LTD.**, has now been removed from Queen Victoria Street,

E.C. to the new head offices at Magnet House, Kingsway, London, W.C.2 (telephone No.: Regent 7050, 50 lines), and all correspondence relating to publicity matters should be sent there.

THE MAGNETA TIME CO., LTD., of Westminster, has acquired the control of the Standard Time Co., Ltd., 19-21, Queen Victoria Street, E.C., and "Magna" directors have personally acquired the control of the **Lowne Electric Clock & Appliances Co., Ltd.**, 108, Bromley Road, Catford, S.E., and the **Silent Electric Clock Co., Ltd.**, 192, Goswell Road, E.C.1. We are informed that the change is expected to result in reduced cost of manufacture. The Catford works are being considerably enlarged and additional plant is being installed. It is not intended to change the personnel of the various businesses, which will be conducted as heretofore.

THE WHOLESALE FITTINGS CO., LTD., has removed its Manchester branch to larger premises at 78 and 80, High Street, the first floor of which is fitted out as a showroom.

MESSRS. SIMPSON, BAKER & CO., electrical and mechanical engineers and merchants, have removed their Cardiff depot to 12, Westgate Street, Cardiff. Telephone No. 3403.

Semaphore dry batteries and cells are now controlled by **Messrs. Harwell, Ltd.**, of 2, Bayley Street, Tottenham Court Road, W.C.1, who are also sole selling agents for insulating material made by the **Improved Solidite Co., Ltd.**

MESSRS. TWISS ELECTRIC TRANSMISSION, LTD., of 39, Victoria Street, S.W.1, have added an extra telephone line, and the number has been changed to "Vic. 3310," 2 lines.

Catalogues and Lists.—**Z ELECTRIC LAMP & SUPPLIES CO., LTD.**, 73, Newman Street, W.1.—A showcard and folder illustrating the "Electrolux" portable cleaning apparatus.

MR. T. L. REED COOPER, II, Tothill Street, Westminster, S.W.1.—An illustrated brochure describing in detail immovable electric pumps, and giving particulars of various sizes.

NATIONAL X-RAY REFLECTOR CO., Chicago (U.S.A.).—Two profusely illustrated booklets dealing with the use of "X-ray" lighting reflectors, principally for the illumination of shop windows.

THE SUN ELECTRICAL CO., LTD., 57-59, Neal Street, Long Acre, W.C.2.—List No. 317. An illustrated folder giving revised prices of "Sunco" electric fires.

THE NUNEATON ELECTRICAL CONTRACTING CO., LTD., Market Place, Nuneaton.—An illustrated descriptive list of new type link disconnecting boxes and service boxes. (Described in our issue of April 8th last, p. 437.)

MESSRS. JOHNSON & PHILLIPS, Charlton, S.E.7.—List J.B.2. A well-produced list of mining type cable boxes of all descriptions, high- and low-pressure, straight-through, 3-way and 4-way, disconnecting and non-disconnecting, dividing, &c. Details of glands and armouring clamps are also included.

SEMAPHORE, LTD., 2, Bayley Street, Tottenham Court Road, W.C.1.—A card giving prices of batteries for flash lamps, torches, &c.

For Sale.—**MESSRS. EDWARDS, SON & BIGWOOD** are to sell by auction at Branson, Burton-on-Trent, surplus plant and machinery, including electrical motors, &c. For particulars, see our advertisement pages to-day.

Peterborough City Council invites offers for one overhead travelling crane, by Gibbons & Co., Ltd., 20 ft. 9 in. span, to lift 6 tons.

Fire.—As the daily Press reports may convey a wrong idea of the extent of the damage, we are asked to state that the fire at the Falcon Works, Loughborough, of the Brush Electrical Engineering Co., Ltd., last Saturday, has not in the least curtailed manufacturing operations. One of the timber sheds with its stock of timber was completely destroyed, together with some log converting machines. The large stock of cars, omnibuses, and similar work in process of manufacture was unharmed. The engineering section of the works, which is away from the scene of the fire, is also intact.

The L.C.C. Turbo-Generator Contract.—With further reference to the contract recently placed with a Swiss firm by the L.C.C. Highways Committee for an 8,000-kW turbo-generator set, we have received from the British Engineers' Association a copy of a letter addressed to the chairman of the L.C.C., in which the Association puts forward the following statement:—

"The London County Council makes its purchases with public funds for the purpose of rendering public services, and if the purchases be made in this country the money expended remains here. In the case of an order for a turbo-generator, it is fair to say that at least 80 per cent. of the purchase price would be distributed amongst our own people in the form of wages and salaries. If, on the other hand, the purchase be made abroad, the money leaves this country, and in something like the same proportion is distributed to foreign labour and salaried officials. Our cost of manufacture is relatively high, because of the larger amount of purchasing power demanded by our workers in return for their production of a given commodity value. Surely the people of this country, who are themselves responsible for the high cost of manufacture, owing to their defiance of sound economic principles, should ungrudgingly pay the higher prices for the products of the home industries, which are the primary source of any well-being they have ever enjoyed or ever will enjoy. A high standard of real wages cannot continue to co-exist with

discrimination, on the part of the spender, against dear home products in favour of the power-priced products of other countries where the wages cost per unit cost of value produced is substantially lower. The two conditions are mutually exclusive. Turbo-generators are dear in this country, but the reason is not far to seek, and our own people are in duty and honour bound to pay the higher prices which they themselves have created and which are eventually redistributed amongst them. Hoping that further consideration of the proposed transaction may result in justice being done to British labour, even at the cost of conferring some small benefit on British capital and brains."

The clerk to the Council replied to the above communication under date August 2nd, stating that the Swiss tender was some £8,000, or about 16 per cent. lower in amount than that of the lowest acceptable British tender.

This matter was raised in the House of Commons on Tuesday. In reply to a question by Mr. G. Balfour, Sir P. Lloyd-Greame (Director of the Overseas Trade Department) said that the Government had no power to interfere with the discretion of local authorities in a matter of this kind. He was informed that the British firms were invited to amend their original tenders. Mr. Balfour drew attention to the difference in hours of labour and rates of pay in this country and in Switzerland, and asked for some method of fair trade to be secured as between foreign countries and ourselves. In reply, it was stated that these considerations were present to the minds of the local authorities when placing the contracts. Another member asked whether a number of the shares in the foreign company were owned by British firms in this country, but Sir P. Lloyd-Greame replied that he did not see that that made the least difference, as the employment would go to foreign and not to British workmen. Mr. Balfour thought it a matter for broad legislation so far as securing fairer trade between home and foreign manufacturers was concerned, but Sir P. Lloyd-Greame replied that it would be obviously impossible to legislate in order to control the placing of all contracts.

Book Notices.—Publications of the Massachusetts Institute of Technology, Vol. 56, No. 30, "A Dynamometrical Comparator; a differential dynamometer for accurate comparison of alternating and direct current strengths," No. 31, "Induction Motor Core Losses." Boston (Mass.): The Institute.

"Steam Boiler Maintenance." By R. Clayton, pp. ix+118; 4 figs. London: Sir I. Pitman & Sons, Ltd. Price 2s. 6d. net. "Principles of Radio Communication." By J. H. Morecroft, pp. x+935, illustrated. London: Chapman & Hall, Ltd. Price 45s. net.

"The Electric Furnace." By J. N. Pring, pp. xii+485; 241 figs. London: Longmans, Green & Co. Price 32s. net.

"Fifty Years of Electricity—The Memories of an Electrical Engineer." By J. A. Fleming, D.Sc., F.R.S. (384 pages and 111 plates.) London: The Wireless Press, Ltd. (To be published shortly.) This history of electrical engineering commences in 1870 and, therefore, covers practically the whole of the science and art.

The *Transactions of the South African Institute of Engineers*, Vol. XII, Part 6, June, 1921. Price 2s. net. Containing discussions on a number of papers which have recently appeared in the journal.

South African Engineers' Electrical and Allied Trades' Directory, published by the *South African Mining & Engineering Journal* in Johannesburg, and sold in this country at 82-85, Fleet Street, London, E.C.4, by Argus South African Newspapers, Ltd. 1921-22 edition. 30s.—This directory, which is quite business-like in get-up and arrangement, covers all branches of the engineering, electrical, iron, steel, machinery, constructional, automobile, hardware, and allied trades throughout the Union, Rhodesia, and Mozambique. The names of 1,500 firms appear in the alphabetical section, which is followed by a geographical section. Other features are sections giving particulars of the overseas agencies held by South African firms; a list of mining and industrial undertakings, with the names of their officials; and a list of municipalities and public supply undertakings. These and other contents should be of great use to home firms doing or contemplating export trade to South Africa.

South African Electrical Trade.—The *British and South African Export Gazette* states that the growing importance of the South African market for electrical material and machinery is demonstrated by the £1,683,112 registered for imports last year. In 1919, £972,398 worth was imported, but from 1910 until that year nothing over £550,000 had been recorded. Some £450,000 is to be spent on the Union telegraph and telephone systems this year. A substantial improvement in the business in electrical supplies may be looked for on the Rand in about two months' time, when additional power will be available.

Our contemporary also draws attention to the increased purchases of electric cooking and heating appliances which are now being made. During the first quarter of the current year imports to the value of £16,605 were registered, as compared with only £3,645 for the same period in 1920, and the demand has since been steadily increasing. "The United Kingdom, of course, now holds the bulk of this business, and is fast cutting out the United States, which last year only managed to secure £9,414 out of £41,337, as compared with £13,688 out of £23,616 in 1919."

Big Reduction in Steel Workers' Wages.—The heavy deflation of iron and steel prices is reflected in the monthly ascertainment of the Midland Wages Board. Since January the average net selling price of finished iron has fallen by over £13 per ton, and the effect of the ascertainment is to reduce ironworkers' wages by 80 per cent. as from Monday last. The decline since February is 142½ per cent. The wages of men not affected by the sliding scale are down 16s. per week.—*Financial Times*. (These percentages are based on the pre-war rates.)

Swedish Wages Reduced to meet German Competition.—Ironworkers and engineers at the Eskilstuna factory, near Stockholm, are reported to have agreed to accept reduced wages in order to meet cheap German competition and secure for Sweden a big Russian order for locomotive parts.—*The Times*.

Sheffield Rejects the German Plant Tender.—The "Daily Mail" states that the Sheffield Electric Supply Committee has decided to reject the German offer (that of the Amsterdam Corporation) to supply a 10,000-kW generating set for £50,000. The lowest British tender at current costs exceeds £90,000, and the buying of plant is to be deferred. Prices, it is thought, will have fallen enough some months hence to enable the Corporation to place the contract with a British firm.

It may be recalled that when the matter was under discussion a few weeks ago, Mr. W. L. Hichens, chairman of Messrs. Cammell, Laird & Co., Ltd., and deputy-chairman of the English Electric Co., Ltd., stated that if the Sheffield City Council was going to set an example of buying the special products of Sheffield abroad, it was difficult to see how other corporations could be persuaded not to follow its example. An ounce of practice was worth a ton of theory. High rates were an important factor in handicapping us against the Germans, and the policy of the council would appear to be to increase unemployment, and thus swell the already swollen rates. Thus they went round in a very vicious circle.

On July 13th the Sheffield correspondent of the *Financial Times* said it was unlikely that the corporation would accept the recommendation to purchase from Germany. The committee which originally made the recommendation had asked to be allowed to reconsider the matter, the chairman stating that the publicity that had been given to the proposal had done an enormous amount of good and brought British competitive prices down.

Scottish Electricians' Wages.—Throughout Scotland, meetings of the Electrical Trades Union are being held, at which the employers' new conditions are being submitted to the men. In the meantime, it is stated, the Scottish Contractors' Association have withdrawn their proposal to reduce wages by 2d. an hour from September 1st.

Cable Makers' Association.—We are notified that in the case of cable drums supplied by members of the Cable Makers' Association subsequent to August 1st, 1921, a reduction of 25 per cent. from the current prices will be allowed, and the same reduction will be allowed for all periods of hire (that is beyond the free loan period of three months subsequent to August 1st, 1921).

Excess Profits Duty.—On the application of the Monte Video Telephone Co., Ltd., the Board of Referees under the E.P.D. has increased the statutory percentage to 7½ per cent. for companies providing telephone services in Uruguay as from December 31st, 1916.

The E.T.U. and Non-Union Labour.—A recent report of the Electricity Supply Committee of the Stepney Borough Council shows that the E.T.U.'s "ban" on the connecting-up of non-union installations has been extended in another direction. The report says that cases have occurred in the borough in which the E.T.U. has given instructions that kinemas are not to be connected to the supply mains if the operators at these places are not members of the E.T.U., in spite of the fact that the installations have been executed by members of the Union. Apart from this, music halls are also affected. One case, in which legal proceedings against the Council are threatened, is that of the Royal Cambridge Hall. Although the wiring, &c., was carried out by E.T.U. members, connection is refused on the ground that several employees at the theatre are not members of the National Association of Theatrical Employees. The installation contractors are unable to carry out final tests, and until they do the proprietors of the theatre will not pay the account, and in consequence are threatened with legal action. In turn the proprietors also intend to sue the Council if the necessary connections are not made. The London District Organiser of the E.T.U. expresses regret that the "ban" cannot be removed, "as this is a trade dispute which involves fundamental principles for the trade-union movement." The committee is of the opinion that the matter should have been raised before the wiring was carried out. It is also stated that this is not an isolated case. The committee recommends "That the Council do authorise the Borough Electrical Engineer and Manager to give the necessary instructions to the Council's employees requiring them forthwith to connect up the 'Royal Cambridge Music Hall' with the Council's mains and to maintain such supply when supplied, and also to give similar instructions with regard to connections to other places of amusement."

Four Years' Electrical Progress in Russia.—In a long descriptive article on the progress of electricity in Russia since the revolution, the *Novy Mir* summarises in tabular form the

results alleged to have been attained, as follows:—In the year 1917, four town stations of 2,421 kW and two village stations of 59.2 kW were opened; in the year 1918 six town stations and two village stations were opened, totalling 4,704 kW and 53.4 kW respectively. The corresponding figures for 1919 were 24 town stations and 13 village stations, or 1,305.3 and 342.7 kW respectively; in 1920, 47 town stations and 53 village stations, of 7,670 kW and 1,029 kW respectively. Progress appears to have slowed down in 1921. As far as it has gone, the year shows only 22 new town stations and 17 new village stations, the respective total powers being 1,683 kW and 320.6 kW. It is pointed out that powerful new stations are being built, and old ones are being enlarged in five governments, in of any form of trade which private enterprise could carry on, and asking for the discontinuance of operations by the Electricity Department in the sale of electrical appliances, &c.

Wolverhampton Contractors' Protest.—At a meeting of the Town Council on August 3rd a letter was read from Mr. Ellis Aldridge, an electrical contractor, enclosing a resolution passed by a well-attended meeting of electrical engineers and contractors protesting against competition carried on by the Wolverhampton Electricity Department. The matter was referred to the Electricity Committee, as also was a protest from the local branch of the Middle Classes Union. That organisation sent a resolution protesting against the municipalisation of any form of trade which private enterprise could carry on, and asking for the discontinuance of operations by the Electricity Department in the sale of electrical appliances, &c.

Annual Outings.—The employees of the HART ACCUMULATOR CO., LTD., of Stratford, held their twenty-fourth annual outing on Saturday, July 23rd, going by charabanc to Southend. The party was photographed during a halt at Brentwood. Dinner was served at the Maisonette Cafe, High Street, Southend. The toast of the Hart Accumulator Co., Ltd., was proposed by the chairman (Mr. F. J. Holmes, M.I.E.E.), manager of the company, who in a few well-chosen words referred to the difficult times caused by trade depression, the coal strike, &c., through which the company had safely passed, and urged upon the employees the necessity for taking their share of hard work to enable conditions to become more normal. Mr. C. Cartwright (vice-chairman) proposed the toast of "The Chairman," which was suitably responded to. Thanks were expressed to the committee who organised the successful outing, and to Messrs. W. McDonald and C. Cartwright, who acted as hon. secretary and treasurer respectively.

The annual outing of the employees of MESSRS. HIGGINS AND GRIFFITHS, LTD., took place on July 9th. The party, accompanied by Mr. Albert Higgins, one of the principals, left Faddington for Windsor, whence by private launch they were conveyed to Cookham and district. The river trip was much enjoyed. Luncheon and tea were served on board to the strains of music provided by an orchestra. Toasts were given by the president, and were suitably responded to. At Cookham, sports occupied attention, and the party then returned to Windsor, where, during a concert interval, the sports prizes were presented. Mr. J. Ansell organised the arrangements with the assistance of Mr. Barclay, treasurer.

On Saturday last the staff and employees of Messrs. Robson & Coleman, of Newcastle-upon-Tyne, went for their annual excursion to Warkworth by charabanc. The party arrived there about midday, and after lunch, games and sports were entered into. A company numbering over 100 sat down to tea, after which prizes, provided by Mr. and Mrs. Robson and Mr. Ridley, were presented to the fortunate winners in the Castle Grounds.

The Electrical Contractors' Association.—The August number of *The Electrical Contractor* records the election of Mr. Orringe as President and the re-election of Mr. H. Maryat as hon. treasurer. The following committees have been appointed (chairmen's names are given in parentheses): Propagandist (Mr. W. A. Shaw); Law and Parliamentary (Mr. W. Cross); Apprenticeship (Mr. A. E. Chesters); I.M.E.A. and Registration (Mr. H. J. Cash); Finance (Mr. Orringe); Trading (Mr. Heywood); *Electrical Contractor* (Mr. Baxter).

Contemplated Withdrawal from Industrial Council.—The Transport and Electricity Committee of Newcastle-upon-Tyne Corporation has decided to hold a special meeting to consider the advisability of withdrawing from the National Wage Agreement and the Industrial Council, as it is not satisfied that the reductions, &c., proposed are adequate to meet the circumstances, having regard to what has been done in other industries.

"Whirlwind" Advertising.—THE PORTABLE UTILITIES CO., one of whose specialities is the "Whirlwind" suction sweeper, conceived the idea of bringing to life a familiar figure in its advertisements of the appliance. Accordingly a lady dressed in a costume on conspicuous lines—spiral lines suggestive of a whirlwind, and equipped with an umbrella also bearing a spiral design and an announcement—was engaged to promenade the streets of a well-known seaside resort. The electrical dealers of the town co-operated with window displays, and excellent results are anticipated.

British Industries Fair.—CORRECTION.—In our issue of July 29th we gave the address of the General Manager of the British Industries Fair (Birmingham) as 73, New Street; the correct address is Chamber of Commerce Buildings, 95, New Street.

An Electrical Conference in France.—The Union des Syndicats de l'électricité, constituting an international conference in Paris in October for the discussion of all problems relating to the transmission of electricity in bulk. The conference will probably meet before the end of next year and the opening is fixed for the 20th. At least three delegates will be invited from each country to attend the conference. The official address of the Union is 7, Rue de Madrid, Paris.

Inquiries.—The names of agents for the following devices have been asked for: Induction coils for "Stecophone" telephones, for telephone pump.

Sterling Dispute Settled.—The dispute between the Sterling telephone & Electric Co., Ltd., and its skilled employees has now been settled, and the works re-opened on the 9th inst.

German Exports.—The quantity of machinery, electrical instruments and motor vehicles exported from Germany in 1920 is now officially returned at 673,611 tons, of the value of 11,270,005,000 marks.

Dublin Electricity Staff Re-organisation.—A Re-organisation Committee on Civic Administration, appointed by the Dublin Corporation, recommends that electrical work carried out by the Council be entrusted to the electricity supply staff; that the Town Clerk, as *ex-officio* secretary of all committees, should have direct supervision of the correspondence of the electricity department; also that the appointment of Mr. F. J. Allan, as secretary of the Electricity Supply Committee, be determined, but that, pending a report of the committee on the proposed re-arrangement, he should continue to act in the capacity of commercial manager of the undertaking.

Wages Reduction.—The Darlington Town Council has approved a reduction in the wages of workers in the electrical, tramway and gas departments by 6s. 9d. per week, to be taken off in two instalments.

German Tubing Manufacturers Combine.—Under the name Verband Deutsche Isolierrohrwerke, a union of fourteen of the principal manufacturers in Germany of insulated tubing has recently been formed in Hagen.

New French Company.—A new company has lately been formed in Paris (45 Avenue de Friedland) with a capital of 1,000,000 fr., and the title La Société La Radiotechnique.

LIGHTING AND POWER NOTES.

Aberfeldy (Perthshire).—ELECTRICITY SCHEME.—Provost Haggart, who has recently purchased the town, has decided to carry out an electricity supply scheme, although he is chairman of the local gas company.

Accrington.—IMPORTANT SUPPLY CONTRACTS.—The Electricity Committee has had several applications for supplies of power in considerable quantities. Messrs. Steiner & Co., of Church Docks, desired a night load of 900,000 units per year. A cable was necessary, and the engineer was instructed to interview the firm thereon. The Phoenix Chemical Co. asked for special terms for a continuous night and day supply. Subject to its taking 150,000 units per month for 12 months, with an equal load night and day, the committee agreed to supply at 1.75d. per unit. Messrs. Howard & Bullough, in agreeing to take a minimum of 15,000 units per month, were also quoted a special price.

Blackburn.—LOAN.—The Town Council has decided to borrow £221,500 in connection with the new generating station at Whitebirk. It was also decided to convene a special meeting to approve a scheme for the supply of electricity to Great Harwood, Rishton, Wilpshire, Clayton-le-Dale and Rams-greave.

Blackpool.—NEW SUB-STATION.—The borough electrical engineer has recommended that, in order to meet the increasing demands on the electricity service, an underground transformer station be constructed in Abingdon Street. The Electricity Committee has approved the recommendation.

Blackrock (Co. Dublin).—PROPOSED LARGE STATION.—At a meeting of the Urban Council, the manager of the Irish Overseas Engineering and Engineering Association brought forward a proposal for the erection of a large capital power station for generating and distributing electricity for lighting and power over a wide area. With modern machinery and a really up-to-date plant, it was stated, the Association should be able to distribute electricity at a price below that at which the Council could generate it. The Association intended to secure a concession for a peat bog, and use the peat as fuel. The matter was referred to the Council's Electric Light Committee for consideration, and the surveyor was directed to give the Association particulars of a scheme which the Council had in view.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—A recent review of hydro-electric progress published by the Department of the Interior (Water Power Branch) states that plant of 560,000 h.p. capacity was installed or under construction during the past year. The capital sunk in hydro-electric enterprises has reached a total of \$175,000,000, and the annual saving of 18,500,000

tons of coal is made; this represents a sum of \$148,000,000. It is stated that the 2,470,580 h.p. already installed is only about 6 per cent. of the available water power according to recent surveys. The resources of Quebec seem to be the greatest, but the most advanced development is in Ontario.

Cookham.—ELECTRICITY SCHEME.—The Town Council has received notice of the intention of the Rt. Hon. the Lord Miston, K.C.S.I., and others to apply to the Electricity Commissioners for a special order to authorise them to generate and distribute electricity within part of the parish of Cookham, being part of the area of the undertaking of the Maidenhead Corporation, and repealing the powers granted to the Town Council to supply electricity within the area. The Council has decided to offer no objection to the application.

Caterham.—PROPOSED PRICE INCREASE.—The Urban Electric Supply Company has applied for an order to increase the maximum price of electricity from 10d. to 1s. 2d. per unit as from September 30th next, and the minimum quarterly payments from 12s. 6d. to 17s. 6d. in the winter quarters, and from 8s. 4d. to 11s. 8d. in the summer quarters.

Cavan.—LIGHTING CONTRACT.—The Urban Council has accepted a seven years' agreement with the local Electric Lighting Co. for the lighting of the town. The price per unit is fixed at 1s.

Ellesmere Port.—BULK SUPPLY.—In reply to a letter of the Electricity Commissioners regarding the withdrawal of the Council's Electric Light Order, the Ellesmere Port and Whitchy Council has protested against its exclusion from the Mersey and West Lancashire Electricity District, but states that it is prepared to take a supply from the Mersey Power Co. in bulk for all purposes at a price to be agreed, or failing an agreement, as may be determined by the Electricity Commissioners, this arrangement to remain in force until the Joint Electricity Authority for the Merseyside and West Lancashire Electricity District is in a position to offer a cheaper supply to the district, or such other period as the Electricity Commissioners may determine.

Edinburgh.—PRICE INCREASE.—The Electric Lighting Committee has decided that it will not be necessary to increase the charges for power, but the charge for lighting has been increased from 4½d. to 4¾d. per unit.

Exmouth.—COMPANY'S PROPOSALS.—On August 3rd the General Purposes Committee reported the receipt of a letter from the Electric Supply Corporation asking whether the Council would agree to cancel the agreement of 1903 and support the Corporation's application for a Provisional Order constituting itself the undertaker, containing a purchase clause as favourable to the Council as the purchase clauses in the agreement of 1903, and providing for a maximum price of 1s. per unit. The Corporation would be prepared to bear the Council's reasonable charges. The committee stated that it would make a recommendation later. The matter was referred to the Finance Committee.

Gloucester.—TEMPORARY PRICE INCREASE.—The City Council is applying for permission to increase charges temporarily in order to recover the financial loss incurred during the coal dispute.

An additional feeder is to be laid in the Bristol Road district, at an estimated cost of £3,000, to meet increased demands.

Keith.—PROPOSED ELECTRICITY SCHEME.—A committee appointed by the Town Council to consider the possibility of a municipal electricity supply scheme has made its report. The committee has examined installations in towns of similar size, and has made a partial canvass among the inhabitants, and both items are regarded as satisfactory. The motive power recommended is either suction gas, oil, or wind power. The report was "received," and will be considered at this month's meeting.

Lanarkshire.—ELECTRICITY SUPPLY.—The County Council Electric Lighting Orders Committee, having considered the question of providing supplies of electricity to the districts of Strathaven and Law, as well as to the county in general, is of the opinion that an application should be made to the Electricity Commission for a Special Order. The clerk is to confer with the Clyde Valley Electrical Power Co. as to the possibility of supplies being obtained for portions of the county for which orders have not yet been made.

Lurgan.—EXTENSIONS.—The Electric Light Committee's recommendation for the extension of cables in various thoroughfares was adopted by the Urban Council, and it was intimated that a report would be made soon on the question of raising funds for extension of the works.

Monmouth.—SUGGESTED COMBINATION.—According to the *Hereford Times*, it was stated at a recent meeting of the Monmouth Town Council that electric light standards were being erected by Hereford within five miles of Monmouth. The clerk suggested that the two undertakings might be combined by the taking over of the Monmouth station by the Hereford City Council. A deputation was appointed to meet the Hereford Council to discuss the subject.

Northwich.—APPLICATION FOR ORDER.—The Electric Supply Co., Ltd., has applied for an Order to supply electricity in the rural district of Northwich and the parishes of Aston-by-Budworth, Pickmere, Tabley Superior, Tabley Inferior, Plumbley, Bexton, Tolt, Lower Foevel, Mobberley, and the urban districts of Northwich, Middlewich, Winstford, and Knutsford.

Portrush.—PROPOSED PRICE INCREASE.—The Urban Council is applying for permission to increase the maximum price of electricity as follows: For any amount up to 20 units, £1 6s. 8d.; for each unit over 20 units, 1s. 4d. At present the maximum amount chargeable is 8d. per unit.

Steaforth.—PROPOSED PRICE INCREASE.—The Urban District Council has applied for an order permitting it to increase the maximum price of electricity from 8d. to 11d. per unit.

Southend.—G.E.R. SUPPLY.—At a meeting of the Electricity Committee an inquiry was submitted from the chief engineer to the Great Eastern Railway Co. stating that the company was considering the question of lighting by electricity the whole of the station premises, goods sheds, signal boxes, &c., on the company's property in the borough, and asking the terms upon which the Corporation would be prepared to supply energy for the purpose indicated for an estimated minimum consumption of 14,500 units. Instructions were given to the electrical engineer to confer with the company on the matter, and to report to the committee in due course.

LOAN INQUIRY.—On July 30th, Col. T. C. Ekin, on behalf of the Electricity Commissioners, held an inquiry into the circumstances in which the Council has applied for sanction to a loan of £114,873 for electricity purposes. Evidence was given as to the growth of the demand and number of consumers, special reference being made to the development of Leigh, where 1,080 kW of plant had been installed. The Inspector was satisfied that additional plant was necessary and, after inspecting the plant, closed the inquiry.

St. Annes.—SUPPLY TO LYTHAM.—The Urban District Council has appointed a sub-committee to confer with the Lytham Urban District Council on the question of an immediate supply of electricity to Lytham. The two districts expect to be incorporated as a joint borough next year.

South America.—WATER POWER.—The *Economic Review*, quoting *Technik und Wirtschaft*, says that the entire economic development of Latin-America depends upon the possibility of its becoming independent of coal. This possibility is given by the possession of water power. In the Iguazu, the continent possesses the greatest waterfall of the world, surpassing in power the falls of the Zambesi and Niagara. Its exploitation has only been prevented hitherto by its unfavourable situation. To conduct electric power from it to the industrial centres of Argentina would mean traversing hundreds of km., and for Brazil, which lies on the other bank of the Iguazu, conditions are not much more favourable. Brazil is, however, carrying on her economic development by means of the Government settlements along the bank of the Iguazu, and this development will be accelerated if the contemplated, strategically important railway to the Paraguay-Argentine frontier in the vicinity of the fall materialises. Quite apart, however, from the Iguazu, most of the South American Republics possess vast, still unexploited, sources of energy in hundreds of rivers, waterfalls and rapids.

Sevenoaks.—PRICE INCREASE.—The Electricity Company has asked the Urban District Council for permission to increase the charges under an agreement for the supply of electricity; in the case of public lighting from 2d. to 4½d. per unit, and for other purposes from 4d. to 8d. A recommendation that the company be offered 50 per cent. increase on the charges laid down in the agreement was referred back.

Teesdale.—PROPOSED ELECTRIC LIGHT SCHEME.—At a meeting of local authorities at Barnard Castle, the practicability of providing electricity to the Tees valley district was discussed, and it was finally decided to ask representatives to secure the financial support of their respective councils. The possibility of employing water power is being considered.

Tunbridge Wells.—LOAN.—The Town Council has applied for a loan of £7,500 for the construction of a water tower, interconnecting pipe-work, &c., at the electricity works.

Torquay.—SMOKE NUISANCE.—Complaints have been made regarding the smoke from the electricity works. It was stated at a meeting of the Council that a private firm had offered to install smoke-consuming apparatus free of charge. The matter was referred to the Electricity Committee for report.

Wolverhampton.—ANTICIPATED DEVELOPMENTS.—The borough electrical engineer recently stated that the electricity undertaking would be fully loaded in a year or eighteen months' time. He considered that when the existing station had been extended to the utmost limit, the demand would be too great for it by 1927, and a new station would have to be erected. Under the proposed joint scheme, in which Stoke-on-Trent, West Bromwich, Stafford, the Midland Electric Corporation and others would participate, it was estimated that the Corporation would effect a saving of £250,000 by taking a supply from the Joint Authority instead of erecting a new station.

The Town Council has decided to support the Joint Authority scheme.

TRAMWAY AND RAILWAY NOTES.

Barrow-in-Furness.—TRACK REPAIRS.—The tramway manager has reported that car failures have occurred owing to the defective state of the permanent way, and urged that the cost of maintenance of cars must be heavy until the points, crossings, and rail corrugations have received attention. On the recommendation of the borough surveyor it is proposed, in order to improve the track, to accept a quotation of the Rail Welding Co., Ltd., to deal with about 500 joints by electric welding.

Belfast.—YEARS WORKING.—The accounts of the tramway undertaking for the year ended March 31st, 1921, record a total revenue of £601,184, as compared with £545,348 in the preceding year. Working expenses totalled £503,555, as against £379,088, leaving a gross balance of £97,629, a considerable decrease from that of the previous year—£166,260. Capital charges were considerably greater, causing a net deficit of £39,635. In the period 1919-20 there was a net profit of £35,150. One factor, stated to have contributed to this loss, was the military "Curfew" order. The number of passengers carried was 100,643,705, an increase of about 5,000,000. The number of car-miles run rose from 6,276,133 to 6,313,203. While the receipts per car-mile increased by 2d., working expenses rose by 4.65d.

Bournemouth.—FARE INCREASE AGREEMENT.—An application by the Corporation for permission to increase fares has been assented to by Poole, which has agreed that the present differential system of services and fares shall be abolished in favour of equal rates throughout the two systems. Bournemouth holds the Poole system on a lease.

Brighton.—YEAR'S WORKING.—The annual report of the manager of the Corporation tramways shows that the total revenue for the year ended March 31st last was £131,478, as compared with £116,839 in 1919-20. Working expenses amounted to £110,675, as against £97,924, leaving a gross trading balance of £20,803 (£18,915). After payment of capital charges a balance of £2,386 remained. Provision for renewals absorbed £22,800, leaving an excess of expenditure over income of £20,414. Although the total car-miles run increased from 1,203,961 to 1,273,787, the number of passengers carried fell from 20,441,351 to 16,268,035. Only the increased fares prevented a heavy fall in receipts.

Doncaster.—NEW ROUTE.—The Town Council has approved a proposal of the Tramways Committee to apply to the Light Railway Commissioners for an Order under the Light Railways Acts to lay a circular tramway track in French Gate, St. Sepulchre Gate, Factory Lane, and Trafford Street to North Bridge Road. Instructions have been given for the laying of the track in Trafford Street in anticipation of receipt of the Order.

Exeter.—PROPOSED SALE OF UNDERTAKING.—A communication from the National Electric Construction Co., Ltd., with regard to the sale or lease of the tramway undertaking has been deferred by the Tramways Committee until the city treasurer has reported upon the financial aspect of the company's proposals.

Gateshead-on-Tyne.—OPTION OF PURCHASE.—At a meeting of the Town Council on the 3rd inst., it was decided not to exercise the option of purchase of the tramway undertaking next year. The matter had been considered by the Parliamentary Committee, which estimated that the sum required to purchase the system would approximate to £500,000, and about £24,000 a year would be needed to meet the interest upon the borrowed money.

Halifax.—PERMANENT-WAY ENGINEER.—The Town Council has approved a recommendation by the Tramways Committee that a permanent-way engineer be appointed, at a commencing salary of £350 per annum. The acting chairman of the Tramways Committee said the new appointment was proposed in view of the tramway manager's report, and in view of the great amount of work involved; they anticipated considerably more work in reconstruction than in recent years.

London.—EARLIER "UNDERGROUND" TRAINS.—Commencing on August 8th, the Underground Railways Co. has instituted a number of earlier trains. Full details have been published, and may be obtained at any of the company's stations.

Newcastle-on-Tyne.—RESULT OF INQUIRY.—The town clerk has received an intimation that the Light Railway Commissioners, who held an inquiry on July 22nd into the City Council's application for permission to construct a light railway through Gosforth Park, have determined the expediency of granting the application, and have satisfied themselves as to compliance by the Corporation with the requirements of the Light Railways Acts, subject only to the passing of a formal resolution by the Council upon the matter. This resolution will be submitted to the Council on September 7th.

North Shields.—INQUIRY INTO ACCIDENT.—On August 4th, Major C. L. Hall, R.E., held an inquiry into the fatal tramcar accident reported in our last issue. Evidence was given as to special instructions to drivers drawn up after a previous accident at this place. The conductor of the overturned car, who had only been employed for a month, stated that he did not

remember reading any instructions to conductors as to the action to take when a driver was in difficulties. The inspector asked if the car was pulled up at the top of the bank or at the bottom end of the curve, a compulsory stopping place, but the witness could not give a definite reply beyond stating that he was sure the driver pulled up to a very low speed. He did not remember which brakes the driver used at the time. He did not ring his bell at the bottom of the curve as this was a compulsory stopping place, but he blew his whistle when the car had passed the spot and was gathering speed. Witness said he had not received any instructions regarding the handling of the brakes or sanding gear. The driver said he had been in the company's service since January 1st this year. On the day in question he pulled up at the first compulsory stop, but passed the second because the wheels "picked up." He applied the hand brake and, partially, the slipper brake, because the track was greasy; he also sanded the track. In spite of the use of the brakes the car continued to travel at an excessive speed. He could not account for the overturning of the car. After further evidence the inquiry was closed.

Walthamstow.—RAILLESS TRACTION.—The Council has pronounced in favour of a railless electric traction system for the district.

TELEGRAPH AND TELEPHONE NOTES.

France.—SUBMARINE TELEPHONY.—A device by which, it is claimed, it will be possible to "harness telephone lines to submarine cables" has been invented by MM. Gaston Vincent and Louis Duverger, two French engineers.

According to *The Times*, the French Government has sanctioned experiments with the invention during the next fortnight over the submarine cable between Antibes, near Cannes, and Saint Florent, Corsica. Although this cable is in a state of disrepair and has been disused for telegraphic purposes for some time, the inventors are confident of success. The cable has a length of only 125 miles, but it is claimed that the new principle can be applied to all existing submarine cables.

FAC-SIMILE WRITING BY WIRELESS.—Last week *Le Matin* of Paris published an account of a wireless message received from the *New York Times* in which the handwriting of the sender in New York was reproduced clearly in Paris. The *Daily Telegraph* says that the actual words of the message were transmitted in a few minutes exactly in the form in which they were written (the inventor of the appliance by which it was accomplished being a French engineer, M. Behn), and goes on to explain that the exactly analogous appliance for the transmission of handwriting and pictures over ordinary telegraph lines, which has been available for some years, has not been largely employed on account of the distortion produced by atmospheric and stray currents. Signor Marconi recently announced the discovery of a method of screening such interferences, which method, however, is still in the laboratory stage.

The Telegraph Service.—DEFERRED PRESS SERVICE.—The P.M.G. gives notice that from August 8th the deferred Press service at the rate of 23d. per word will be restored between the United Kingdom and Canada, "via Imperial" only.

Mr. Pike Pease, assistant P.M.G., in reply to questions in the House of Commons, has circulated the following tabular statement comparing the number of and revenue from ordinary inland and Press telegrams during the six months ended June 30th, 1921, with the figures for the corresponding periods in 1919 and 1920:—

ORDINARY INLAND MESSAGES.

Year.	Number.	Revenue.
1919	34,737,000	£1,602,250
1920	34,329,000	£1,544,897
1921	27,172,000	£1,757,926

PRESS MESSAGES.

Year.	Number.	Revenue.
1919	1,470,000	£44,570
1920	1,374,000	£64,426
1921	1,398,000	£67,241

The Telephone Service.—THE MONEY BILL.—On the motion for the second reading of the Telegraph (Money) Bill in the House of Commons on August 7th, Mr. Kellaway, P.M.G., explained that the £5,000,000 for which the Bill made provision would last till the end of April next, by which time he hoped the House would have before it the report of the Select Committee on Telephones. The money was not needed for new work, but for the completion of contracts which had been made and work already in progress. Much had been done in the arrears and, although they had now 23,000 applications which they could not entertain, at this time last year, they had refused 35,000 applications. The new exchanges covered the country generally, and if they were to meet the increasing demand plant must be available. The three main trunk routes of the cable system from London were rapidly nearing completion, and there was a marked diminution of the calling-up time in the trunk service, no doubt due to the trade depression and revised rates having reduced the number of calls. Generally, there had been an improvement in efficiency; the time taken in answering calls in London had been reduced from 7.5 secs. in May, 1920,

to 5.3 secs. in May, 1921. He wished that the financial situation of the country made it possible to go in for a large extension of the automatic telephone system because, although it did not effect anything like the saving in working costs which was generally supposed, it got rid to a great extent of the human factor. But the automatic system entailed a very heavy capital expenditure, and in the present condition of the country's finances he did not think that he would be justified in asking the House to agree to great expenditure on installing the system. There were some 13 automatic exchanges at work in the country, and they were proving very satisfactory. He hoped that before long it would be possible to lay before the House proposals for introducing the system into London. Mr. Kellaway fully realised the necessity of doing everything possible to develop the telephone system in rural districts, but the great difficulty was the disinclination on the part of the residents in those districts to accept a party line system, such as that which was in operation in Canada and in America.

Mr. Pike Pease, Assistant Postmaster-General, said that new exchanges had been opened at Perth, Carlisle, Liverpool Central, Huddersfield, West Bromwich, and Northampton. Exchanges in replacement of worn-out exchanges had been completed at Leith, Bristol, Lincoln, Derby, Birmingham, and Hove. A number of applicants for telephones could not be supplied owing to shortage of plant. The number of new exchanges was 54, and 35 exchanges had been ordered but not yet completed. In 46 other places equipments were in course of design, and 235 others were ear-marked for extension or replacement at an early date. In January last year 40,000 lines were lost in two hours in a snowstorm, and it was plainly in the interests of the service to put the lines, if possible, underground.

Wireless Telegraphy.—IMPERIAL CHAIN.—The Imperial Conference of Prime Ministers has endorsed the scheme proposed by the Imperial Wireless Telegraphy Committee, with some modifications. Australia has withdrawn from the scheme, but promises co-operation. Australia would be the last to receive messages, as there would be three or four retransmissions on the way, and Mr. Hughes considers that there can be direct communication, at any rate for short periods each day, between Australia and England, or through one intermediary station. Mr. Hughes on his return will put the matter before the Australian Parliament, which will be free to adopt any scheme, and Australia will take the financial responsibility.

New Zealand was not included in the list of stations outlined in the Norman Report, and Canada was also omitted. South Africa does not really form part of the Imperial chain, of which it is an offshoot. The chain is, therefore, curtailed to about one-half of the Empire, including transmission across the Atlantic, for which, however, a receiving station has not been planned. Existing stations in Canada are the property of companies.

The Post Office is to be the wireless authority for this truncated scheme. In order to expedite the construction of the stations, it is proposed to standardise all the engineering parts. The withdrawal of Australia will increase the loss which will fall upon the Post Office, the Indian Government, and the Crown Colonies by more than one-fifth. The estimated cost of each station is £185,000. The scheme does not provide for the erection of any high-powered station comparable to those now operating between the Continent and the United States or between France and the Far East.—*Daily Telegraph*.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Australia.—MELBOURNE.—Sept. 28th. Victorian Government Railways. Lifting magnet and generating set with control apparatus and accessories. (Contract No. 34,241.)

QUEENSLAND.—P.M.G.'s Department.—November 5th. Bronze wire, Schedule 536. (July 29th.)

Belgium.—August 17th. The Belgian Ministry of National Defence. Supply of 5,000 three-electrode valves for the military wireless telegraph service. Tenders to the Third Direction Générale du Ministère de la Défense Nationale, 10, Rue du Meridien, Brussels.

August 25th. Municipal authorities of Schaerbeek, Brussels. Alterations to the existing static transformer boxes and the "repartition" box, and for the construction of two additional static transformer boxes. Copies of the plans and specifications (2½ fr. each) from the Caisse Communale. Also supply of electricity meters. Particulars (1½ fr.) from the Caisse Communale. Tenders are to be addressed to the Administration Communale, Schaerbeek.

September 2nd. Provincial Government of Limbourg. For the establishment of an electricity distribution system between Beeringen-Bourg Leopold, Tessenderloo, Beeringen and Zon-

hoven. Copies of the plans and specifications may be obtained from 99, Rue des Flamands, Louvain, or they may be inspected up to August 29th at the offices of the Provincial Government at Hasselt, where also on Tuesdays those desiring further particulars can make individual inquiries. Tenders are to be on special forms and enclosed in double envelopes, the outer one to be sealed and marked "Offre pour l'Entreprise de l'Etablissement d'une partie du Réseau de Distribution de l'Energie Electrique dans le Limbourg."

Belfast.—August 22nd. Electricity Department. One 12,500-kW turbo-alternator, with condensing plant and auxiliaries. Four water-tube boilers, with superheaters and forced-draught fans. Four fuel economisers. Two steel chimneys, with four electrically-driven suction draught fans. One electrically-driven centrifugal pump, capacity 18,000 g.p.m. (July 22nd.)

Covenry.—September 1st. Electricity Department. Two 10,000-kW, 3-phase turbo-alternators, complete with condensing plant; four water-tube boilers with chimneys, superheaters, mechanical stokers, economisers, and all accessories. (July 29th.)

Horsham.—August 27th. Electricity Department. One circulating water pump, one steam ejector air pump, one water extracting pump, complete with driving units or, alternatively, a centrifugal circulating water pump, one Edwards air extraction pump, complete with driving units; 1,000 yards l.p. feeder cable, .15—.075—.15 sq. in. area; 1,000 yards 3-core pilot cable, .003 sq. in. area. (See this issue).

India.—High Commissioner for India.—August 30th. Telegraph cable. (See this issue.)

London.—L.C.C.—September 5th. H. and L.p. switchgear for sub-station. August 5th.)

West Ham.—September 8th. Board of Guardians. Three months' supply of electrical fittings. Mr. T. Smith, clerk to the Guardians, Union Road, Leytonstone.

Paddington.—August 22nd. G.W. Railway. Three months' supply telegraph instruments, electrical apparatus, wires, cables, telegraph ironwork and tools, and drysalteries. (See this issue.)

Manchester.—Lessees of the City Hall. Tenders to undertake the electrical work for all exhibitions to be held in the Hall. The Lessees Provincial Exhibitions, Ltd., 60, Corn Exchange Buildings, Fennel Street, Manchester.

South Africa.—PRETORIA.—October 4th. Electric Light and Power Department. Coal-handling plant, 6,600-V cables, induced-draught and ash-handling plant, pumps, piping, &c.—Mr. T. C. Wolly Dod, General Manager, Municipal Electricity Supply, P.O. Box 423, Pretoria.

Durban.—August 31st. Corporation. One 3,000-kW, three-phase, 50-period, 6,600-V turbo-alternator with condensing plant, circulating water pump and piping. (See this issue.)

September 28th. Corporation. Two 500-kW rotary converters, switchgear, and automatic controlling devices, also h.p. supply feeders.*

Sale.—Urban District Council. Cables, transformers, switchboards, house meters, and a.c. motors. (See this issue.)

Southampton.—August 30th. Electricity Department. E.h.p., 3-phase cable. (See this issue.)

Stockton-on-Tees.—August 31st. District Fund, Gas and Electricity Committees. Articles and stores for six months. (August 5th.)

Uruguay.—September 19th. Board of State Electrical Stations. Generating plant for four electrical groups, consisting of a.c. and d.c. generators, Diesel engines, &c.*

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Crook (Durham).—Electrical installations in 228 houses (housing scheme).—G. Morrison, Blackpool.

Hastings.—Town Council. Accepted:—

Fawcett Construction Co., Ltd.—Alterations, &c., to buildings, £11,191; platforms, galleries, ladders, &c., £736.

Brush Electrical Engineering Co., Ltd.—1,125-kW Brush-Ljungstrom turbo-generator plant, £17,705.

Bumstead & Chandler, Ltd.—Centrifugal pump engine and tachometer, 2864; 24-h.p. fan engine, £4,020.

Stirling Boiler Co., Ltd.—Stirling water-tube boilers, "A" type, under-feed stokers, Crosby water regulators, foundations, flues, coal chutes, and Lea coal meters, £10,085.

Aetco & Co., Ltd.—Steam and water pipes and valves, Lea recorders, and Holden & Brooke feed-water heater, £3,198 13s. 6d.

Holden & Brooke, Ltd.—No. 10 high-velocity heater, £245.

Ferguson, Patin, Ltd.—Switchgear, £367.

Premier Cooler & Engineering Co., Ltd.—Forced draught cooling tower, £1,880.

Manchester.—Tramways Committee. Accepted:—

Silicium bronze trolley wire.—F. Smith & Co., incorporated in the London Electric Wire Co. & Smiths, Ltd.

Steel tramway poles.—J. Spencer, Ltd.

Baths and Wash-houses Committee. Accepted:—

Electric lighting installation at Levenshulme Public Wash-house.—Alliance Electric Co.

Education Committee. Accepted:—

Installation of electric light.—Plymouth Grove School: A. Harrison. Upper Jackson Street School: Garner, Holt & Co.

Electricity Committee. Accepted:—

Cable.—Western Electric Co., Ltd.; Johnson & Phillips, Ltd.
Supplies of cable for six months.—British Insulated and Helsby Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; Enfield Edison Cable Works, Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.

Stores for six months:—

Adhesive tape.—W. I. Henley's Telegraph Works Co., Ltd.
Blackley tape.—Connolly's (Blackley), Ltd.

Dry batteries for flash lamps.—Siemens Bros. & Co., Ltd.

Box compound for e.h.p. work and bitrite tape.—Callender's Cable & Construction Co., Ltd.

Box compound (for l.p. work) and resin oil.—Dussek Bitumen Co.

Carbon brushes.—Le Carbone; Morgan Crucible Co., Ltd.

Dynamo brushes and copper tape brushes.—Wm. Patterson, Ltd.

Earthenware pipes and bends.—Doulton & Co., Ltd.; Isherwood Bros., Ltd.

Insulators.—Bullers, Ltd.; Doulton & Co., Ltd.; Gaskell & Grocott; Taylor, Tunncliffe & Co., Ltd.

Fuse boxes.—Siemens Bros. & Co., Ltd.

Lion jointing and packing.—Jas. Walker & Co., Ltd.

Rubber tape.—L. Andrew & Co.; Callender's Cable & Construction Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.

Service boxes.—Forrest & Sym; Hardy & Padmore, Ltd.; Jos. Stubbs, Ltd.

Auto-balancers and auto-transformers.—General Electric Co., Ltd.

Trifurcating boxes.—British Insulated and Helsby Cables, Ltd.; Johnson & Phillips, Ltd.

Tubing, &c.—Brotherton, Edison Tubes & Conduits, Ltd., and Simplex Conduits, Ltd.

D.C. wire.—London Electric Wire Co. & Smiths, Ltd.

Tin fuse wire.—Connolly Bros. Adhesive Tape & Insulating Co.

Tinned copper and tin fuse wire.—Hawkins Bros. & Co., Ltd.

Stepney.—Electricity Department. Recommended:—

Half mile 3-in. conduits, £135.—Albion Clay Co., Ltd.

Meters and combined meters and demand indicators.—Aron Electricity Meters, Ltd., combined meters and demand indicators. Recommended.

The supply of meters (50 and 100 amps)—Ferranti, Ltd. Recommended.

Meters (24 and 35 amps)—Rexon Manufacturing Co., Ltd. Recommended.

Eighteen circuit breakers, £289.—G. Ellison. Accepted.

Five-ton lift, at Osborn Street sub-station, £1,395.—Marryatt & Scott. Recommended.

Steelwork for fitting of stores at Osborn Street.—Drew, Bear, Perks & Co., Ltd. £872. Recommended.

Nine line reactance coils at Limehouse generating station, £1,464.—British Thomson-Houston Co., Ltd. Recommended.

Two additional circuit breakers, for use on the converters at Osborn Street sub-station, £164.—G. Ellison. Recommended.

Salisbury.—Joint Isolation Hospital Committee. Accepted:—

Salisbury Electric Light & Supply Co., Ltd., for renewing the battery at the hospital and putting it in working order, at £198.

Wolverhampton.—Town Council. Accepted:—

Underfeed Stoker Co., Ltd.—£741 for 8 hoppers with special guides, rack, and pinion, and controlled double doors.

NOTES.

The Ramsay Memorial Fund.—A new scholarship has just been created in connection with the Ramsay foundation in France. It is recommended that the French candidate shall be a post-graduate research student and undertake research work on problems connected with chemistry and engineering at a school in the British Empire which he may select with the approval of the trustees.—*Reuter.*

Fatalities.—On July 31st, at Hayle, William Mills, a linesman employed by the Cornwall Electric Power Co., came into contact with a "live" cable, and the shock made him fall from a standard, with fatal results.

On August 5th, William Tomkins, a plumber, was employed at the top of a ladder when his head came into contact with an electric cable, burning his ear and rendering him unconscious. Artificial respiration was tried without success.

A New Method of Barge Propulsion.—A Reuter message from New York outlines a rather complicated method, devised by a New York engineer, of propelling a number of barges. A generating plant is installed in one boat and transmission cables from this provide power to motors on individual barges. It is suggested that the motors being identical in type and the power constant to each, the barges will move as a unit, and there will be no strain on the cables. Each barge will be equipped with a secondary battery to enable it to move independently in harbours or docks. A demonstration trip, in which only the generating boat and one barge took part, was made from New York to Oswego via the Hudson river and Erie canal.

Heating Rivets with Electricity.—Mr. A. S. Mill, writing to the *Electrical World*, draws attention to the economy effected by heating rivets electrically. At a price of 2.8 cents per kWh, a batch of 3-in. rivets was heated at a cost for energy of 0.1 cent per lb. under favourable conditions. The average cost is about 0.35 cent per lb. The heater requires about 60 kW at full load, and heats up 150 3-in. by 3½-in. rivets in twenty minutes; a ½-in. by 5-in. rivet can be heated in fifty seconds. Compared with the former practice, using four coal-fired heaters, which required 16 hours' attendance per week, the first cost of an electric rivet heater is more than covered in the first year's service.

The County of London Co.'s Bill.—The County of London Electric Supply Company Bill was read a third time in the House of Commons on August 10th.

Appointments Vacant.—Electrical foreman (£45 per month) for the Gold Coast, West Africa; e.h.p. and i.p. plumber-jointer, for the Wolverhampton Corporation Electricity Department; plumber-jointer, for Stoney Borough Council Electricity Department; assistant in the mains department, for the Wolverhampton Corporation Electrical Engineer's Department; junior charge engineer, for Barnsley City Council Electricity Department; instructor in oxy-acetylene and electric welding, for the Loughborough College. (See our advertisement pages to-day.)

Electrolytic Disinfecting Fluid.—The report of the Medical Officer of Health (Dr. F. W. Alexander) to the Borough of Poplar, for 1920, states that 39,255 gallons of electrolytic disinfectant were manufactured, making 78,510 gallons as broken down for distribution. The cost was for materials, £153; electrical energy, £105; total, £258. Since the installation of the plant, a period of 15 years, 576,759 gallons of fluid have been manufactured at a cost for electricity of £769, and materials £938, less than 1d. per gallon (previous to the war the cost was under 4d. per gallon, but even with the strong fluid which at present is being made and broken down, the cost is still about 4d. per gallon when the gallons are reckoned in bulk).

The Government of Greater London.—It was recently announced by Sir Alfred Mond, Minister of Health, that a Royal Commission is to be appointed to consider the question of the government of Greater London. It is considered probable that, among the main questions which will receive the Commission's attention, transport and electricity supply will be included.

Electrical Fires.—A part of the big station of the Triphasé company at Asnières, France, was destroyed by fire lately owing, it is said, to a short circuit. *L'Industrie Electrique*, however, takes exception to this too general explanation, and says it may more easily have arisen from overheating of the conductors, ignition of the oil in the transformers or circuit-breakers, or breakage of the wires in cables through electrolysis. Abuse of the term "short circuit" leads to the frightening of persons ignorant of the effects of electricity, and very often casts unmerited discredit on electric installations.

Date of the End of the War.—The Premier announced in the House of Commons on July 28th that the official date of the termination of the war, except as regards Turkey, will be September 1st next. The Defence of the Realm Regulations and other temporary laws expire at the end of the war, except such as have been continued by fresh statutes. An official date for the end of the war also affects many contracts.

Human Electromotive Force.—That a considerable deflection is produced on a sensitive high-resistance galvanometer by applying the fingers to the terminals is well known to electricians who use such instruments, and has probably been ascribed to electrolytic or thermal e.m.f.'s. But a new light is thrown on the subject by Messrs. G. G. Scott and J. Tulgan, of the College of the City of New York, in a letter to *Science* of July 20th. They say:—

"Recently, while making a nerve muscle preparation, the thigh muscles of the left leg of the frog were removed and the nerve on the same side isolated but not sectioned. The body was well moistened with physiological saline, and lay on a glass plate which was also well moistened. The toes of the left foot were held in the left hand, while forceps, held in the right hand, were accidentally placed upon the body of the frog. Immediately a violent contraction of the muscles of the left leg occurred. This was so unusual that we investigated it further. The same results were obtained repeatedly. It must be noted here that one metal was used instead of two as in Galvani's experiment, and in place of the other metal the human hand was used. The current stimulating the nerve might have been due to the difference in potential between the metal and the hand, and for that reason we substituted the right finger for the metal previously used and obtained the same results. We therefore concluded that the nerve was stimulated by the action current of the human body, the electrodes being the fingers of the right and left hands and the indicator or the galvanometer being the contractions of the frog's muscles.

"The same experiment was tried on a number of frogs and in every case we obtained the same results, although more striking in some preparations than in others. We found that by making contact with any part of the frog's body or even the saline solution on the plate the muscles contracted.

"When a non-conductor was interposed between the toes and the hand we found that no contraction took place. When a non-conductor such as wood was used for the right electrode no contraction took place."

Interlinking in California.—In order to meet pressing demands for power supply in 1920, pending the installation of additional generating plant, says Mr. F. B. Lewis, in the *Electrical World*, the companies in the northern and southern halves of the State of California were inter-connected, with marked advantage to the load curves and to the cost of working, as the hydro-electric stations were thus more fully utilised. In the southern half of the State seven systems are interlinked, covering an area of about 150 by 150 miles, with a maximum demand of 300,000 kW—which occurs, strange to say, in the forenoon during July, owing to the heavy demand of the agricultural load. The daily load factor is also greatest in the summer. Great attention has been given to consideration of the operating conditions at

all periods of the year, to ensure that both the steam-driven and the hydro-electric plant shall be utilised to the best advantage.

Educational.—The report of the Standing Joint Committee of local education authorities and teachers' associations on scales of salaries for teachers in technical schools, &c., has recently been published (H.M. Stationery Office, 3d.). Among the recommendations are special additions to salaries for honours degrees or their equivalents, the latter being determined by the local authority concerned, in addition to any list which may be drawn up by the Standing Joint Committee. The report states that instructors should be skilled in trade processes or artistic crafts, and have had at least five years' commercial or industrial experience after the age of 21. Principals, head masters, and head mistresses, heads of departments and instructors are classified under six heads, but the committee recommends that standard scales should be formulated by the local education authorities. Service towards additions to salaries is detailed under six heads, and it is recommended that the scale shall take effect as from April 1st, 1921.

Institution Notes.—**INSTITUTE OF METALS.**—The Autumn Meeting of the Institute is to be held at Birmingham from September 21st to 23rd, and a large percentage of the Institute's 1,400 members is expected to be present. Visits to a number of works in the district are being arranged, and among the papers to be read are the following:—"Experiments in the Working and Annealing of Copper," by F. Johnson, D.Sc.; "The Extrusion Defect," by R. Genders, M.B.E., B.Met.; and "The Electrolytic Etching of Metals," by F. Adcock, M.B.E., B.Sc.

All applicants for membership whose forms are in the secretary's hands before noon on September 7th will be entitled to take part in the proceedings.

I.E.E. WESTERN CENTRE.—The tenth annual meeting of this Centre was held in Hereford on July 25th, when about 80 members were present. Members arrived from their various districts by motor-car, and a meeting was held in the Booth Hall, Mr. A. J. Newman presiding. The following officers were then elected for the ensuing session:—Chairman, Mr. MacWhirter; vice-chairmen, Messrs. C. T. Allan and F. Tremain. After routine business had been disposed of, Mr. Dymond, Chairman of the Hereford Electricity Committee, gave an interesting address upon the city's electricity undertaking and the rural supply system. After luncheon, various parts of this system were inspected. The party was entertained to tea by Mr. W. T. Kerr (the City Electrical Engineer) and Mrs. Kerr.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Mr. WILLIAM C. JEARY, late of the General Electric Co., Ltd., Armorduct Manufacturing Co., Ltd., Magic Appliances, Ltd., and recently manager for Great Britain for N. V. Telg, Amsterdam, is now managing director of the Jeary Electrical Co., Ltd., 8, Lambeth Hill, Queen Victoria Street, E.C., which company has been formed for the purpose of taking over the business of the late Mr. G. Braulic.

The Bolton Corporation Electricity Committee has passed a resolution of appreciation and thanks to the borough electrical engineer, Mr. W. J. H. Wood, and his staff, for their excellent and indefatigable services during the coal dispute.

Mexborough Urban Council and Mr. J. B. FELTHAM, the Council's electrical engineer, have compromised on the amount of arrears of salary in controversy, and the salary has been fixed at £500 a year, subject to confirmation at a further meeting of the Council.

Major F. J. CHAPLE, D.S.O., has succeeded Mr. E. A. Paris as general manager to the Yorkshire (Woolen District) Electric Tramways Co., Ltd. In addition to the D.S.O., he holds the French Legion of Honour and the Croix de Guerre.

Sir GEORGE HADCOCK has joined the board of the Still Engine Co., Ltd.

An Australian newspaper states that Mr. GEORGE A. P. WYEMOUTH (of Weymouth's, Ltd., Melbourne, and the English Electric Company of Australia, Ltd., Sydney), having decided to practise privately, has resigned from the boards of these companies. He will continue to act as technical adviser on all electrical engineering matters to both companies.

We regret to learn of the serious illness of Mr. W. L. MADGEN, but we are glad to hear that his health is now improving.

Mr. F. O'FLYNN has resigned his position as electrical engineer to the Limerick Corporation.

Mr. A. L. TESTER, A.M.I.E.E., who joined the firm of Messrs. Williams & Williams, Ltd., engineers and metal case-makers, of Chester, towards the end of last year, has just been appointed sales manager to Mr. B. A. Williams, managing director. He will control the sales organisation from the Sardinia House office in Kingsway, W.C.2.

Mr. H. R. FORBES MACRAE, general manager of the Sydney Municipal Electricity Department, is shortly visiting this country and America to study the latest electricity supply developments. He is expected to arrive in London in October. We shall refer to the matter further next week.

Electric Locomotion & Foundry Co., Ltd. (£75,895).
Private company. Registered July 23rd. Capital, £6,000 in 21 shares. To take over (1) the business of iron and brass foundry and (2) the business of electrical and mechanical engineers, carried on by G. D. Gillender & Co., Ltd., of 10, Abchurch Lane, London, E.C. 4, and (3) the business of electrical and mechanical engineers, carried on by R. C. Stanbrook and Co., Ltd., of 10, Abchurch Lane, London, E.C. 4. The first directors are: G. D. Collins, South, Gatehead, Gateshead; R. H. Bowden, Newmill, South, Gatehead, Gateshead; W. W. Duns, 31, Monarch Terrace, Gateshead; G. D. Gillender, 38, Claremont Street, Gateshead; T. Gillender, 24, George Street, Blaydon, Durham; J. C. Chambers, 10, Abchurch Lane, London, E.C. 4. The first secretary is: G. D. Gillender, 10, Abchurch Lane, London, E.C. 4. The first auditors are: G. D. Collins, South, Gatehead, Gateshead; R. H. Bowden, Newmill, South, Gatehead, Gateshead; W. W. Duns, 31, Monarch Terrace, Gateshead; G. D. Gillender, 38, Claremont Street, Gateshead; T. Gillender, 24, George Street, Blaydon, Durham; J. C. Chambers, 10, Abchurch Lane, London, E.C. 4. The first auditors are: G. D. Collins, South, Gatehead, Gateshead; R. H. Bowden, Newmill, South, Gatehead, Gateshead; W. W. Duns, 31, Monarch Terrace, Gateshead; G. D. Gillender, 38, Claremont Street, Gateshead; T. Gillender, 24, George Street, Blaydon, Durham; J. C. Chambers, 10, Abchurch Lane, London, E.C. 4.

B. I. Staff Guild Stores, Ltd. (175,937).—Registered July 26th. Capital, £1,000 in 5s. shares. To carry on a co-operative basis for the benefit of the members and those entitled to the privileges of members the business of stockeepers in all its branches. No person shall be eligible to become a member unless he shall be at the time when any shares are acquired by him employed on the permanent staff of British Insulated and Helsby Cables, Ltd., for the last 21 years of age, or else a member of the management committee of the said company. The first directors are: J. Davidson, 10, Aspinall Street, Prescott; F. A. Dabbs, 20, Beverley Road, Liverpool; W. Pirie, 132, Warrington Road, Prescott; F. S. Phillips, Steadler, Whiston, Lane, Prescott; F. Smart, Auld House, Warrington Road, Prescott; E. Mather, 64, Beaconsfield Street, Prescott; D. W. Aldridge, Beechwood, Warrington Road, Prescott; W. G. Pender, Mayfield, Old Lane, Eccleston, near Prescott; C. E. Croston, 4, Jubilee Avenue, Broad Green, Liverpool; B. Wood, Lea Hurst, James Lane, Prescott. Minimum cash subscription: 400 shares. Qualification: One share. Secretary: W. Leisley, Registered office: Warrington Road, Prescott.

Norwegian Radio Co., Ltd. (1,981F).—Particulars filed July 12th. Capital, Kr. 1,000,000 in Kr. 1,000 shares. Incorporated in Norway July 1st, 1919, to manufacture and deal in radio stations and apparatus. British address: 30, Grainger Street, Newcastle-on-Tyne, where A. E. Salvensen is authorised to accept service. Directors: Major C. H. Bruun (chairman), C. Wisbech, H. A. J. Krag, and K. Holmvang (manager), all of Christiansia.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

C. F. Elwell, Ltd.—Mortgage debenture dated June 30th, 1921, to secure £26,000, charged on company's property, present and future, including uncalled capital. Holders: Radio Communication Co., Ltd., 34-35, Norfolk Street, Strand, W.C.

Central Electric Supply Co., Ltd.—Particulars of £500,000 8 per cent. secured and guaranteed redeemable notes, authorised by resolution of March 29th, 1921, and covered by trust deed dated June 22nd, 1921, whole amount issued, charged on certain freshhold lands and buildings in Marylebone and company's undertaking and other assets, present and future (subject to £300,000 4 per cent. guaranteed debenture stock). Trustees: Merchants Trust, Ltd. (Registered July 23rd, pursuant to Order of Court.)

Dudley, Stourbridge & District Electric Traction Co., Ltd. (14,763).—Return dated June 8th, 1921. Capital, £200,000 in £5 shares (20,000 ordinary and 20,000 preference). All shares taken up. £200,000 paid. Mortgages and charges: £72,540.

Cuba Submarine Telegraph Co., Ltd. (4,710).—Return dated May 11th, 1921. Capital, £220,000 in £10 shares (16,000 ordinary and 6,000 preference). All shares taken up. £220,000 paid. Mortgages and charges: Nil.

Chesham Electric Light & Power Co., Ltd.—Particulars of £35,000 debentures authorised July 22nd, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Pernambuco Tramways & Power Co., Ltd.—Particulars of £90,000 debentures, authorised June 15th, and covered by trust deed dated July 15th, 1921, whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital and tramway, electric lighting and power and gas undertaking, and other real or immovable property in Brazil. Trustees: Hon. A. P. Henderson and Capt. C. H. Schreiber.

Hall Brothers (Manchester), Ltd.—Issue on June 30th, 1921, of £150 debentures, part of a series already registered.

Thomas Bolton & Sons, Ltd.—Third mortgage dated July 19th, 1921, to secure £150,000, charged on company's undertaking and property, present and future, including uncalled capital. Holders: R. C. Henderson and J. S. Gray, 39, Threadneedle Street, E.C.

London-Platino-Brazilian Telegraph Co., Ltd. (12,093).—Return dated May 25th, 1921. Capital, £400,000 in £10 shares. 37,490 shares taken up. £374,800 considered as paid. Mortgages and charges: Nil.

Chelsea Electricity Supply Co., Ltd. (20,468).—Return dated March 30th, 1921 (filed May 10th). Capital, £400,000 in £5 shares (74,000 ordinary and 6,000 preference). 49,436 ordinary and 6,000 preference shares taken up. £218,650 paid. £58,330 considered as paid. Mortgages and charges: £24,672.

City of Oxford Motor Services, Ltd. (91,103).—(formerly City of Oxford Electric Tramways, Ltd. Renamed February 11th, 1921).—Return dated March 21st, 1921. Capital, £150,000 in £1 shares. 63,000 shares taken up. £1,007 paid. £61,993 considered as paid. Mortgages and charges: £37,500.

General Electric Co.—A memorandum of satisfaction in full on July 21st, 1921, of first mortgage debenture stock issued by the General Electric Co., Ltd., and secured by trust deed dated November 30th, 1900, securing £200,000, has been filed. There has also been registered a trust deed dated July 22nd, 1921, to secure £350,000 7 per cent. mortgage debenture stock, charged on Witton Works, cottages and buildings in Aston-juxta-Birmingham, the Peel Corner Telephone Works, and various other properties in Salford and Coventry; the Fraser & Chalmers Works, Erith, the Osram Works, Hammersmith, the Union Works, Wembley, Magnet House, Kingsway, and the company's undertaking and property, present and future, including the said capital. The trustees for the debenture stock holders are the London City & Midland Executor & Trustee Co., Ltd., 5, Threadneedle Street, E.C.

New Gutta Percha Co., Ltd. (74,517).—Registered June 8th, 1921. Capital, £125,000 in 50,000 preference shares of £1 and 138,250 ordinary shares of 10s. Return dated June 8th, 1921: 14,106 preference and 138,250 ordinary shares taken up; £30,475 paid on 13,350 preference and 138,250 ordinary; £25,750 considered as paid on the remainder. Mortgages and charges: £25,000.

CITY NOTES.

In our last issue (p. 191) we published a brief summary of the directors' statement of Fuller's United Electric Works, for the year ended March 31st, showing a loss of £129,408. We now have before us a copy of the report itself, and we are enabled to supplement the information already given by explanatory comments included in the directors' review of the year's operations. It is pointed out that the year under review was an anxious one for all industrial enterprises, and

in common with many others, Fuller's experienced great difficulties in their business. The loss of £129,408 includes £6,678 loss on realisation of investments, also interest on short-term notes, £13,353, whilst in order to meet the great drop in prices the stock has been substantially written down. Until the autumn of last year large orders were being placed for the company's products, but in the latter part of August the motor trade suffered a severe set-back, which has since become more acute. The result was that contracts booked were not taken up and orders were cancelled, and the anticipated business did not materialise. The same conditions were experienced in the colliery, rubber, and other industries on which the company was dependent for orders. In consequence the company, which had made large purchases in order to meet the anticipated trade, found itself with heavy stocks at a time when business had seriously shrunk. Owing to this depression in trade, the overhead charges largely exceeded the contemplated ratio to the business effected, which, together with the depreciation in the value of stock, has adversely affected the year's trading. Important economies have been made to reduce the overhead charges to meet the present conditions of trade. The carbon factory felt the effect of unrestricted German competition, with the result that the directors decided to close this department temporarily pending the passing of the Key Industries Bill. Proposals were submitted to the meeting, held on July 28th, for reducing the capital by writing down the ordinary shares to such a figure as will almost cancel the loss shown in the accounts. This will permit future profits to be distributed in paying dividends, instead of being applied to pay back the deficit shown in the accounts. The directors and their relations hold between them over two-thirds of the ordinary shares, and the loss, therefore, will be largely borne by them. The company during the year found it necessary to obtain loans from the bankers, who now ask for security, and it was in order to enable this to be done that the directors asked the shareholders to sanction the creation and issue of debentures as mentioned last week. There are at present indications of returning trade, of which the directors have every confidence the company will obtain its share.

In the balance sheet "stock-in-trade" stands at £171,777; goodwill "as at April 1st, 1920" figures at £25,000, and preliminary expenses at £22,775. The issued and subscribed capital is £401,493 in preference and ordinary shares, and £200,000 in short term notes, 7 per cent., income tax free. The loan from the National Bank of Scotland is £77,494. Sundry creditors and credit balances appear at £68,187, and on the assets side sundry debtors and debit balances are £84,488, less £2,500 reserve for bad and doubtful debts.

The two special resolutions coming before the meeting were: (1) Sanctioning the issue of first mortgage debentures for securing an aggregate principal sum up to but not exceeding £150,000. Resolution (2) reads:—

(2) That the capital of the company be reduced from £500,000 divided into 250,000 ordinary shares of £1 each and 250,000 8 per cent. cumulative participating preference shares of £1 each, of which 101,307 ordinary shares and 280,000 preference have been issued and are fully paid, to less 14 of such preference shares which have been forfeited) to £378,794 8s., divided into 38,913 ordinary shares of £1 each, 131,307 ordinary shares of 4s. each and 250,000 cumulative participating preference shares of £1 each by writing off from each of the 131,307 ordinary shares issued the sum of 10s. per share, which has been lost or is unrepresented by available assets.

The twenty-first ordinary meeting was held on August 4th at the Connaught Rooms, Mr. Godfrey C. Isaacs, the deputy chairman, presiding. In proposing the adoption of the report, after referring to the absence of the chairman, Senatore Marconi, who was away from London engaged in some very important research work, Mr. Isaacs said that in the balance sheet the first mortgage debentures stood at £65,100, showing a reduction of £28,250 since the preceding year, due to favourable opportunities arising as a consequence of the depreciated value of the frame for purchasing the debentures on advantageous terms. The general reserve account and the reserve account for obsolescence of plant together represent the same figure as at the end of 1919. In the profit and loss account salaries showed an increase of some £4,500, general charges, difference in exchange and depreciation of investments showed an increase of some £39,000, all of which, with the exception of about £2,000, was due to depreciation of Government securities and to the reduced value of foreign currencies. Expenses of ship telegraph stations had very materially increased, in part due to the greater number of stations in operation at the end of 1920, as compared to 1919, but the increase which had taken place in operators' salaries was mainly responsible for the high figure of £588,693, which appeared under this heading in the accounts. On the credit side the revenue had amounted to £933,567, as compared with £772,018 for 1919. It was, of course, disappointing to see a set-back in the profits, but they must not be dependent upon that account. They were going through a very bad period, which was being felt in practically every business. They had suffered perhaps far less than most. There had been a very substantial increase in all working costs, material had risen considerably, wages of every description had been raised substantially, whilst travelling expenses were more than double what they used to be. That which had affected them most, however, was the state of foreign currencies and the depreciation of Government securities; but those losses might be for the most part only temporary, and he thought they could

confidently look to their being far less extensive finally than the figure at which they had been calculated. That which was most material and upon which they could congratulate themselves, was that the business during the period showed further expansion. The number of ships' installations increased during 1920 by approximately 12 per cent., and the revenue from ships' telegrams showed even a greater appreciation. Those circumstances, together with the fact that the business this year continued to expand, had been mainly responsible for their feeling justified in recommending that part of the balance of profit of previous years should be used to maintain the dividend for the last year. Until foreign currencies became more normal the profit in sterling of their foreign business must, of course, continue to suffer, but they hoped they had seen the worst in that direction. When he last addressed them they were in the throes of a strike of wireless telegraph operators. He then explained that they were unable to make any change in the pay of their employees without the consent and approval of shipowners. On August 26th last terms of settlement were arrived at which gave a very substantial increase of salaries. Subsequently by an award of the Industrial Court, dated July 1st this year, some reduction in those rates was made consequent upon the reduction affecting the wages of other seafarers. Since the last meeting shareholders would probably have heard of a serious attempt on the part of a new wireless company to compete with them by offering to shipowners terms and conditions which were represented to be more advantageous than those furnished by their company. That competition, fanned by the word "monopoly," had met with some success in some directions. It had been explained to them that whilst shipowners had been in every way satisfied with the service which the company had furnished, they had not been altogether loth to give some support to a competing company, believing that competition was a healthy thing. That that was true generally could not be questioned, but personally he was very strongly of opinion that a business such as theirs was likely to give infinitely better results if under one control. First of all there was the efficiency of the service, which amongst other things meant "safety at sea"; efficiency was largely dependent upon discipline, and discipline was far better maintained under one control. Then there was the question of cost. For a business of that nature to be carried out in a thorough manner, which the very nature of it demanded, one required depots and responsible men in every important port throughout the world. Finally, there was the all-important question of research and invention, both very costly, but without them there would be no progress. That there should be some who did not altogether share their opinion was not unnatural, and they did not complain. They believed that their experience, their world-wide organisation, and the care which was given to the conduct of the business, would ensure their holding their own at all times. Therefore, upon merit alone they would confidently rely whenever they might be faced with competition which did not infringe their patents. They claimed that the competing company was infringing a number of their patents, and they had communicated with them accordingly, resulting in certain admissions being made and a request that they should grant them a licence. That would seem to be the equivalent to saying to them: "We could not take your business from you without using your patents; since you have knowledge of what we are doing we must discontinue unless you will give us authority to go on." One could scarcely believe that such a request was put forward with any seriousness. They were, of course, taking steps to secure the necessary injunction together with compensation for whatever damage they might have sustained. Very considerable improvement had been made in wireless installations which were being fitted on ships at sea since the war. These improvements would have been introduced during the war but for the fact that the company was required to turn out sets and install them upon ships as fast as was possible. The new designs, carrying the latest improvements, were now being installed. The range of a ship's station had been increased under normal conditions to between two and three thousand miles; and thus a ship crossing the Atlantic was now able to keep in direct communication with one or other of the two coasts during the whole voyage. Wireless telephony for use by ships had made considerable strides during the last year. There could be no doubt that wireless telephony was destined to play an important part on ships at sea. There had also been great improvements in the wireless direction finder since he last addressed them. He had told them of the substantial increase which had taken place in the pay of telegraph operators. That increase was the only increase which the shipowners had to bear in connection with wireless telegraphy. Notwithstanding the great increase in all costs the charge for the supply of their apparatus and the services which they rendered in connection therewith had not been increased. In that respect they were perhaps one of the few exceptions in these times. He could not think of anything else the cost of which had not considerably risen. It was in consequence of the volume of the business that they had been able to continue on the old terms. So long as they were able to maintain their position and increase the business year by year, it was the policy of the board, in spite of monopoly, to make no increase in the charge for the services on board ship which the company performed.

Sir C. J. Stewart seconded the motion, which was adopted without discussion.

Belgium.—The Société d'Electricité & Hydraulique, the well-known Belgian electrical engineering concern, of Charleroi, reports a net profit of 264,603 fr. for the financial year ending April 30th last. This is being devoted to wiping out the loss shown in the balance sheet for the preceding twelve months, and in writing down the value of the company's holding in the shares of the Société d'Eclairage Electrique de Saint Petersburg to the extent of 162,524 fr.

Shropshire, Worcestershire & Staffordshire Electric Power Co.—Including £740 brought forward, the accounts for 1920 show an available balance of £33,255. There is put to reserve sinking fund £4,572; the dividend on the 7 per cent. preference shares for the year requires £3,500; the dividend on the 6 per cent. preference shares for the year, £9,000; £16,183 is carried forward.

W. T. Henley's Telegraph Works Co., Ltd.—The directors have declared a dividend on the preference shares at the rate of 4½ per cent. per annum, less income tax, for the half-year; also an interim dividend on the ordinary shares of 1s. per share, less income tax.

Vera Cruz Electric Light, Power & Traction Co.—A dividend of 5 per cent. less tax, is to be paid for the half-year, making 10 per cent. for the year; £15,000 is put to depreciation and reserve account; £21,981 is to be carried forward.

Northampton Electric Light & Power Co., Ltd.—Interim dividend at 3½ per cent. (8 2½d. per share), less tax, on the B ordinary shares is announced.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Hadfields.—£1,000,000 7½ per cent. 10-year first mortgage debenture stock.

Chatham & District Light Railways Co.—Dividend at the rate of 4 per cent. per annum, less tax, on the ordinary shares for the half-year.

Liverpool Overhead Railway Co.—The directors do not see their way to declare an interim dividend on the preference or ordinary shares. The end of "control," the present state of trade, and the consequent serious loss of revenue, coupled with the enormous increase in working expenses, render it impossible to forecast the financial results for the remainder of the year.

STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE markets are feeling the effects of the high tide of holidays, but in spite of general business being as apathetic as, in August, it usually is, a variety of interesting developments serve to keep alive the financial interest of those who follow the electrical departments. The movements of prices in the markets for new issues are comforting to those who have embarked money upon the latest attractions. After the first rush of stocks to sell their Shropshire, Worcestershire & Staffordshire Electric 7½ per cent. debenture stock, the price rose from ½ discount to a premium of 10s. With the guarantee of the British Electric Traction behind the security, it does not look expensive even at 97½, which is the present price of the fully-paid scrip. General Electric Co.'s 7 per cent. debenture stock is 1 premium—as against 4 discount soon after it came out at 92½—and the 7½ per cent. Extension debenture of the Metropolitan Electric Co., issued at 95, looks quite high enough at 7½ premium. North Metropolitan Electric 7½ per cent. debenture, also offered at 95, commands a premium of 5½.

Those who subscribed to Fuller's United Electric Works short-term Notes will view with the reverse of pleasure the disastrous report issued by the company. For the year ended March 31st last, a loss of no less than £129,400 is shown, the debit being reduced to £121,300 by £8,100 brought forward from last time. The directors propose to write off 16s. per share on the issued 151,500 ordinary shares of £1 each, and to create first mortgage debentures up to £150,000. The sum of £14,000 had been set aside for excess profits duty, and this provision, ironical as it now appears, comes in usefully for writing-off experimental and development expenditure, part of the preliminary expenses, and depreciation of plant and machinery. Another company, of another class, which has passed its ordinary dividend is Vickers. The last time that proprietors of the ordinary shares received a dividend was in May, 1920. No particular surprise is felt at the present announcement, and the shares remain about 11s., the tax-free preference stiffening to 13s. 3d.

In the list of electricity supply shares, County ordinary are better at 8½. Charing Cross keep good at 4½, but St. James & Pall Mall are back to 6, at which price the yield on the money is 10 per cent. The various interim dividend announcements are up to anticipation, and the prophets begin to talk of the 1920 dividends being fully maintained when the tale of the present twelvemonth is completed. The manufacturing list exhibits a good tendency. Better prices are quoted for British Aluminium. Henleys, Siemens, Telegraph Constructions and General Electric preference.

The Eastern group of cable stocks and shares is stiffening, from which it would appear that investment is quietly taking the fairly heavy block of deceased account stock, which recently came to market. Prices went back so little, however,

as to imply that there was a good deal of support ready to pick up the stocks if the prices declined to tempting levels. Chili Telephones stand out again as a strong feature, and Great Northern is a shade better, while Anglo-American preferred goes steadily ahead.

August 16th is the date upon which the arrears of dividends are to be paid on the coupons of the Mexican Light & Power, the Mexican Electric and the Pachuca companies. On the bonds of the first two named, there are eleven coupons due, and ten on Pachuca Fives. It is peculiarly hard luck that all of these should be subject to income tax at 6s. in the pound, but this is the law. Bondholders do get consolation, however, in the fact that these coupons can be sold at a substantial premium in the Stock Exchange. Some of the proprietors have been cashing the coupons at the Bank of Montreal, but a much better price is given by people who buy them for transhipment.

Marconis have been going softly, people being afraid to speculate so closely to the time of a dividend declaration that might contain a surprise—in either direction. The Telephone debate in the House of Commons brought in a few inquiries for Automatic Telephone shares. The Postmaster-General gave the system a handsome advertisement, but said that the present condition of national finances did not justify the very heavy capital expenditure that an extension of the automatic system would involve. The price of Automatic Telephones is about 10s.

No particular change has occurred in Home Railway Electric stocks, but British Columbia issues are better, and Brazilian Tractions recovered to some extent. Anglo-Argentine Second preference have gone back to 24, the same price as the Firsts. Engineering shares are scarcely altered. The Yorkshire Electric Power Co. has done well in the past six months, having regard to the coal strike, its net profits of £28,300 being rather less than £2,000. Rubber shares are entirely neglected.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price	Yield.
	1919, 1920.	August 9.	1921. Rise or fall.
Brompton Ordinary...	13	12	8
Charing Cross Ordinary...	8	8	8
do. do. 4½ Pref...	44	44	8
Chelsea...	4	6	8
City of London...	18	14	12
do. do. 6 per cent. Pref...	8	6	8
County of London...	8	8	8
do. do. 6 per cent. Pref...	6	6	8
Kensington Ordinary...	7	9	8
London Electric...	33	33	8
do. do. 6 per cent. Pref...	6	6	8
Metropolitan...	6	7	8
do. 4½ per cent. Pref...	44	44	8
St. James' and Pall Mall...	12	12	8
South London...	6	7	8
South Metropolitan Pref...	7	7	8
Westminster Ordinary...	10	10	8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref...	6	6	8
do. do. Def...	13	12	8
Chile Telephone...	6	6	8
Cuba Sub. Ord...	7	7	8
Eastern Extension...	10	10	8
Eastern Tel. Ord...	10	10	8
Globe Tel. and T. Ord...	10	10	8
do. do. Pref...	6	6	8
Great Northern Tel...	92	94	8
Indo-European...	10	10	8
Marconi...	26	26	8
Oriental Telephone Ord...	12	12	8
United R. Plate Tel...	8	8	8
West India and Panama...	6	6	8
Western Telegraph...	10	10	8

HOME RAILS.

Central London Ord. Assented...	4	4	8
Metropolitan...	12	12	8
do. District...	NH	NH	8
Underground Electric Ordinary...	NH	NH	8
do. do. "A"...	NH	NH	8
do. do. Income...	4	2	8

FOREIGN TRAMS, &c.

Anglo-Arg. Trams, First Pref...	54	124	8
do. do. 2nd Pref...	NH	54	8
do. do. 6½ Deb...	6	6	8
Brazil Tractions...	NH	NH	8
British Columbia Elec. Ry. Pref...	6	6	8
do. do. Preferred...	5	44	8
do. do. Deferred...	3	6	8
do. do. Deb...	44	44	8
Mexico Trams 6 per cent. Bonds...	NH	NH	8
do. do. 6 per cent. Bonds...	NH	NH	8
Mexican Light Common...	NH	NH	8
do. Pref...	NH	NH	8
do. 1st Bonds...	NH	NH	8

MANUFACTURING COMPANIES.

Bakewell & Wilcox...	15	15	8
British Aluminium Ord...	10	10	8
British Insulated Ord...	15	15	8
Callenders...	16	16	8
Crompton Pref...	64	64	8
Crompton Ord...	10	10	8
Edison-Swan...	10	10	8
do. 6 per cent. Deb...	6	6	8
Electric Construction...	10	10	8
English Electric...	8	8	8
do. Pref...	8	8	8
Gen. Elec. Pref...	64	64	8
do. Ord...	10	10	8
Handley...	15	15	8
do. 4½ Pref...	44	44	8
India-Rubber...	10	10	8
Mex. Vickers Pref...	8	8	8
Siemens Ord...	10	10	8
Telegraph Con...	90	90	8

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, August 9th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	84d.
a Ammoniac Sal	per ton	485
a Ammonia, Murate (large crystal) ..		488
a Bisulphide of Carbon .. .. .		..
a Borax		234
a Copper Sulphate		231
a Potash, Chlorate	per lb.	6d.
a Perchlorate		8d.
a Shellac	per cwt.	45 10s.
a Sulphur, Sublimed Flowers		217
a Soda, Lump		216
a Soda, Chlorate	per lb.	4d.
a Crystals	per ton	27
a Sodium Dichromate, oaks	per lb.	7d.
METALS, &c.		
p Babbitt's Metal Ingots	per ton	295 to 2900
c Brass (rolled metal 2' to 12' basis) ..	per lb.	102d.
c " Tubes (solid drawn)		1 1/4 to 1 1/2
c " Wire, basis		114d.
c Copper Tubes (solid drawn)		114d.
c Bars (best selected)	per ton	2105
c " Sheet		2105
c " Rod		2105
d " (Electrolytic) Bars		2105
d " Sheets		2145
d " Wire Rods		2105
d " H.C. Wire	per lb.	113d.
f Ebonite Rod		3/6
f Sheet		3/6
a German Silver Wire		2/9
n Gutta-percha, fine		13/7
n India-rubber, Para		13/7
l Iron Pig (Cleveland Warrants)	per ton	Nom.
l " Wire, galv. No. 8, P.O. qual. ..		235
g Lead, English Pig		235
g Mercury	per bot.	210 16s. to 211
e Mica (in original cases) small ..	per lb.	34 to 37
e " " medium		47 to 50
e " " large		107 to 207 & up
p Phosphor Bronze, plain castings ..		1/4 to 1/9
p " " rolled bars and rods ..		2/1 to 3/6
p " " rolled strip & sheet ..		2/3 to 2/7
d Silicon Bronze Wire	per lb.	1/3
r Steel, Magnet, in bars		1/8
c Tin, Block (English)	per ton	2161 to 2163
n " Wire, No. 1 to 16	per lb.	3/9
p White Anti-friction Metals	per ton	268 to 2285

Quotations supplied by—

a G. Boot & Co.	James & Shakespear,
c Thos. Bolton & Sons, Ltd.	Edwards Ltd. & Co.
d Frederick Smith & Co.	Bolling & Lowe.
e F. Wiggins & Sons.	Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	A. F. Ormiston & Sons.
Telegraph Works Co., Ltd.	
p R. W. F. Dennis & Co.	

The Engineers' Club (London).—The announcement that the Engineers' Club will open its doors on September 1st comes after a prolonged period of silence, during which those who have applied for membership have doubtless wondered what had become of the scheme which was so enthusiastically adopted at the general meeting on June 2nd. It should, however, be realised that an undertaking of this magnitude cannot be established on a sound basis in a few days or weeks; the original scheme, moreover, fell through, and the formulation of a new one was a difficult and delicate matter. We understand that the arrangements which have been successfully effected show a very marked improvement upon the former scheme, and that the delay of a couple of months has proved a fortunate circumstance.

The premises, which will be opened next month, are situated at the corner of Coventry Street and Whitcomb Street, within a few minutes' walk of Charing Cross, and easily accessible by tube railway (Piccadilly, Leicester Square, and Trafalgar Square stations), or by omnibus services passing Piccadilly Circus. They were until recently occupied by the Road Club, and after renovation will be available for all club purposes in full going order. Ample accommodation is provided, including some 76 bedrooms, and we have no doubt that the Club will very quickly become the rendezvous of engineers in all branches of industry. While the qualifications of applicants for membership will be strictly scrutinised, in order to ensure that the Club shall be in fact as well as in name an Engineers' Club, the definition of an engineer is broadly interpreted, including architects, chemical engineers, and metallurgists, in addition to the civil, mechanical, electrical, gas, hydraulic, and other well-recognised professions. Mr. E. Manville, M.P., is the president, and Mr. E. L. Hill (39, St. James's Street, S.W. 1) honorary secretary, to whose indefatigable and enthusiastic efforts the success of the scheme is mainly due. We understand that after September 30th an entrance fee will be imposed upon all new applicants for membership. The subscription for town members is ten guineas, for country members five guineas, and for overseas members (who will not be required to pay an entrance fee) two guineas.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

ANNUAL MEETING.

(Continued from page 195.)

The New President.

At the annual general meeting on July 22nd, Mr. S. T. Allen was unanimously elected president of the Association for the year 1921-2. Mr. Allen has been vice-president during the past year, during which he has been actively engaged in the interests of the Association, on its own Council and committees and as its representative on other bodies, and his well-known force of character, combined with his personal popularity, ensures that his year of office will prove fruitful of results, of advantage to the Association and the electricity supply industry in general. Before he attained to his present position as chief engineer and general manager of the electricity department of the County Borough of Wolverhampton, Mr. Allen had gained a wide and varied experience in electrical engineering. His general education was acquired at Plymouth and Mannamere College, and his technical training at Cardiff University College. Afterwards he served a term of pupilage with Messrs. S. F. Walker & Co., at the Cardiff Electrical Engineering Works, where he remained for a time as draughtsman, before assuming a post of responsibility as electrical engineer in Cardiff and the adjoining district to Messrs. Gilbert & Co., of London, taking charge of all their electrical work in that quarter. Mr. Allen's next appointment was that of electrical engineer to the Ebbw Vale Steel, Iron and Coal Co., in which capacity he was engaged on the design and erection of electrical plant. He now turned his attention to public electricity supply, making his *debut* in that profession as senior charge engineer at the Plymouth Corporation Electricity Works, which led to his attaining the position of chief assistant borough electrical engineer in the same town and holding it for seven years. His first appointment as "chief" was that of city electrical engineer at Carlisle in 1908, which he held for five years, after which he was appointed to his present position.

In our issue of July 30th last year we published an account of the important extensions of plant which were carried out at Wolverhampton by Mr. Allen, in great part during the war, to meet the urgent demands for power in the town. Not only was the plant completely modernised and trebled in capacity—the engine room and boiler house were reorganised and practically rebuilt, and that without interrupting the supply. The

cost of the extensions was only £16 a kilowatt, and the new plant effected a remarkable economy of fuel. At the same time, the undertaking itself was radically reorganised.

In addition to his normal duties, Mr. Allen took an active part in developing the local industries; as chairman of the District Joint Industrial Council for Electricity Supply, he established cordial relations between the employers and employes, and presiding over the Electrical Engineers' Committee which prepared the joint scheme for electricity supply for the North-West Midlands District, he was largely responsible for the proposals embodied therein (this scheme has just been published, and is abstracted elsewhere in this issue).

published, and is abstracted elsewhere in this issue).

A Member of the Institution of Electrical Engineers, Mr. Allen is a past chairman of the South Midland Centre; he is also a member of the Council and of the Executive Committee of the British Electrical Development Association, and a member of the British Engineering Standards Association.

It will be seen, therefore, that the new President of the I.M.E.A. has not spared himself in the past in promoting the interests of the industry with which he is identified; and the experience and energy which he brings to his new appointment afford a guarantee that his year of office will be a successful one, and that the choice of the Association will be amply justified.

Mr. Allen, at the annual general meeting, expressed a hope that he would be able to entertain the Association at Wolverhampton next year; we trust that Fate will be kinder to him than, unfortunately, it has been to his predecessor, Major Richardson, and that by that time industry will have regained its customary activity.

If so, we have no doubt that the Convention of 1922 will bear favourable comparison with any of its fore-runners.

Commercial Problems in Electricity Supply.

By E. Cross, A.M.I.Mech.E., A.M.I.E.E. (Abstract.)

In our anxiety to attain the highest possible efficiency in the generation of power we must not lose sight of the principal object, which is to afford such supply at the lowest possible rates consistent with reliability. It is not necessarily advisable to seek to generate the maximum quantity of power per

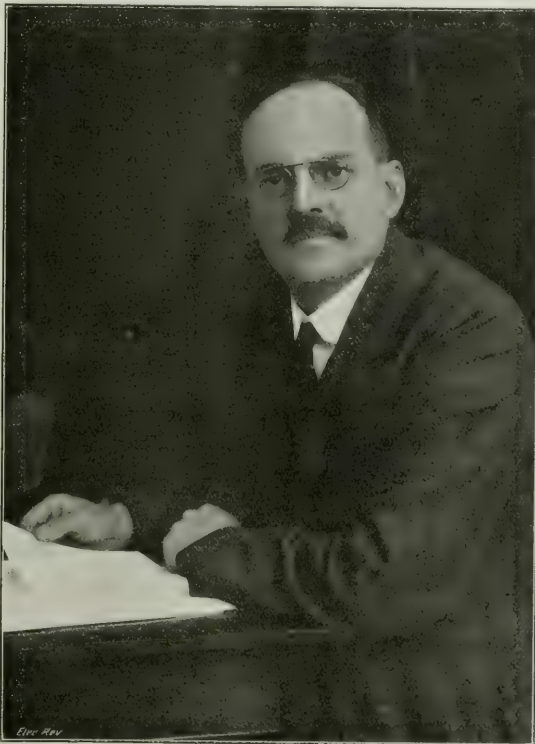


Photo by

SYDNEY T. ALLEN.

Whitlock.

large quantity of coal. If the reliability of the supply is required, as in straining to get in the last degree of efficiency, it will prove infinitely more costly to the supply department and to the consumer in the end.

The additional capital expenditure which can be justified to effect a saving in coal consumption is given by the following formula:

$$1.30 \times 10,000 \times 0.55 \times 0.019 \times \left(1 + \frac{1}{100} \right)^n$$

Where 1 = Additional expenditure warranted per pound of coal per unit saved.

c = Cost of coal in bunkers in shillings per ton.

l = Maximum load in kilowatts.

f = Percentage average load factor over one year.

n = Rate of interest.

y = Number of years of active life.

How much capital expenditure is warranted to gain 0.3 lb. of coal per unit at 30s. per ton with a load of 10,000 kW at a load factor of 35 per cent, assuming an active life of 15 years and interest 6 per cent?

$$1.30 \times 10,000 \times 0.55 \times 0.019 \times 0.3 = £50,850.$$

Dealing with the turbine room, if the heat in one pound of steam is made up of $Ht+c$ where Ht is that portion which can be converted into work and c that quantity (assumed constant) which is abstracted by the cooling water, it follows that the efficiency $Ht/(Ht+c)$ is higher the greater the value of Ht , and high steam conditions and reheating at intermediate stages, which are methods of increasing the value of Ht , will make for improved efficiency; Ht is also increased by improving the vacuum which also tends to improve the overall efficiency within limits.

The author presents in the original paper a series of diagrams to show the effect of varying certain factors (i.e., gain in steam and coal consumptions by increasing the vacuum and the latter's commercial effect on cost; variation in cost for different cooling-water conditions; relative losses in transmission lines; economical distance from load at which plant can be erected for an abundant supply of water; approximate correction factor for coal consumption with fuels of different calorific value; &c.) which need careful study.

He shows that with a given temperature of cooling water, an increase in the vacuum requires a larger quantity of cooling water, and more power for driving the circulating and air pumps due to an increase in the ratio of compression. Both items become appreciable if the vacuum be improved to any appreciable extent, and regarding the true percentage saving in coal by increasing the vacuum, a point is soon reached when any further improvement in vacuum means an actual loss in coal.

If bleeding is used, the quantity of cooling water required will be less, but heating the feed water by passing out steam from one or more intermediate stages of the main turbine would reduce the saving due to increased vacuum in the same way as in the case of increased steam conditions, as less steam is condensed and $Ht/(Ht+c)$ is greater the less the value of c . Steam auxiliaries are very efficient provided the heat in the exhaust steam can be made full use of (otherwise they are wasteful); the only loss, ignoring radiation, &c., is due to the boiler plant, but as there is such a loss in the boiler house, it follows that the less steam generated the more efficient is the station plant. Before installing auxiliary steam plant the efficiency of which depends entirely on the efficient use of the exhaust, due regard must be given to whether or not it can be efficiently used at all loads.

The most efficient way of utilising exhaust steam for feed heating is to pass it out from the main turbine, as a greater amount of work has been obtained from each pound of steam so used than if it had passed through a small turbine or steam ejector; in fact electrical auxiliaries, including electrically driven feed pumps, show a saving over steam auxiliaries when the feed water is heated by bleeding the main turbine. Although it is stated that steam feed pumps are less efficient than those driven electrically under the conditions stated above, their use is recommended on the score of reliability. If electrically-driven pumps are used for the sake of the last degree of economy, then stand-by steam pumps should always be ready for immediate service, but it is doubtful whether the extra capital cost (with spares) of the dual system could be justified. Having decided to install steam-driven feed pumps for regular use, the exhaust steam from which is utilised to heat the feed water, the possibility of utilising, efficiently, exhaust steam from other auxiliaries is more remote, and in any case bleeding the main turbine is more efficient.

Dealing next with the effect that the capital cost of the plant has on the most economical vacuum, the author demonstrates that it does not pay to install plant to work with a vacuum less than 27 in. Hg. The load factor is good, due to the fact that a high-vacuum turbine is more expensive than a low-vacuum turbine, while the cost of condensing plant and auxiliaries for the same temperature of water is also greatly increased.

It is not a good commercial proposition to strain at the last 1/10 in. of vacuum even if an abundant supply of cold circulating water is available, and this contention is more pronounced where artificial cooling is necessary, as the external

heat on the cooling water system is then comparatively high, thus reducing the economical vacuum, which is still further reduced due to the additional capital expenditure involved by the erection of coolers.

In considering the economical distance from the load at which plant can be erected for an abundant supply of cold water, the author shows that the cost of transmission per unit proves to be the least with 11,000 volts for a distance of about 4 miles at 80 per cent. load factor to about 8 miles at 10 per cent. load factor, but beyond these points 33,000 volts is the best commercial proposition. If energy had to be delivered at 6,600 volts, cables for this pressure would be cheaper than for 11,000 volts for the first mile or two, as a step-down transformer would have to be debited to the 11,000-volt transmission.

If overhead lines had been assumed instead of underground cables, it is doubtful whether there would be any great improvement. Overhead lines are cheaper to install but more costly to maintain, and as the impedance is considerable owing to the reactance voltage, the economic loading of an overhead line is less than for an underground cable. As the voltage drop is higher it has a bad effect on the regulation, and in order to keep this in the neighbourhood of that for underground cables the line voltage must be increased to reduce the percentage drop, the actual drop being practically constant.

The conclusion arrived at from the foregoing reasoning is that with the more recent practice of cutting down the losses in the latent heat as a percentage, by adopting high steam conditions, the gain due to high vacuum is relatively of less importance than when lower steam conditions were the order of the day. Therefore, the actual saving in improvement of vacuum is not so great as to warrant the cost of annual capital charges, maintenance, and losses on long transmission lines. The difference in efficiency of, say, a 100,000 and a 200,000-kW station is small, working under like conditions, and if the load from the latter has to be distributed over a large area it might prove to be more economical to erect two 100,000-kW stations in suitable positions instead.

Never was it more necessary to take the "long view" before embarking upon schemes of great magnitude.

Buying at the present high prices and borrowing at such high rates of interest will for the time being have a serious effect on the annual capital cost per unit delivered to the consumer. The industry cannot stand still, but extensions should only be made to meet the demands as they arise and not to forestall the requirements for long periods in advance. We must not overlook the effect in the future of carrying out a large scheme under present financial disabilities in order to obtain 20 per cent. efficiency if, in the near future, Dr. Ferranti's prophecy at Ilkley last year is realised, and capital costs have fallen to figures approaching pre-war prices.

In busy industrial districts capital stations of 100,000 to 150,000 kW capacity will be found advisable, and present-day experience does not indicate that any commercial advantage could be obtained in housing a greater capacity of plant under one roof. The capacity of the roads for laying underground cables is also limited. Many small stations have been erected at pre-war cost, and as much of the capital debt has been repaid their continued existence would be justified in some instances both for stand-by purposes and for dealing with "peaks."

An important saving in capital cost can be made by retaining for a time the plant in the smaller stations as spares.

In a capital station in some cases it has been deemed necessary to allow up to 50 per cent. spare on the working capacity of the plant; provided the sum total of the capacity of the smaller stations amounted to at least a single large unit there would not be the necessity for providing more than one large spare plant at the capital station. Even if we were starting *de novo* in the erection of capital stations in suitable positions it would be advisable to provide stand-by stations at suitable strategic points to deal with emergencies. Many advantages would be derived from the use of oil as fuel at the stand-by stations instead of coal, even at a higher cost.

In conclusion, the author asks: Why should not the ordinary factory operate during more than one shift, as is the case in the heavy steel trades, collieries, and power stations? Such a rearrangement would accelerate production and very materially decrease cost.

In some instances it has been found commercially feasible to install rotary-converter sub-stations at the centres of gravity of important blocks of local load, but even in these cases the combined capital and running costs take a serious toll of the receipts. The perfecting of a reliable automatic apparatus would lead to its adoption where rotary sub-stations have already been installed, but where it is found necessary to extend a more satisfactory solution of the problem would seem to be forthcoming in the shape of the mercury arc rectifier.

Are we satisfied that we shall always obtain energy for the purpose of the generation of electricity by the medium of steam? The advent of the gas turbine would necessitate a revision of future schemes, and it would be unwise to assume that such an eventuality is so remote as to be unworthy of some attention. Moreover, it is claimed that the mercury-steam combination with 35 lb. pressure in the mercury vapour boiler will give about 52 per cent more output per lb. of fuel than a steam turbine generating plant using 200 lb. per sq. in. gauge steam pressure.

DISCUSSION.

Mr. C. M. SHAW (Worcester), referring to a diagram, said that some years ago he made similar calculations, and arrived at an economical distance of 2½ miles, with cooling water at 50 deg. F., not ¼ miles as given by Mr. Cross. They were talking about big generating stations nowadays using dirty water for condensing, which led to a falling vacuum; with cooling towers the tubes kept clean, and the vacuum was maintained. With regard to a case discussed in the paper, in which the effect of using the short available supply of water at 65 deg. F. and supplementing it with water from cooling towers at 75 deg. was shown, he pointed out that if the towers were designed for 75 deg. at full load, the average temperature would be much lower. Alternative "B" (running with half the amount of water that was desirable) would result in a very unsatisfactory vacuum.

Mr. S. E. FEDDEN (Sheffield) congratulated the author on the excellence of his paper, and on having installed the largest generating set in this country. Referring to the consideration that was being given to the use of high pressures nowadays, to effect a very small gain in economy, he said they must consider the whole of the plant, and be very careful before embarking on the use of high-pressures in respect of the increased capital cost, maintenance, and repairs. He questioned whether much benefit would be gained in that direction. With regard to the auxiliaries, he had found the advantage of having a proportion driven by steam, to prevent a complete shut-down. Most of his pumps were electrically driven, but a steam pump kept running in reserve was well worth having. Old plant should be retained for peak loads, even if it were inefficient, in view of the high prices now obtaining. The author had referred to the reheating of steam at convenient stages; the consensus of opinion was to the effect that nothing was to be gained by reheating—the small saving was swallowed up by the large capital cost. The use of steam abstracted from the steam turbine for heating feed-water was also mentioned; he had never been able to understand how, if heat were allowed to escape with the flue gases at the steam generator itself, the loss could be made good at a later stage. He had used air heaters, but had found it difficult to utilise the heated air. While the author assumed a life of 20 years for the station plant, he had found it profitable to scrap turbines at 15 years, bringing down the steam consumption from 16 to 12 lb. per kWh, without altering the condenser. Twelve years was taken by the author as the life of the cooling towers, but the speaker had some 20 years old, which showed no sign of decay. The Local Government Board allowed only five years' life. With regard to the proposal to run with a reduced vacuum, this meant using more steam, more boilers, and more coal. He believed in generating at 11,000 volts without step-up transformers; the generators gave no trouble. He also transformed direct from 11,000 volts to 200 or 250 volts in one step. With a normal load factor, the traditional allowance of 1,000 volts per mile of transmission line was fairly near the mark. If they had sufficient boilers, there was no need to use high-class coal. He did not care to concentrate more than 100,000 or 120,000 kW at one spot, owing to the immense quantities of coal, ash, and water to be handled, and the difficulty of getting the energy away from the station. He thought that 15,000-kW sets were large enough, and actually less costly in operation than bigger ones. The efficiency of a 10,000-kW set was practically as good as that of the big sets, and the cost was not much greater. The small sets, also, were more easily put on load. Large gas-engine stations would require enormous quantities of cooling water. At Neasden, where cooling towers had to be used with water from wells, the costs were excellent; at Stonebridge Park, under similar conditions, the plant could be extended to 100,000 kW. He held that the generating plant should be kept near the load; 18 years ago he recommended this course, and all later experience confirmed this.

Ald. WINTER (Rotherham) claimed that Mr. Cross was the best electricity engineer in the world! As chairman of the Electricity Committee, he always did what the engineer advised him to do—that was the sort of chairman such undertakings should have. (Applause.)

Mr. C. W. CHARLESWORTH (Wolverhampton) dealt with the capital expenditure that was justified in order to effect economy of fuel, and pointed out that the particular method of repayment of loans that was adopted must be taken into account. There were four systems, and Mr. Cross's formula only related to one of them; the example he gave agreed with the "terminable annuity" system, but another method would result in a deficit of £500. Buying and borrowing at the present high rates would affect the annual costs not only for the time being, as the author stated, but throughout the whole future of the undertaking. The position was reflected in the recent prospectus of the Shropshire, Worcestershire and Staffordshire Electric Supply Co., which was raising capital at 7½ per cent. over a period of ten years.

A long communication from Mr. A. C. PAIN related to the utilisation of exhaust steam and the recovery of waste heat from coke ovens, &c.

Mr. W. M. SELVEY said that electrical engineers were not always good at propaganda—they let the business come to them. In this connection, the Coal Conservation reports were an excellent form of propaganda; they showed that

electricity was now the motive power. A great demand for power was being experienced, which had been held back for a few years by the financial stringency. Mr. Cross had made it clear that the advocacy of the super-station was a good and overdue one, calculations made with the data available had shown that they must move with very great caution in putting a large station at a considerable distance from its load. Mr. Fedden and he had concluded that a station of 100,000 kW with a load factor of 50 per cent. might be put ten miles from the load, where Mr. Cross arrived at ¼ miles. He was glad that they were returning from wide and hasty generalisations to the detailed study of concrete cases, and he congratulated the Association on securing this very excellent paper. With regard to the economy due to a high vacuum, he drew attention to the Callendar theory of super-cooling, and said it was not purely a question of moisture content. He advocated the installation of steam-driven pumps as a stand-by to electric pumps, and said that 45 ft. was sufficient head for cooling towers. If the gas turbine were to be a success, they would have to have a new cycle; the efficiency of the present cycle was less than that of steam.

Mr. W. H. PATCHELL pointed out that the size of the station affected the choice of size of generating set; he had seen plans for power stations in the United States to contain six or seven 30,000-kW sets, which were not too big for such stations. In the Detroit district feeder networks were in use at 40,000 and 20,000 volts, overhead. For low pressures he certainly would use underground cables, but for high-pressures overhead mains were far away the best. In Wales he had put down both overhead and underground mains for 6,000 volts, and preferred the latter. Mr. W. T. Kerr and Mr. Napier Prentice had done splendid pioneering work with overhead mains, for which wide facilities should be given. In the case of gas engines, the cooling water was a very serious question; it must not be allowed to deposit scale in the gas-engine jackets, hence much more water was needed than might be supposed. There was a great deal of useful information in the paper.

The President, Major RICHARDSON, referred to the Knap-sack station in the Rhine Valley, of 195,000 kW, which had been put up near the lignite beds, though this necessitated the use of cooling towers, in preference to a site near ample water supplies, 10 km. farther away.

Mr. Cross, replying on the discussion, said that prices were quite different now to what they were a few years ago. If only half the normal quantity of water were available, he was convinced that it was quite good practice to use a large condenser, or mix part of the outgoing water with the incoming water and get an average result. He believed in feed-water heating, and would give data when the tests were completed. Depreciation was not alone to be considered—obsolescence came in; the old plant at Rotherham was in good condition, but obsolete for its purpose, owing to its lower efficiency. Cooling towers which were kept constantly on load, and always moist, would last a long time. He thought it was better to run on a reduced vacuum for a month or two than to put up costly cooling towers. At Rotherham he had adopted big sets right away, to avoid the usual "steps and stairs"; a single one of his consumers took half the output of a 30,000-kW set. The generating plant cost £14 a kilowatt, and the whole installation, including the buildings, £32 per kW. The gas turbine was a symbol of what might happen; in view of the possibilities, they had better not lay long mains. It would be a serious matter if private consumers got another means of motive power. In South Yorkshire it was not feasible to run overhead mains on a large scale.

Annual General Meeting.

The twenty-sixth annual report of the Council was submitted and adopted at the annual general meeting which was held on July 22nd, when Mr. S. F. ALLEN (Wolverhampton) was elected president and Mr. A. S. Blackman (Sunderland) vice-president. Mr. Allen said he hoped to entertain the Association next year at Wolverhampton. The hon. secretary (Mr. A. C. Cramb, Croydon), the hon. solicitor (Mr. P. M. Heath, Manchester), and the hon. treasurer (Mr. H. Faraday Proctor, Bristol) were all re-elected, and the ballot showed the additions to the Council to be as follows: Engineers of large towns: Messrs. S. E. Fedden (Sheffield), P. F. Wheelwright (Blackburn) and G. Tough (Coventry). Engineer of small towns: Mr. R. W. L. Phillips. Committee representatives: Councilors E. C. Ransom (Ipswich) and E. P. Dymond (Hereford).

Owing to the issue of a monthly report, with the primary object of keeping members in closer touch with the Council, the report for 1920-21 was less voluminous than in previous years; it showed that five members resigned and the membership of three lapsed, but eight new members were elected, the balance for the year therefore remained unchanged. The membership now includes the committees and chief engineers of 204 undertakings, and there are, in addition, 15 associates. There are eight standing committees (some information concerning each of which is given in the report) among which the bulk of the Association's work is divided. The accounts show a satisfactory balance of £372 for the year.

During the discussion on the report Mr. S. E. FEDDEN (Sheffield) objected to the B.E.A.M.A. and I.M.E.A. Joint Com-

matter's proposal to discontinue the price contract adjustment clause and to substitute for it the fixed date and penalty clause (Clause 31 of the I.E.E. conditions) now that prices were falling, because when they were on the increase manufacturers had refused to supply at a fixed price.

Mr. F. W. PURSE (West Ham), while supporting the previous speaker, explained that the manufacturers' contention was that, as the material had to be purchased when the order was given, there was little probability of a reduction being made, even if the prices fell between the dates of placing the contract and delivery. The manufacturers refused to consider the suggestion that the purchaser should inspect the books in the price adjustment clause case; however, that clause was still in force, as the matter had not yet been settled.

The SECRETARY (Mr. A. C. Cramb, Croydon) said that the I.M.E.A. desired a penalty clause so as to be able to influence manufacturers regarding delivery.

The PRESIDENT (Major H. Richardson, Dundee) was firmly in favour of a fixed contract.

Mr. N. STANLAND (Hornsey) was of the opinion that so long as a combination of manufacturers existed, they would be at a disadvantage whether they had a fixed price or sliding scale; sooner or later the I.M.E.A. would have to fight the B.E.A.M.A. He had been told that the manufacturer could make a profit by selling a certain article at a third of its

price, but the B.E.A.M.A. forbade its members to supply at that price.

Mr. S. T. ALLEN (Wolverhampton), in answer to Mr. J. K. Brydges (Eastbourne), announced that no arrangement had yet been come to with the G.P.O. with regard to marking its conduit. The G.P.O. contended that it would be difficult to do so because the conduit used by electricity undertakings was initially made for, but rejected by, the G.P.O.

Mr. J. K. BRYDGES (Eastbourne) also complained about the attitude of the British manufacturer of heating and cooking apparatus with regard to the cost of replacement and time taken to make repairs, to the annoyance of users. The Secretary asked for information on this subject which he promised to forward to the E.D.A. to be dealt with.

Mr. H. R. BURNETT (Barrow) moved a resolution, which was carried, requesting the Council to consider the desirability of arranging for the expenses incurred by members of the Council in attending Council meetings to be defrayed by the whole of the undertakings in the Association.

Councillor HILL (Willesden) moved a vote of condolence (which was passed) with the relatives of the late Ald. Vaughan, of Maidstone, and with the Maidstone Electricity Committee, and the meeting concluded with the chairman's announcement that the Association's premium had been awarded to Messrs. C. W. Charlesworth (Wolverhampton) and W. M. Miles (Sheffield) for the papers they had read during the meeting.

THE ENGINEERING CONFERENCE, 1921.

(Continued from page 195.)

Steam versus Electric Winding.

By W. C. MOUNTAIN. (Abstract)

If the collieries are so isolated that a supply of electricity cannot be obtained from a public power station, and the collieries are of large capacity, such as those in Yorkshire, Nottinghamshire, South Wales, and to some extent in Lancashire, the most economical method to adopt is to install steam winding engines and to utilise the exhaust steam in mixed-pressure turbo-generators.

If the collieries are of moderate size, or are small, and there are several of them under one or more ownerships, it is probable that electric winding can be economically adopted, particularly if power can be obtained from a power company at a reasonable cost, but even under these circumstances the type of winder to be adopted must be carefully considered, because unless the power company has a large capacity it may be necessary to adopt electric winders with lighter balancers, as small direct-driven or geared winders, with three-phase motors with rheostatic control, may throw a peak load on the power station which will cause serious trouble.

There are also collieries where blast-furnace or coke-oven gas could be used either in gas engines or under boilers, and there is no doubt that in simplicity and first cost the use of steam turbines, with water-tube boilers using gas as fuel and properly arranged for superheaters, has advantages, and that a very high degree of economy can be obtained.

On the other hand, circumstances may make it possible to utilise the gas direct in gas engines, but it all comes to a question of cost and efficiency in running, also freedom from stoppages due to breakdowns or repairs that may be necessary in daily working.

In heavy winding in collieries in Derbyshire, which may be taken as typical of the heavy duty in this country, the exhaust steam from the winding engines is used in mixed-pressure turbo-generators and in 1918 the costs per unit delivered to the busbars in the power station were as follows:—

	Labour in steam	15 per cent in interest and depreciation on capital	Total cost.
	Per kW	Per kW	Per kW
	<i>d</i>	<i>d</i>	<i>d</i>
Exhaust steam only	0.0189	0.06	0.0789
Mixed pressure steam	0.0092	0.06	0.1502
High pressure steam	0.227	0.06	0.287

In the case of the high-pressure steam the coal to the boilers was taken at 7s. per ton.

Up-to-date medium steam winders are economical as regards the consumption of steam per shaft h.p., and it must be remembered that in utilising exhaust steam turbines a kilowatt can be obtained for about 35 lb. of exhaust steam at 16 lb. pressure absolute delivered from the winding engines into the turbines.

Electric winding has made very substantial progress and a great deal of heavy work of this description has been done in South Africa. The winders are fitted with semi-conical or parallel disengagement mechanisms with the requirements, and the motors are rated to give from 1,450 to 1,600 h.p. normally, but are capable of carrying a peak load of from 3,000 to 4,000 h.p. Electric winding has also been successfully applied to mines in South Wales, the North of England, and elsewhere.

(a) For small collieries there is a future for electric winding if the coal used under the boilers is of any considerable value.

(b) In large collieries there is a future for electric winding if the cost of coal used exceeds 8s. to 10s. per ton, but this, of course, depends entirely upon the relative costs of steam winders with their boilers compared with the electrical equipment.

(c) Electric winding cannot be economically applied to collieries for very large outputs where it is necessary to install a generating plant to produce the necessary output for operating the winder, because the h.p. required for winding is so greatly in excess of that required for driving other machinery, and as it would be necessary to provide a stand-by plant, the costs would be prohibitive.

(d) In collieries generally, particularly those in which electric winding is adopted, colliery owners would be well advised to take their power from the supply companies, assuming they can purchase it at a reasonable price, even if this price is slightly in excess of the cost at which they can produce energy themselves, due to the amount of capital required for the generating plant being so heavy. The same capital expenditure could be applied to much greater advantage in increasing the electrical plant on the surface and underground.

DISCUSSION.

In opening the discussion, Mr. M. DEACON expressed the opinion that putting down new boilers to generate electricity for winding engines was not economical, as good winding engines were so economical of steam, and electrical winding plant cost at least three times as much as steam-winding plant. Unless power could be purchased from a power station in the district the total electrification of a colliery plant was not an economical proposition, but where two or three collieries were so situated as to enable them to use a combined plant, the position was much better. If situated near blast furnaces or coke ovens, then a cheap source of power was available, and electric winding then became more feasible. A vast field still remained open for the utilisation of this waste heat in this country, and the lay-out of the sixteen contemplated large areas of electrical supply should provide for the utmost employment of these coke oven and blast furnace gases.

Mr. LUCK asked whether, seeing that the winding engines only worked part of the time, it would be possible for a colliery to generate electricity during its slack time and supply it to the power company, or for public purposes. To this, in the absence of the author, and at the chairman's request, Mr. DEACON replied that there was no surplus electricity available at a colliery. Energy not required for winding was used for lighting, &c.

Mr. THOMPSON called attention to the fact that the system of generating electricity from waste heat was now being extensively used in Yorkshire.

The Utilisation of Exhaust Steam in Turbines.

By M. DEACON, M.Inst.C.E. (Abstract.)

An enormous development of the use of exhaust and mixed pressure steam turbines has taken place, particularly at collieries, where the volume of exhaust steam is necessarily large in relation to the h.p. developed, and hundreds of collieries in the United Kingdom are now performing the bulk, and, in many cases, the whole, of the underground pumping, hauling, and electric lighting, through the medium of mixed-pressure turbines. A colliery of average depth (say, 500 yds.)

and raising from 2,000 to 3,000 tons of coal per day, will produce enough exhaust steam to develop at least 1,000 h.p., and with the assistance of h.p. steam when the supply of exhaust steam is insufficient, from 1,500 to 2,000 electrical h.p. may be produced through the medium of turbines and electric generators. Assuming there are 500 such collieries in the kingdom fully equipped with turbines, the total economy in fuel amounts to 2,000,000 tons or more per annum.

In a mixed-pressure turbine plant at one of the collieries under the author's control the exhaust steam is conveyed from No. 1 winding engines and the fan engines to a receiver, and thence to an accumulator, the exhaust steam from the No. 2 winding engines being taken direct to the accumulator, from which it is conveyed to the turbines, which are direct coupled to the generators running at a speed of 3,000 r.p.m.

The pressure of the exhaust steam generally given off from a winding or fan engine varies from 2 to 3 lb. per sq. in. above the atmospheric pressure, which represents the pressure in the accumulator when not regenerating and, together with a vacuum of from 27 to 28 in., produces the required energy.

The exhaust steam from several engines may be introduced into the accumulator, and owing to the intermittent operation of winding engines, the more constant-running engines there are which can contribute a constant supply of steam the better, in order that, if the winding engine is stopped for several minutes as is sometimes necessary, the period of stoppage is bridged over by the evaporation of the water in the accumulator.

The cost of generating electrical power by exhaust steam is naturally very low, having regard to the fact that the steam would otherwise be wasted. Disregarding the exhaust steam as of any value, the cost of running is confined to labour, repairs, stores, and interest on capital and depreciation of plant. Taking the two latter at 20 per cent. on the capital outlay the cost of production per kWh with exhaust steam only is approximately 0.20d., and with mixed-pressure consisting of 20 per cent. of h.p. steam 0.40d. These costs are based upon plant at collieries controlled by the author, and are taken upon the present-day values of plant, wages, and stores, and with small coal at 20s. per ton with the plant running ten hours per day. On 20 hours per day instead of ten, on approximately full load, the cost per kWh would have been 0.10d. for exhaust steam, and 0.20d. for mixed-pressure steam. Prior to the war the cost was rather less than half the present-day cost.

The following tables show the approximate steam consumptions, including all losses in the turbine and generator, for 1,500, 2,000, and 3,000-kW turbines, with h.p. and with exhaust steam:—

HIGH PRESSURE STEAM.

Pressure 175 lb. per sq. in. Superheat 150 deg. F.
Vacuum 28½ in.

	1,500 kW. Lb. per kWh.	2,000 kW. Lb. per kWh.	3,000 kW. Lb. per kWh.
Full load	13.50	13.10	12.68
Three-quarter load ...	13.85	13.55	13.08
Half load	14.75	14.50	13.88

EXHAUST STEAM (Mixed-pressure set).

	1,500 kW. Lb. per kWh.	2,000 kW. Lb. per kWh.
Full load	29.25	28.95
Three-quarter load ...	30.20	29.85
Half load	32.75	32.40

DISCUSSION.

In opening the discussion on Mr. Deacon's paper, the CHAIRMAN remarked that the very large amount of energy realisable from low-pressure steam was not yet fully appreciated. Dealing with the economic advantages of low-pressure turbines for generating electricity, Mr. MACLAY mentioned a case where it was more economical to reduce the boiler pressure from 65 lb. to 15 lb. and put in exhaust-steam turbines in place of the high-pressure sets. The speaker strongly favoured the use of surface-condensing plant as against the jet type.

Mr. E. S. WOOD instanced an old pit, established in 1735, where he had scrapped 24 underground boilers and replaced the whole power system with electrical plant. He also used exhaust steam for driving air compressors.

In replying to the discussion, Mr. DEACON stated, *inter alia*, that he did not consider complete electrification of a large colliery the most economical method to pursue. With heavy winding a steam engine was under better control. In the plant described in the paper, very little high-pressure steam was used, and this was automatically controlled by a governor.

Damage to Tires and Rails caused by Brakes or Slipping Wheels.

By C. P. SANDBERG, C.B.E., M.Inst.C.E. (Abstract.)

Investigation into the mutual action between steel or iron brake shoes and the wheels or rails to which they are applied, indicates that the energy absorbed by the brakes is immediately converted into heat, and if the surface temperature attained exceeds the lower limit of the critical range of the material, then in any ferrous material containing over, say,

0.3 per cent. carbon, very definite structural changes will occur. If the thickness of the heated layer is small in comparison with the whole mass, then directly the heating effect ceases, the surface will be very rapidly cooled by conduction, and the metal will be left in the hard or martensitic state.

In addition to the thermal formation of a hardened skin the following action may also take place: Sliding of one surface over the other proceeds to a point at which both surfaces have become so heated that they are soft and plastic and tend to seize together at numerous points of contact. Whilst so united the surface layers are dragged bodily forward forming an overlap in advance of each area of adhesion and a tear behind it. The adhesion is only momentary, and the surfaces are quickly dragged apart, and recommence to slip over one another until sufficient rise of temperature and softening have occurred to cause another seizing. This alternating action of seize and slip probably occurs many times per second during the application of the brakes, and gives rise to the jarring or squeaking noises which accompany such applications, the period of the sound vibration evidently bearing a relation to the periods of slip and seize of the brakes.

The result is to produce a series of surface tears or cracks upon both brake block and the wheel or rail, the cracks running in a direction at right angles to that of the motion, and forming at regularly spaced intervals, evidently bearing a relation to the periods of seize and slip. Numerous examples of such cracks have been found upon wheel tires, and even in a more marked degree upon tramway rails acted upon by powerful (magnetic) track brakes. Corresponding cracks are also found upon brake blocks; the spacing and also the depth of the cracks appear to be greater upon the brake blocks than upon the tires or rails.

With a steel tire, which is firmly shrunk upon a rigid wheel centre, or a tramway rail which is supported throughout the whole of its length, there would appear to be no tendency for the surface cracks to spread downwards to any appreciable depth. The existence of such cracks upon a tire or a tramway rail is thus without any measurable effect upon the liability to fracture, and the chief point to be considered is that the cracks are evidence of very excessive wear, since, owing to the manner in which they are formed, portions of both surfaces must at the same time be wiped bodily away. This wear is additional to that due to ordinary rolling abrasion common to electric traction and the total wear may be two or three times greater than is the case under normal running.

The results of wheel braking may be directly responsible for damage to rails when the brakes are applied with such violence as to lock the wheel and to transfer the sliding motion from between brake block and tire to between tire and rail. In addition, driving wheels frequently slip when starting and direct evidence has been obtained that from one, or from both, of these causes (*i.e.*, skidding or slipping) surface damage may be done to a sound rail which may lead to its ultimate failure in the road. The surface cracking of a railway rail is essentially more serious than that of a tire or a tramway rail, since it is only supported at intervals along its length, and is bent to an appreciable extent each time it is loaded. Under such conditions there is a definite tendency for a surface crack gradually to spread downwards until the section is sufficiently weakened to fail suddenly and completely under a normal working load.

References to rail damage caused by skidding or slipping wheels have been included in several recent American publications, and the investigations have ascribed the formation of the cracks to the failure of the hard and brittle martensitic skin under subsequent wheel loads. According, however, to the views outlined above, the author's investigations point rather to the fact that the cracks are actually formed momentarily in advance of the martensite, and that their subsequent formation is doubtful or at least of minor importance.

Since occasional slipping or skidding cannot be avoided there is no sovereign remedy against rail failures of this description. The original surface damage is, however, clearly visible upon the rail tread, and could be observed during routine rail inspection. Any rail showing either a hardened surface or, still more important, signs of transverse cracks, should be treated with suspicion.

(To be continued.)

An Electrically-propelled Battleship.—According to the *Scientific American*, the U.S.S. *Maryland* will be ready to carry out her official trials early in November. The *Maryland* is a "super-Dreadnought" of 32,600 tons displacement, is 624 ft. long, 97.5 ft. in beam, and has a draught of 30.5 ft. The drive and equipment is wholly electrical. The motive power is provided by two 11,000-kW steam turbo-generators, running at 2,080 r.p.m. These supply power to four 7,000-h.p. induction motors which are 12 ft. in overall diameter and revolve at 170 r.p.m., the propellers being directly connected to them. Power for auxiliaries and general purposes is generated by six 300-kW turbo-generators. Oil fuel is to be used in all the boilers. The building programme of the United States Navy includes a number of electrically-propelled vessels, including three more battleships of the *Maryland* type, six 43,000-ton battleships, and six battle cruisers. The production of several of these is now proceeding under the direction of Mr. W. L. R. Emmet, who was instrumental in obtaining the adoption of the electric drive for battleships.

JOINT ELECTRICITY AUTHORITIES.

The North Lancashire and South Cumberland Scheme.

THE following is an abstract of a scheme for the constitution of a Joint Electricity Authority for the provisionally delimited North Lancashire and South Cumberland Electricity District* that has been submitted to the Electricity Commissioners by the Provisional Joint Committee for the district, the chairman of which is Mr. C. G. Hibbert and the secretary Mr. J. J. Farrer, chief engineer of the Barrow-in-Furness Corporation Electricity Undertaking.

It is proposed that the "North Lancashire, Westmorland, and South Cumberland Joint Electricity Authority" shall consist of 30 members, eight of whom are to be appointed by the authorised undertakers in the district—namely, three by the Barrow Corporation, two by the Lancaster Corporation, and one each by the Kendal and Morecombe Corporations and the Windermere Electricity Supply Co., Ltd.; one jointly by the County Councils of Lancashire, Cumberland, and Westmorland; one each by the Urban District Councils of Millom, Dalton, Ulverston, and Grange (in the west), and Carnforth, Heysham, Ambleside, Grasmer, Kirby Lonsdale, and Windermere (in the east); one each by the rural district councils of Boscobel and Ulverston (in the west), and Lancaster, Tunsdale, and South Westmorland (in the east); one by the Furness Railway Co., and one jointly by the London & North-Western† and Midland† Railway Co.s; three by large consumers in the west, and one by large consumers in the east of the district.

The voting power will be in respect of: (a) rateable value applicable only to local authorities (other than county councils) represented on the Joint Authority—one vote per £50,000; (b) capital invested in the Joint Authority—one vote for each £10,000; (c) and kWh sold or purchased in the district from a public supply undertaking—one vote for the first 500,000 kWh and one vote for each additional million kWh per annum.

All money required for the provision by the Joint Authority of generating stations or main transmission lines in the district, shall be raised by the Joint Authority, but not required in connection with the distribution of electricity within the area of any local authority represented on the Joint Authority (other than a County Council) shall, unless the Joint Authority otherwise determine, be raised and lent by the local authority for that area to the Joint Authority.

The Joint Authority shall in each financial year estimate its probable revenue and expenditure (other than capital expenditure), and if it appears that there will be a deficiency in the net revenue of the undertaking the Joint Authority shall, after deducting any amount which should be provided out of the reserve fund of the Joint Authority, apportion 25 per cent. of the deficiency between the local authorities (other than County Councils) represented on the Joint Authority in proportion to the rateable values of the districts of such local authorities; 25 per cent. in proportion to the number of inhabitants in the respective districts of such local authorities as appearing in the last published census return in existence at the time when the Joint Authority apportions the deficiency; and the remaining 50 per cent. in proportion to the number of units of electricity consumed in each of the respective districts.

The Joint Authority shall apportion the net surplus revenue of the undertaking remaining in any year (after making the payment provided for in "revenue account," and the annual proceeds of the reserve fund) among the local authorities represented on the Joint Authority in the same proportions as deficiencies are chargeable to such local authorities, and the sums so paid shall be carried to the credit of the respective district funds, and general district rates of their respective areas.

Provided always that if such net surplus revenue in any year exceeds £5 per centum per annum upon the aggregate capital expenditure for the time being on the undertaking, the Joint Authority shall make such a rateable reduction in the charges for the supplies of electricity as will secure that in the next succeeding year the net surplus revenue shall not exceed the said percentage on such aggregate capital.

The Joint Authority shall enter into agreements whereby the whole of the generating plant (but not necessarily the buildings) of the five authorised undertakers in the district shall be transferred to the Joint Authority. The agreements may provide for the working of the plant by the undertakers on behalf of the Joint Authority until such time as the Joint Authority is in a position to shut down the plant and provide for its own power source.

It is the necessity for any immediate large expenditure on the generating plant, it is proposed that the existing Barrow-in-Furness works of the Barrow Corporation should continue to be worked, and that a hydro-electric station should be constructed at Backbarrow which would together generate a large proportion of the total supply required, and the remainder would be generated at the Cavendish Park power

house (Barrow), of Messrs. Vickers, Ltd., from whom it would be purchased. In the event, however, of Messrs. Vickers' Cavendish Park power house being acquired by the Barrow Corporation, and transferred to the Joint Authority, the whole of the supply would be generated at these works, and the construction of the proposed hydro-electric station at Backbarrow would be deferred for the time being.

As soon as the financial conditions become favourable for the raising of the money necessary for the construction of a capital station, it is proposed that the Joint Authority should (in the event of Messrs. Vickers' Cavendish Park power house not being acquired) proceed with the construction of a generating station containing two 5,000-kW sets, with provision for the addition of two sets of 10,000 kW each, which would preferably be constructed in Barrow, where for some years a large proportion of the supply for the district would be required, and where a suitable site with an ample supply of water for condensing purposes and good railway facilities is available.

It is proposed to interconnect the generating stations of the Barrow, Lancaster, and Kendal Corporations by means of 33,000-volt, three-phase, 50-period, transmission lines, which will be principally erected overhead, and that 6,600-volt transmission lines shall also be constructed from Lancaster to Morecombe and Heysham; Lancaster to Galgate; Lindale-in-Cartmel to Grange; Lindale-in-Cartmel to Arnside; and Barrow to Dalton.

In view of the urgent need for a supply in certain portions of the district and to avoid extending the generating plant at works which will be shut down when the scheme is carried out, it is suggested that the Board of Trade should, under the powers conferred by Clause 18 of the principal Act, immediately construct the 33,000 and 6,600-volt transmission lines and hand them over to the Joint Authority within two years of its formation.

The Joint Authority shall become the distributing authority for the whole of the district, with the exception of the areas in which the five existing undertakers are already authorised to distribute, in which areas the Joint Authority shall only distribute with the consent of the Electricity Commissioners. In the first instance it is proposed that the necessary work should be carried out for the distribution of electricity in portions of the area only, but should any other constituent authority express a desire for electricity to be distributed within its area, the Joint Authority would extend the transmission lines (or provide isolated plant until such time as an extension of the transmission lines may be desirable), provided that such constituent authority enters into an agreement with regard to the prices to be paid for the supply, and also with regard to the capital required for the work of distribution.

The distribution in all areas not already supplied shall be on the four-wire system, three-phase, 50-periods, at 380 volts for power and 220 volts for lighting and heating purposes. Wherever practicable the existing systems shall be changed over to this system of supply, and large power users will be supplied at 6,600 volts, three-phase.

It is proposed that the Joint Authority should, at a later period, consider the desirability of utilising the generating plant at the National Projectile Factory, Lancaster, the water power which is available at Troutbeck, Kentmere, Eskdale, and the Duddon Valley, and that the waste gases from the blast furnaces in the district should, wherever possible, be utilised for the generation of electricity.

In the appendices to the scheme certain statistical information is given which is summarised below: The total plant capacity in 1920 of the Barrow-in-Furness, Lancaster, Morecombe, Kendal, and Windermere undertakings was 9,290 kW with a maximum demand of 4,627 kW, the kWh sold being 8,360,607. It is estimated that the maximum demand will be 9,920 kW in 1925 and 11,705 in 1930, and that the kWh sold will amount to 20,012,000 and 23,568,000 respectively.

In 1920 a total of 11,220,275 kWh was generated at a consumption of 20,829 tons of coal or 4,159 lb. per kWh. It is estimated that during the first period (1925) of the proposed new scheme 22,176,000 kWh will be generated at a consumption of 22,940 tons of coal or 2.32 lb. per kWh, thus showing a saving of 13,341 tons per annum. Similarly, during the second period (1930) 25,990,000 kWh will be generated at a consumption of 19,232 tons of coal, or 1,658 lb. per kWh, thus showing a saving of 26,915 tons per annum.

The first period of development provides for the erection of a 1,500-kW hydro-electric power house at Backbarrow (about one mile below the foot of Lake Windermere), at which point a weir and headrace already exist, and, by increasing the sectional area and lengthening the latter, a total fall of about 37 ft. will be obtained over a distance of approximately 575 yards. It is proposed to install three 730-h.p. turbines to run at 250 r.p.m., and to each of these to couple direct 500-kW alternators to generate at 6,600 volts, three-phase, 60 periods, and by step-up transformers to 33,000 volts, for main transmission. These machines would be run in parallel with those at Baeclench Street works, and would take as much of the load as the water available would allow. Assuming that approximately 50 per cent. of the water power available is utilised for the generation of electricity, 4,450,000 units per annum would be available for consumption, after making allowance for supplies to the owners of the water rights.

The proposed 33,000 volt main transmission lines will be

* *Electricity Bill*, 1920, p. 721.

† The London & North-Western Railway Co. and the Midland Railway Co. have agreed to contribute towards the cost of the proposed scheme in the proportion of 1/3 and 2/3 respectively. The London & North-Western Railway Co. has also agreed to contribute towards the cost of the proposed scheme in the proportion of 1/3 and 2/3 respectively. The Midland Railway Co. has also agreed to contribute towards the cost of the proposed scheme in the proportion of 1/3 and 2/3 respectively.

five in number, totalling 48 miles in length, of which nine miles will be underground and the rest overhead; the conductors will be 0.05 sq. m. sectional area. There will also be five 6,600-volt lines, totalling 29.5 miles in length, of which five miles will be underground and the remainder overhead; three of the conductors will be 0.05 and two 0.01 sq. m. sectional area.

The estimated total capital expenditure during the first period (1925) is £287,250, allocated as follows: Main transmission lines, ex. (excluding telephone or pilot wires), £157,250; Backbarrow hydro-electric station (1,500 kW at £40 per kW), £60,000; and distribution (for which constituent authorities will be liable), £70,000. By the end of the second period (1930) the total will have reached £736,850, made up as follows: Main transmission, £171,850; hydro-electric station £60,000; Barrow capital steam station (2,000 kW at £20 per kW), £100,000; and distribution, £105,000.

The income and expenditure during the first period (1925) is estimated as under (generation and transmission only, excluding local distribution): Total revenue, £129,000 (20,640,000 kWh at 1.5d.); generation costs, £105,200 (1,223d.); transmission costs, £12,190 (0.142d.); net surplus £7,610 (0.088d.). For the second period the figures are: Total revenue, £160,000 (26,665,000 kWh at 1.44d.); generation costs, £120,600 (1.086d.); transmission costs, £27,320 (0.245d.); net surplus, £12,080 (0.109d.).

The above figures may be compared with the financial statistics of the existing undertakings for 1920 which are: Total revenue, £96,808 (8,360,607 kWh at 2.779d.); cost of production, £105,316 (3.023d.); net deficiency, £8,508 (0.244d.).

The North-West Midlands Scheme.

The draft scheme for the constitution of a Joint Electricity Authority for the North-West Midlands Electricity District that has been submitted to the Electricity Commissioners, and which is abstracted below, was prepared by a Conference of Authorised Undertakers in the district, the chairman of which is Mr. S. T. Allen, chief engineer of the Wolverhampton Corporation electricity undertaking, and the hon. secretary Mr. F. E. Warbreck Howell.

It is proposed that the area provisionally delimited by the Electricity Commissioners* shall be modified by the inclusion of so much of the county of Worcester as is included in the borough of Stourbridge and the urban districts of Lye and Wollescote, and so much of the county of Stafford as is included in the urban district of Rowley Regis. Further, it is desired to exclude from the area so much of the county of Chester as is included in the municipal boroughs of Congleton and Macclesfield; the urban districts of Alsager, Ballington, Buglawton, Sandbach, and Yeardsley-cum-Whealy; and the rural districts of Congleton, Disley, and Macclesfield, and so much of the county of Derby as is included in the urban district of New Mills and the rural district of Mayfield.

The members of the Joint Electricity Authority may or may not be members of the undertakers who appoint them, and each undertaker shall appoint one or more representatives in accordance with the gross revenue of the undertaker—namely, up to £20,000, one member; between £20,000 and £50,000, two members; between £50,000 and £100,000, three members; between £100,000 and £150,000, four members; between £150,000 and £200,000, five members; and for each additional £100,000, one member. The voting power will also be in accordance with the gross revenue of the undertaking, namely, up to £20,000, one vote; between £20,000 and £40,000, two votes; and for each additional £20,000, or part thereof, one vote.

The Joint Electricity Authority shall have power to borrow money for the purposes of its scheme, and the following technical provisions are not intended to be binding, but may be varied at any time with the approval of the Electricity Commissioners. The system of supply to be adopted will be 3-phase, 50-cycle, a.c., the generated pressure to be from 6,000 to 6,600 volts; the main transmission pressure from 30,000 to 33,000 volts; and the secondary transmission pressure from 6,600 to 11,000 volts.

It is proposed that arrangements shall be made in pursuance of Section 13 of the Act to transfer to the Electricity Authority, upon terms which are now under consideration, the following generating stations:—

Ocker Hill, Tipton, Staffs., belonging to the Midland Electric Corporation for Power Distribution, Ltd., Stafford, belonging to the County Borough of Stafford. Park Road, Hanley, Staffs., belonging to the County Borough of Stoke-on-Trent. Birchills, Walsall, belonging to the County Borough of Walsall. Black Lake, West Bromwich, belonging to the County Borough of West Bromwich. Commercial Road, Wolverhampton, belonging to the County Borough of Wolverhampton. And the other existing stations in the district to be transferred later as and when determined by the Electricity Authority, viz.,

Shrewsbury, belonging to the County Borough of Shrewsbury. Newcastle-under-Lyme, belonging to the Borough of Newcastle-under-Lyme. Leek, Staffs., belonging to the Urban District Council of Leek. Market Drayton, belonging to the Market Drayton Electric Light & Power Co., Ltd.

It is not considered desirable that any of the existing generat-

ing stations should be shut down immediately, but that they should be maintained so long as economic conditions permit.

After the interconnecting transmission cables or lines have been laid or erected and the economic conditions warrant it, all the existing d.c. generating stations and plant, and later, when necessary, the more uneconomical of the existing a.c. station plant, will be shut down.

The scheme provides for the erection of three new capital generating stations, one near Rugeley on the river Trent, having an ultimate capacity of 80,000 kW, the second near Ironbridge on the river Severn, having an ultimate capacity of 150,000 kW, and the third on the river Trent near Stone, having an ultimate capacity of 30,000 kW.

The Electricity Authority will make provisions for the supply in bulk, on terms to be arranged, to the two small tramway generating stations situated at Stoke-on-Trent and belonging to the Potteries Electric Traction Co., Ltd., and for adequate supplies to be provided from the main transmission system for the railway companies for traction and railway purposes when required.

The Electricity Authority may utilise, as far as it is economical and expedient, such water power resources as may be available.

LEGAL.

ELECTRICAL APPARATUS CO., LTD., v. J. CONCORD & CO., LTD.

At Lambeth County Court on Monday, plaintiffs brought an action against defendants, engineers, of Balm Road Mills, Leeds, claiming the return of £97 15s., the price of a Concord improved inclinable power press, No. 19. They pleaded that there was an implied condition in the sale of the press that the machine was in all respects made of sound castings and materials and parts, but that the machine did not comply with the conditions, as there was a latent flaw in the frame which caused the press to break.

A good deal of evidence was heard, including that of Mr. E. A. CHELL, managing director of the Rodney Iron Foundry, Ltd., Walworth, who said the broken part had undoubtedly been welded at some time during its manufacture, though he did not believe it had been broken in two parts.

Mr. FRANK W. WARD, for the defence, said he was managing director of Burton, Griffiths & Co., Ltd., machine tool makers. There was some evidence of welding in the broken part of the frame. It was on the inside, but he did not think the piece had been broken in two before it was welded. He was of the opinion that the press was not capable of doing the work which it was set to do. Another press should have been used for flattening the brass pieces. It was not strong enough to stand the concussion, and if two pieces of brass slipped in, there would be a fracture. This was not an uncommon kind of accident, and he had known of three or four similar ones.

Judge PARRY said he had formed the opinion that the press was sent out with a welded casting, and that it was unfit for the purpose for which it was designed. He was surprised at the amount claimed by plaintiffs, as they could have asked for more damages for the loss they had sustained through the machine breaking down. He gave judgment for plaintiffs for the £97 15s. claimed, with costs.

MARCONI WIRELESS PATENTS.

A VERDICT in favour of Marconi's Wireless Telegraph Co., Ltd., and the Compania Nacional de Telegrafia Sin Hilos has been given in the Spanish Courts as the result of a joint action brought by these companies against the Compania Iberica de Telecomunicacion for infringement of patents relating to thermionic valves. The award nullifies certain "Telecommunication" patents known as the "Deforest Audion"; requires the defendants to hand over to the plaintiffs all materials manufactured under the patents concerned; and orders the payment by the Telecomunicacion Company of an indemnity to be fixed.

Electrification Scheme in Czechoslovakia.—A scheme involving the construction of a barrage 70 metres in height at Stechovice, near Prague, has been submitted to the Minister of Public Works. This barrage, situated 30 kilometres south of Prague, would produce over 250 million kW-hours a year, and would save Czechoslovakia 60,000 wagons of coal. The realisation of this scheme would cost from 250 to 300 million crowns. All organisations concerned in Central Bohemia, notably the Chamber of Commerce at Prague, the Agricultural Board, and the Federation of Czechoslovak Industries, support the project, which has attracted the attention of many foreign engineers and financiers. It is stated that the electrification of Central Bohemia and the improvement of the Vltava as a waterway will completely alter the economic situation of that region. The first essential to economic development in Czechoslovakia is the increase of national output, especially as regards agricultural produce. With this end in view, a scheme should be drawn up for the rational utilisation of the hydraulic resources of the country, and for the investigation of kindred problems. The realisation of the barrage scheme at Stechovice would mean a considerable advance in this direction.

THE
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ELECTRICAL REVIEW.

**LARGE CONSUMERS AND LOCAL
AUTHORITY UNDERTAKERS.**

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IN certain of our big industrial towns a rather curious position is developing, perhaps one may say has already been reached in some cases, as between a local authority as the purveyor of electrical energy and a few of the manufacturers who are large consumers.

The municipal undertaker is providing the essential motive power, which may be partly utilised in the form of heat, for carrying on the particular business or industry of one or more large manufacturers.

One feature of this position is that the manufacturer is relieved of a large capital expenditure which he would otherwise have to incur in the provision of prime movers and so forth. This is an advantage to him, as any avoidance of capital expenditure without a corresponding restriction of output is advantageous, because it leaves a larger margin of available credit for his special business. It may be an advantage in respect of net income as well, if the capital charges included in the price for supply are at a lower rate than the manufacturer would have to pay out of revenue for dividends, interest, and amortisation. Generally speaking, a local authority with power to pledge the rates can obtain capital at lower rates than industrial undertakings, and even if its loan repayments are larger than the manufacturer would generally allow for depreciation or its equivalent, the total annual payments may be less in the municipal case. In this event, the manufacturer gets some advantages of a directly financial kind, because indirectly, the general body of ratepayers guarantees the interest and repayment on a substantial part of the capital employed in his business. There is a further way in which this condition of things operates to the advantage of the manufacturer. One, or a very few, large consumers naturally receive a good deal of consideration from the committee and officers controlling the municipal supply undertaking. If these few consumers provide a very large part of the revenue, the undertaking cannot be quite so independent in dealing with them as it is with small consumers. It may be supposed that for the protection of both parties contracts will be entered into covering a long term of years. But there is always either a definite period to such contracts or some period of notice to terminate, and when that period arrives, or such notice is given, the supply party will be very loth to lose a large consumer on questions of price. It will be inclined to accept a price which will barely cover its capital charges and costs rather than risk having a large proportion of its plant standing idle, earning nothing towards those charges.

Of course, this need not always cut one way. The manufacturer may be very much inconvenienced by having to put in his own generating plant, perhaps with some period of interruption of his production, perhaps with some necessity to enlarge his works, at a cost which may be very onerous. A good deal will depend upon the state and prospects of trade at the time the bargain has to be reconsidered.

Whilst many municipal authorities have men of good commercial aptitude and bargaining capacity in their electrical engineers and town clerks, it is by no means certain that they will be a match for the managers of big industrial concerns, but it is quite certain that those municipal officers have not the same direct personal incentives to keen bargaining. Also, they have to carry with them their committees and councils, on which the interests of big local concerns are generally sure of very full consideration.

There certainly seems to be some little danger of the municipal undertaking being run rather conspicuously in the interests of its big consumers in these cases.

On the other side, it is no doubt an advantage to other and smaller consumers that there should be big industrial loads with good load factors justifying the use of the most economical plant, and the most competent management. Always provided that the big consumers' price covers the proper share of capital charges and working expenses, the small consumer may be positively benefited. It might be impossible to supply him so cheaply if the undertaking were run on the smaller and less economical scale corresponding to the absence of the large industry load.

There is a certain risk in the event of a slump in the particular industry. However fair and carefully drawn up the contract may be, it is impossible to get payment from a commercial concern which has no income. Even bankruptcy proceedings in such cases are apt to be singularly unsatisfying. Something of this kind actually occurred a considerable time back when a town with one predominant industry, to supply which it had specially developed its electrical undertaking, found itself in a difficult position—as regards the undertaking—during a prolonged slump in that industry. And, of course, there is a possibility of a municipal council getting into the hands of a majority of a political party which will use its power to put pressure on its opponents, or to favour its friends, through the medium of the electricity or other undertaking. There need be no actual corruption in the narrow sense, yet a good deal of harm may be done by such political action.

It seems as though these cases call for some superior authority which will see fair play to all concerned, preventing, on the one hand, a big manufacturer taking advantage of the cheapness of municipal credit to the detriment of his fellow citizens and fellow consumers; and on the other hand, preventing any capricious action influenced by political or other motives from taking unfair advantage of a large consumer whose business is essentially dependent on a reasonably cheap supply of electrical energy.

Possibly the Electricity Commissioners and Parliament may see fit to give Joint Electricity Authorities such powers. Clearly if a Joint Electricity Authority were in command of the generating side of the supply industry over a large area there would be less risk of such dangers to either party as above outlined which may emerge under present conditions.

THE case of Bell v. Sir W. Armstrong and strong, Whitworth & Co., Ltd., which Short Time. was recently heard by Mr. Justice Sargant, whose judgment was reported in

The Times of July 30th, involved a question of considerable interest to employers who have apprentices in their works. To state it quite briefly, the point was this: If an apprentice is put on short time, e.g., to work every other fortnight, is he entitled to be paid as for full time in accordance with the terms of his indenture? Like many another industrial problem, this has arisen owing to circumstances brought about by the war. Before and during the war Messrs. Armstrong employed a large number of apprentices under an indenture which is in a form commonly used on the North-East Coast. The apprentice is bound for five years at a wage of from 7s. to 12s. per week of 53 hours. These hours may be temporarily shortened; but an apprentice working for the full shortened period is deemed to have worked a full week. In 1918 the weekly hours were reduced from 53 to 47. All went well until the armistice, when, in consequence of the cancellation of war contracts and of there having to change over to peace work, Messrs. Armstrong found it impossible to continue to employ all their apprentices. Some agreed to their indentures being cancelled; others were sent to college for training. As regards the remainder, they were kept on, but in the middle of July, 1920, Messrs. Armstrong adopted a system of short time, paying them

for working every alternate week. The plaintiff in the action was one of these. He sought a declaration that he was entitled to be paid according to his indentures for every week. The employers alleged that they were entitled to make the reduction both under the terms of the indenture and by reason of an alleged custom under which the wages of an apprentice, like those of a journeyman, were based only on time worked.

Mr. Justice Sargant rejected both these pleas, and found for the plaintiff. He said: "When one considers the object of the indenture, and the fact that both parties bind themselves for a period of five years, the one to employ and teach the apprentice and the other to serve the employer, it is impossible to read into the indenture or its schedule such a modification of the employer's *prima facie* liability as would enable him to employ the apprentice for shorter hours and at a proportionately reduced wage." In the result the plaintiff was declared to be entitled to his wages as prescribed by the indenture for the whole period since he had worked short time. For the sake of simplicity, the above account of the case has not been complicated by any reference to another claim made on behalf of the plaintiff, namely, that he was entitled to be paid not only his 10s. 6d. a week, but all the war bonuses and additions to his wages which had been made either voluntarily by the employers or pursuant to the Munitions of War Act. It is enough to say that on this part of the case the learned judge was against the apprentice, and found for the employers.

This case will no doubt settle a large number of claims now outstanding between apprentices and employers in all parts of the country and in many different industries. We have every reason to doubt the wisdom of those who have insisted upon forcing the matter to a decision, for it must inevitably lead employers either to reduce the wages of apprentices generally or to adopt a form of indenture which will relieve the employer from making payments to apprentices for working when there is no work for them to do. We fancy, however, that the Ministry of Labour will be glad to have had the point decided as it has been. Numerous claims for unemployment benefit have been made in respect of apprentices working a week on and a week off, in respect of the week during which they are not working. Mr. Justice Sargant has made it plain that they must be regarded as earning all the time, and they can, therefore, prefer no claims for unemployment benefit.

THE announcement issued by the The Lesson from directors of Yarrow & Co., Ltd., that the Clyde. they will have to close down their works

on the Clyde in November next is a serious development in the industrial situation. The decision has been reached not because of any want of faith in the future of British engineering and shipbuilding, but because, as things stand now, it is impossible to carry on with any reasonable success, and that being so, employes are given early warning so that they may seek work elsewhere. We hope that the shutting down in November may be averted, but that cannot be unless those concerned realise that commercial undertakings can only be successfully carried on when they are conducted on economic lines. It is not only the employes of Yarrow & Co. who have to take this lesson to heart or lose their employment, for there are many businesses that have been beaten about by adverse circumstances such as have affected the Clyde company, and cannot survive unless the workers recognise the imperative obligation that rests upon them to do their part to maintain the security of the undertaking from which they desire to draw their wages. As we go to press, Messrs. Brunner, Mond & Co. are announcing their intention to close down unless their men remain at work in sufficient numbers to carry on manufacturing operations. If the conditions imposed by labour are such as to continue the cost of shipbuilding or anything else at an excessive figure so that orders or purchases fall away, then where is the inducement for capital to carry on? Or assuming that there are special

orders available on condition that delivery be given within a specified period, but such delivery cannot be given because of labour's unwillingness to co-operate, are we in any better plight? The Yarrow difficulty is that cost has become excessive, and delivery to date cannot be given, because of repeated strikes, reduction of output, and demarcation disputes which have taken place in various industries throughout the country. As a matter of fact, the Yarrow decision should be an urgent appeal to that part of the industrial community throughout the United Kingdom that has not come to its senses, to do so quickly—before it is too late! Yarrow's evidently believe that common sense will return, or they would hardly describe their closing as a temporary measure.

It is remarkable, after all the talk there has been during the past five or six years, on the need for removing suspicion from the relationship of master and man, that it should still be necessary for Sir Robert Hadfield to be writing, as he does in *Unity*, calling for the dissipation of the great cloud of suspicion and mistrust which is poisoning all relationships, hampering the recovery of the country. Sir Robert feels that while the workers may bow to the logic of facts and accept wage cuts, because they have no alternative, unless some permanent edifice of conciliation and co-partnership is reared on the foundation of the present agreements the peace for the present attained will prove "but a hollow truce." He believes that "renewed prosperity will bring renewed demands in all probability ill-timed and impatiently urged, and we shall traverse the whole 'vicious circle' again. Sir Robert suggests, therefore, that all employers should now meet the workers "in full and frank discussion of all the conditions of their common industry, laying the cards on the table as to the state of the order books and the conditions under which contracts may be obtained, the profits and losses made during recent years, and to discuss, with a view to arriving at a permanent scheme, the question of unemployment." A good deal of this reads very much like other matter that we have been hearing and reading for years. The time for discussion seems now to be far spent. We may go on discussing for years and years while works close down and unemployment grows. What we ought all to be doing now is *working our hardest* and bearing whatever sacrifice is necessary, in order to keep alive the industry by which we live.

We are glad to note from the official **Empire Patents.** report of the work of the Imperial Conference that the important subject of an Empire patent came under consideration, and that a recommendation was agreed to by the whole Conference to the effect that a Conference of Representatives of the Patent Offices of H.M.'s Dominions shall be held in London at an early date to consider the practicability of instituting a system of granting patents which should be valid throughout the British Empire.

We trust that engineers in general and our readers in particular will do their best to see that this recommendation is not forgotten, and that a conference on patents is not very long postponed. We have often pointed out the enormous disadvantage of a British patentee as compared with an inventor in the United States. In the States, as is well known, an inventor by a single payment of £7 secures protection in every State of the Union, whereas in this country he is not only subjected year by year to a heavy and increasing tax upon his British patent, but is also obliged in order to secure protection throughout the British Empire to take out separate patents and pay separate renewal fees in each of the states, colonies, and dependencies coming under the British flag. This system may quite properly be described as a heavy brain tax, and it operates as a protective tariff against the introduction of new inventions in the Empire. The sooner a British Empire patent on the excellent model in force in the U.S.A. is adopted the better. It is a long-overdue reform, and the cost of it would be trifling compared with the advantages to be gained.

The question of commercial education at the Universities was discussed at the recent Congress of the Universities of the Empire at Oxford, and it appears that the subject was received

with ready sympathy. The late Lord Balfour of Burleigh had gone to a good deal of trouble to obtain accurate information as to the work already being done in the various Universities throughout the Empire, in order that he might introduce the subject from the chair.

The principal address was given by Sir William Ashley, Professor of Commerce at the University of Birmingham. Sir William expressed the opinion that during the next 20 years faculties of commerce, or something like them, would be found in every important University in the Empire. Sir William said that he had never been ashamed of being frankly utilitarian in recommending a curriculum of commerce. Instead of aiming only at mental culture, and trusting that in some way utility would emerge as a by-product, he claimed that they should aim directly at utility, and seek to obtain the mental discipline and mental enlargement they all desired by means of such useful studies. He laid stress on the necessity of working together with the commercial community, which at present seldom sends its sons to the Universities, and would only consent to do so if it was sure of receiving most of them back again into commercial life.

We need hardly remind our readers that we have always been in favour of the adoption of commercial courses and commercial degrees at our Universities. We feel strongly that in comparing ourselves with foreign nations, such as, for instance, the Germans, we must be forced to the conclusion that they are provided with a commercial army better equipped than our own on nearly all points of education. They are linguists and economists, and although at times the similarity of phrase or method suggests too thorough a uniformity in the method of teaching, and occasionally causes them to make themselves ridiculous, it must be admitted that too frequently a German in a foreign country is better able to push his wares than is the average Englishman in similar circumstances. Perhaps he is armed with fuller authority and freedom of action. Given these weapons in the hands of a British representative, would not his personal initiative carry him further?

There should be a faculty of commerce in every University with a man at the head who is not only versed in political economy and in the text-book side of commercial knowledge, but who has had actual commercial experience. The teaching of languages should be brought into the course, and the student should be given the choice of, say, three languages in accordance with his future intentions as to the locality in which he intends to work.

The commercial student should be taught the niceties of commercial honour and good manners, for we have not lost our pride in British commercial integrity, and he should also be trained to express himself either in writing or in speech clearly and effectively. Salesmanship is perhaps a little overdone in the United States, but it is certainly underdone in this country, and although, for our part, we attribute the unfortunate commercial position in which this country finds itself to-day, to causes quite other than inefficiency on the part of our commercial travellers, it must be obvious to everybody that such efficiency was never more necessary than it is now if we are to recover our position as suppliers of the world's markets.

From the point of view of the engineering trade it would appear to be clear that the commercial traveller, however well trained, would be practically useless unless he had some technical knowledge of the machinery and plant which he had to sell. For this reason we would suggest that the most effective way to help the engineers would be to give them such commercial training as time permits, in combination with their technical training at the Universities.

We hope this subject will not be allowed to drop.

SAWDUST AS FUEL.

MESSRS. J. SADD & SONS' TIMBER MILLS.

IN view of the prevailing high price and unsatisfactory quality of the coal that is now being sold for power producing purposes, any instances of the successful use of cheap fuels should be of considerable interest and value to engineers. In this connection remarkable economies have been made in the cost of power production by the efficient use of sawdust, chips, and fine wood shavings, considerable quantities of which are pro-

duced at saw mills and timber conversion and treating works, both in this country and abroad.



FIG. 1.—BIRD'S-EYE VIEW OF MESSRS. J. SADD'S TIMBER YARDS.

duced at saw mills and timber conversion and treating works, both in this country and abroad.

There are several ways of utilising this type of wood fuel, one of which is to burn it in boilers for steam generating purposes. An example of a steam-electrical installation consuming such fuel we described some five years ago,* but another and probably better way of reaching the same goal is to produce gas from the sawdust, which can be used to drive internal-combustion engines and electric generators, with the added advantage that provision can be made for the recovery of the tar, wood naphtha, acetic acid, &c., from the gas as is done in Sweden.

An installation of the latter type, without the recovery of by-products, however, we described about nine years ago.† It is situated at Maldon, in Essex, and is owned by Messrs. John Sadd & Sons, Ltd., English and foreign timber merchants, whose mills are illustrated in fig. 1, which was reproduced from a photograph taken from the air. The initial installation, which commenced operation in June, 1910, comprised two sets of 100-h.p. Crossley waste wood-refuse gas plant and two 100-h.p. Crossley horizontal single-cylinder gas engines direct coupled to Crompton dynamos generating electricity at a pressure of 220 volts. A view of a portion of the older part of the engine room showing the switchboards is given in fig. 2. Since that time the plant has grown considerably, and is now in a prosperous condition; the following additional plant has been installed in recent years:—

Gas Producers.—A 100 h.p. Salmon & Whitfield set, a 200-h.p. Crossley set, and a 250 h.p. Ruston and Hornsby set; in addition, one 250-h.p. Dowson and Mason and one 150-h.p. National producers were in-

stalled (to consume anthracite coal) as stand-by plant, but no occasion has as yet arisen for calling them into use.

Gas Engines.—One 120-h.p. Kynoch horizontal single-cylinder engine direct-coupled to a Crompton dynamo, one 250-h.p. Crossley four-cylinder vertical engine (fig. 3) direct-coupled to an E.C.C. dynamo, and a 500-h.p. Premier four-cylinder horizontal engine (fig. 4) rope-driving an English-Electric dynamo; a view of the valve gear of the latter engine is shown in fig. 5.

The three newer generators produce electricity at a pressure of 440 volts, and the dynamos are assisted by a battery of 112 E.P.S. and 112 D.P. accumulator cells having a 1,200 ampere-hour capacity, and being capable of delivering about 1,000 A momentarily. By this means the engines can be kept on full load, notwithstanding the exceedingly variable station output, which is characteristic of all timber mills. The engines are so closely governed that the variation in speed is not large enough to interfere with the maintenance of a steady pressure at the busbars, which desirable end is considerably facilitated by the use of very heavy flywheels on the engines.

The gas engines are water-cooled, the water being circulated through the cylinder jackets by gravity, and the cooling towers are illustrated in fig. 6. The necessity for the latter arises from the fact that the water in the tidal river which surrounds the works is not sufficiently fresh to be used for cooling purposes. A Ruston and Hornsby waste heat boiler is connected to the exhaust of the 500-h.p. Premier engine, and supplies steam to heat a timber-drying kiln; still further use is thereby made of heat which is generally exhausted to atmosphere.

The switchboards, portions of which are to be seen in

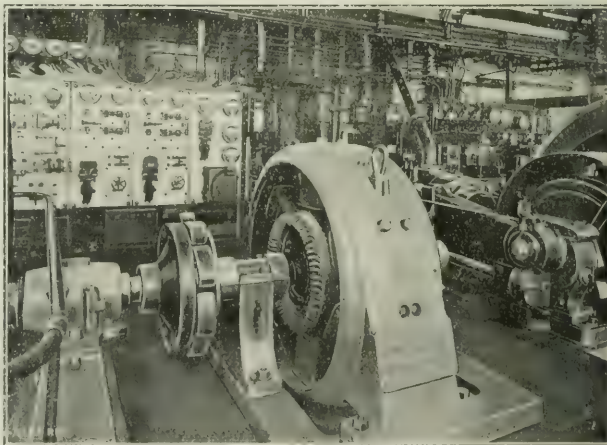


FIG. 2.—ENGINE ROOM AND SWITCHBOARDS

fig. 2, were supplied by Messrs. Crompton & Co. The whole of the auxiliaries are electrically driven, and a 10-ton travelling crane spans the engine room.

Very little difficulty is experienced with the gas producers, two views of which are to be seen in figs. 7 and 8; they are operated entirely on wood refuse produced in the adjoining timber yards, and have given every satisfaction. The gas is first passed through a dust-collecting box over a water seal, and then up through a coke scrubber and afterwards through a centrifugal motor-driven tar extractor, fig. 8, to a wood wool scrubber, and

* *ELEC. REV.* April 7th, 1916, p. 389.† *ELEC. REV.* Dec. 27th, 1912, p. 1,039.

thence into the bus pipe. The gas produced is of such excellent quality that the engines will, with perfect freedom, produce well over their nominal rated output for considerable periods.

Clinker is formed, due to the presence of stones, gravel, &c., in the bark, and a certain amount of care and judgment is needed while charging when the fuel is damp (it may contain up to 40 per cent. of water), and poking is necessary to keep the fuel solid in

the quantity produced, and as the plant is growing so rapidly such recovery will probably be undertaken in the near future; the matter is receiving consideration at the moment.

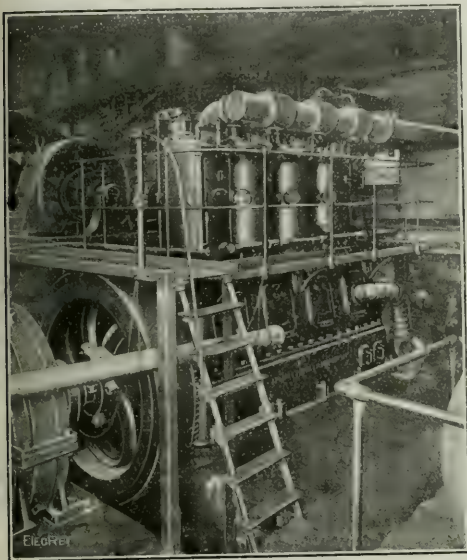


FIG. 3.—VERTICAL CROSSLEY GAS ENGINE.

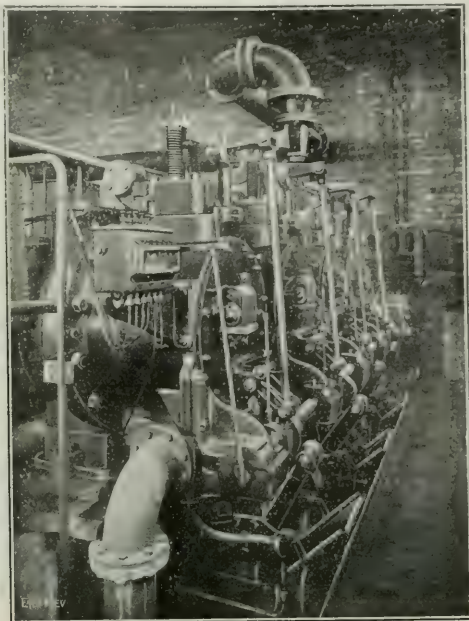


FIG. 5.—PREMIER ENGINE VALVE GEAR.

the plant. The scrubbers, washers, pipe connections, and engines are cleaned out periodically after a definite number of hours of operation; thus the plant is always

Messrs. J. Sadd & Sons, Ltd., besides lighting and electrically driving the whole of the machinery in their own extensive mills and yards, wherein some 50 motors are installed, aggregating 668 h.p., as illustrated and described in the previous article above referred to, also supply electricity for lighting and power purposes in the town of Maldon and the adjoining village of Heybridge. Distribution is entirely by means of overhead mains supported on wood poles, and wayleaves are readily granted by the owners of property *en route*, the supply being on the 3-wire system at 200 and 400 volts pressure.

During the twelve months ending April 30th, 1921, the maximum load recorded at the generating station was 475 kW; the quantity of electricity sold amounted to 998,364 kWh; and the fuel consumed in the gas producers to 2,876 tons—comprising 1,015 tons of scrap wood, 740 tons of sawdust, 545 tons of chisellings, and 576 tons of bark. Since January, 1921, the energy sold has averaged 83,622 kWh per month, and the cost of production has been 1.351d. per kWh at the bus-bars. This figure, however, is rather high owing to numerous repairs which are being carried out in order

to overtake arrears in this direction, and it is anticipated that when "normal conditions" can be resumed the figure will approach 0.75d. per kWh. It should also be mentioned that energy is being supplied to consumers on much more favourable terms than are quoted in other districts.

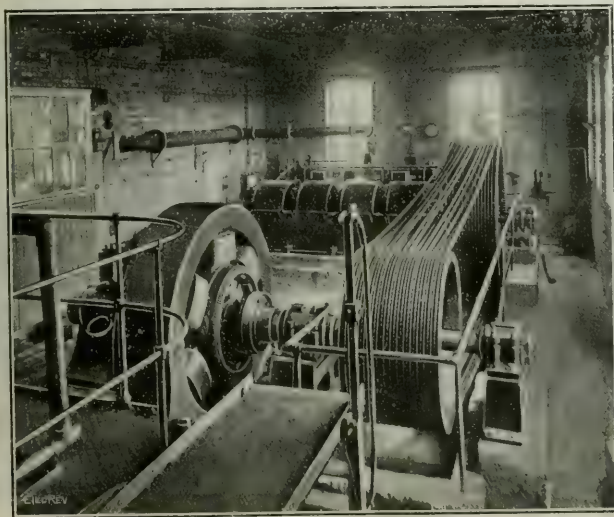


FIG. 4.—HORIZONTAL PREMIER GAS ENGINE.

maintained in a clean state. The crude tar as produced, probably containing about 40 per cent. of moisture, is sold at a price of £1 per barrel, and the wood ash from the producers is a valuable fertiliser with a market value of £3 per ton. Whether it is economical to recover the by-products from the gas depends, of course, on

Three shifts are run at the power house, as part of the owners' timber mills run throughout the night, and about 100 h.p. is also supplied to a flour mill continuously for 24 hours per day; it is contemplated that other local works and factories will demand supplies in the near future. Nearly 100 consumers are at present connected to the mains; their number is being added

that scrap wood and sawdust, &c., when used intelligently is a satisfactory and economical fuel. In concluding, we have to thank Messrs. J. Sadd & Sons for their permission to visit the works and publish the foregoing article, and also Mr. M. Lonsdale, chief electrical engineer to the firm, for his assistance in the preparation of the particulars embodied therein.

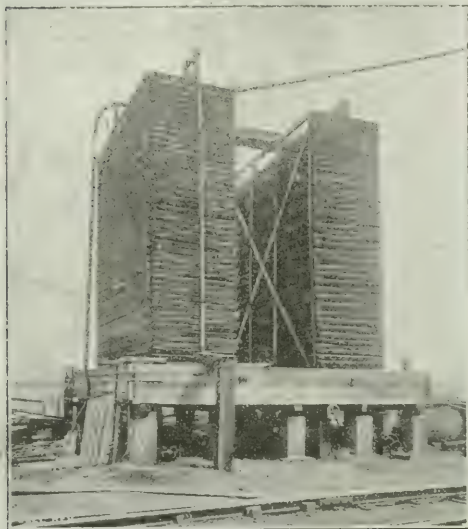


FIG. 6.—WATER-COOLING TOWERS.

to rapidly, and the overhead mains are being extended to embrace outlying districts. Public lighting is at the moment restricted to a small area, but plans are in contemplation for lighting electrically the main streets in Maldon. Electricity for heating and cooking purposes is being favourably received in the town, and be

LEAVES FROM AN INSPECTOR'S NOTE-BOOK.

By "ANODE."

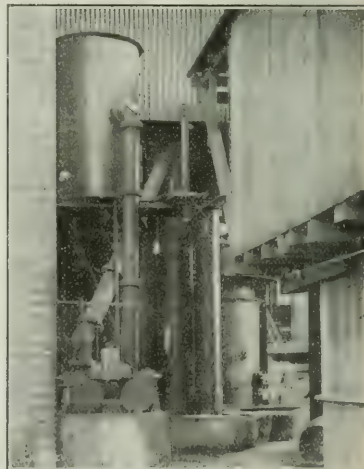
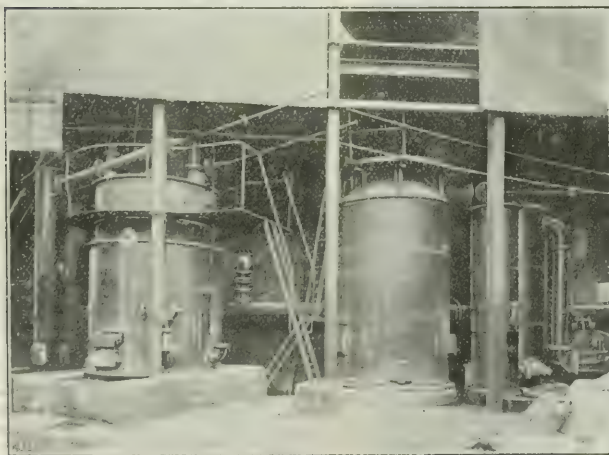
MANY years ago, shortly after I had been introduced to Ohm's law and other interesting electrical facts, I attended evening classes in electrical engineering at the local technical school, and I well remember the teacher, a very clever engineer (a real one, not one of the incubated brand), getting on his hind legs and enthusing over the glorious future of electricity, and the burden of his song was:—

"In a few years the whole of the world will be run by push-buttons, which will set in operation the illimitable power of this mighty mysterious force we call electricity. You will ride in electrically-propelled vehicles. You will sail in electrically-propelled ships. You will find electric lifts to take you up and down. Your food will be cooked by its agency. When you are ill it will cure you, later on it will kill you, and then its aid will be invoked to cart you off to the crematorium, and it will then perform its last offices and incinerate you. Further, all this electrical machinery will be entirely out of sight, placed in obscure corners, economising space, and all we shall see will be the small push-button controlling and directing the mighty motors which shall do our bidding and work our will."

Not so bad for 25 years ago!

A lot of this prophecy has come true, especially the "obscure corner" part, and it is this that I intend to take as my text.

I had on my list of inspections a 1-h.p. motor at a bacon factory, and on attending there I found that the motor was bolted to the ceiling, and the only means of access was by climbing up a greasy ladder, after which



FIGS. 7 & 8. WOOD REFUSE GAS PRODUCERS AND TAR EXTRACTOR.

sides the usual lighting apparatus, automatically regulated incubators and service water heaters were in use so far back as 1912.

Sufficient has been said regarding this interesting installation, whereby electricity may almost be said to be produced as a by-product of the timber mills, to show

I had to twist myself through an angle of 60 deg., remove a band cover, hold on, strike a match, check the clearances, get covered with fat, find the bearings badly worn, oil all over the windings, the commutator as black as the ace of spades and badly grooved, and the brushes worn down and sparking brilliantly.

All this trouble was due to the motor makers, who tell the simple non-technical user that their motors work well in all positions, and once fixed it is only necessary to oil them once a month, as lubrication is automatic.

Our bacon factor looks at the pretty picture of the large works where motors are made, listens to the tale of the salesman, who descants on the large sets they are turning out for the Slocum-on-Slush Council, "3,000 volts, sir," "and every one up to Board of Trade standard," "guaranteed full cream, and that's the stuff we turn out," and thinks that the X.Y.Z. Co. are just the people to turn out his 1-h.p. motor.

Accordingly, in it goes, it is stuck up in the ceiling, and is a nine days' wonder; the most intelligent man in the shop is detailed off to look after it, which he does daily, flooding it with oil, and fancies he is well on the way to becoming a second Edison. Then he gets tired of it, a fuse blows, the factory is stopped for a day, the insurance agent blows in, effects an insurance, and henceforward it is my funeral. I point out all the defects, instruct the attendant how to look after the machine properly, adjust the brush position, and so it goes on till the motor finally breaks down.

One repairer with whom I was discussing the matter summed it up as follows:—

"The average user of an electric motor knows nothing about it, and doesn't want to, so he insures it, and rests contented. All he knows is that if it starts making a noise and things inside bump about, it is a mechanical fault; if sparks and flames come out, it is an electrical fault. You are called in, and you have to get them out of their trouble; but if you expect them to take an intelligent interest in the motor, well, you are expecting too much. The millennium is not just yet, and when it arrives we will be too busy looking after other things to bother with 1-h.p. motors."

I have come across open-type motors in boot shops, where they have been placed on the floor in just such a position that they will collect all the dust from the grinder, and it is nothing unusual to find the whole of the machine full of leather dust, resulting in the machine running hot owing to the non-conducting cover of dust with which it is surrounded, while it would have been an easy matter to have put the motor a couple of yards or more away, with a horizontal instead of a vertical drive, meaning less bearing wear and a more satisfactory drive.

In another case I came across a motor driving a circular saw, the motor being placed in a pit and covered with an extremely loose-fitting cover. The motor was covered with sawdust, and naturally ran excessively hot. The risk of fire was very great, and I had a lot of difficulty in persuading the owner to bring the motor out of the pit, fix it on the floor level, and cover it with a really good sheet-iron cover. In this case the motor was fixed in the pit in order to save floor space, but I venture to say that what he lost in floor space by removing it, was more than gained by the extra facility given for examination, and the lengthening of the life of the motor through cooler running.

Motors in laundries come in for rough treatment. In one case I found an open-type machine fixed on the floor of the wash-house, and running in an atmosphere full of water vapour, and, in consequence, continually breaking down. It would have been an easy matter to place the motor in a small building outside the wash-house, where the conditions would have been more suitable, but the owner grudged the small expense he would have been put to, and preferred the continual losses through stoppage of the plant, which amounted to a large sum yearly.

Motors in breweries also cause a lot of trouble, which could easily be avoided by installing machines suitable for the work.

Totally-enclosed motors should be put down in all cases where water vapour is present, and the use of semi-enclosed or open motors should be limited to situations where the atmosphere is normal and free from dust. It is quite an easy matter to have the windings coated with acid-resisting varnish, and if its use were universal

throughout breweries, &c., electrical trouble would be greatly minimised.

The same remarks apply to all chemical works, and tanneries also run their plant under equally bad conditions.

It must not be imagined that it is only in the case of small users of electric power that we find these instances of neglect.

In many instances I have found machines placed in bad positions simply because that happened to be the easiest way of accomplishing the task, no regard being paid to the question of efficiency and upkeep, and this is especially noticeable in collieries. I am not now speaking of motors fixed in temporary positions, as in some circumstances it is essential that a motor be put to work at a moment's notice, and even if it has to run under continuous overload it has to go through with the work, pending one more suitable being obtained. The instances to which I refer are those of permanent pumping plant, one case being that the motors and pumps were fixed at the lowest part of the mine, with the result that when a breakdown occurred to two of the three sets, the whole of the pumps were flooded, whereas had the motors been brought 10 ft. higher up there would have been a storage capacity which would have enabled considerable repairs to be carried out before water trouble was threatened.

And the moral: Leave the job to engineers, real ones, not incubated ones!

RUSSIA'S ELECTRIFICATION.

AMBITIOUS SCHEMES AND CONSIDERABLE PROGRESS.

A RUSSIAN paper states that for the purposes of the electrification of the industrial establishments of the Vladimir Government, the Tiekoff and Pistofo marshes will be turned to account in the first place, after which others will be exploited for the purpose of yielding fuel to drive the machines. These marshes are all of considerable extent and of useful depth for fuel production. On the Tiekoff marsh it is intended to install during the next three years 60 peat presses, and to extract at the rate of 6,000,000 poods of peat per year. This quantity will supply the electrical station to be installed, the buildings of which are now in process of construction near the Rubisky marsh. It is intended to install three turbo-generators of 60,000 kW. It is intended also to follow on with an electric station at the Pistofo marsh. The idea is to connect all the industrial centres of the Government to this central station, and such would include the district of Ivano-Vosnesensk, Schuya, &c. The extension of the distribution from these stations to the agricultural establishments of the Government is likewise contemplated.

In the current year on the construction of the electricity generating station on the Rubisky marsh, the construction of a full gauge railway connecting it with various centres, the length being 153 versts, will be proceeded with. A temporary electric station has been installed to light the establishments on the Rubisky marsh, where a sawmill will be erected, also engineering shops, workmen's dwellings, and general service buildings. The utilisation of the above electric stations is expected to effect a saving of 80,000 cubic sazhen of firewood per annum.

Although determined efforts are being made to effect what are called capital repairs in the Petrograd electric stations, it has to be admitted that delay has occurred owing to scarcity of competent labour. There is also great difficulty in obtaining some parts and materials, which have failed to be delivered, although ordered in apparently good time; and it was feared that if the necessary steps were not at once directed towards obtaining these goods, the repair work then in hand would have to cease by August 15th. In some cases the workmen have formed Cartels or group unions and addressed themselves to overhauling the turbines, and reinstalling them with considerable success.

It is announced in one journal that a concession granted to a large Scandinavian group for the exploitation of submarine cables between Russia and Denmark, Japan, and China has been confirmed.

The telephone system of Tula is said to be completely ruined, and in its place a new underground double wire system is being laid. The work is proceeding with great energy, about 1,000 men being engaged on it. The number of subscribers expected, when the work is completed, is 1,500, or approaching three times the number that was connected to the old system.

It is hoped to start the Kashirsk electric station in the month of November. The plant already installed represents 10,000 kW, but this is to be increased to 60,000 kW. The machinery will be run on coal from the Moscow district.

An electric station to supply the Utkin factory, Petrograd, is being completed. The present power is 10,000 kW.

The Russo-French Metallurgical Works, Petrograd, were to deliver a first consignment of electric ploughs by the first of August.

WORKING CONDITIONS IN FACTORIES.

REPORT OF H.M. INSPECTOR OF FACTORIES.

From the report of the Chief Inspector of Factories and Workshops for the year 1920* (the electrical inspector's portion of the report was abstracted in our issue of August 5th) we learn that notwithstanding the trade depression during the year the number of registered factories increased by 4,610 to 140,064, while workshops continued to disappear, their number being 141,971. The total number of persons employed in all factories in 1919 was 6,127,706—i.e., 2,157,783 females and 3,969,923 males. Thus when practically all the females employed as substitutes for men during the war period had given up their occupations, there were employed in the factories alone 430,000 more females than in 1913, while at the same time there were 350,000 more males.

Rather fuller accident statistics are given than in former years; they show that the total number of accidents reported in 1920 was 138,702[†], of which 403[‡] were due to electricity. The total number of accidents in electrical generating stations was 531[§] of which 59[¶] were due to electricity, and in electrical engineering 2,442^{||}, of which 42^{|||} were due to electricity. During the year 350 fires were reported, of which one was in a generating station and six in electrical engineering works.

During the year the Employment of Women, Young Persons, and Children Act, 1920, and the Women and Young Persons (Employment in Lead Processes) Act, 1920, became law. The Departmental Committee on Factory Lighting that was appointed in 1913 and issued its first report in 1915, when its work was suspended owing to the war, resumed its investigations towards the end of the year, but owing to the urgent need for economy its inquiries have since been restricted. It has, however, assisted the department to prepare a pamphlet on factory and workshop lighting, and an important memorandum on artificial respiration in cases of electric shock was issued during the year. It is proposed to reorganise the inspectorate so that the men's and women's sides will be amalgamated and women inspectors will become eligible for all posts. The number of districts is to be increased from 62 to 88, and four additional electrical inspectors are to be appointed. Though the changes will involve considerable redistribution of the staff, the total will remain about the same.

Crane Accidents.—The grave character of many of the cases arising from overhead cranes is noticeable. Certain types of accidents which are known to be preventable by fencing or slight modification in the design of the mechanism responsible for injury, still continue to occur up and down the country. Investigations show clearly that cranes are not examined sufficiently often nor carefully enough. Further, repeated failures suggest that the original safe load should be reduced as the crane increases in age, to allow for the factors of fatigue and deterioration of material generally. The whole subject is one of special importance, for not only is the total of accidents high, 2,579 in 1920, but many prove grave in character—no fewer than 109 terminated fatally. The use of cranes is increasing, and the modern tendency is towards higher speed in hoisting and lowering, and (in overhead cranes) acceleration also in speed of travel.

Electric Hoists.—It is reported that a hitherto unsuspected cause of crane feeding-up was revealed by the bursting of periphery wheels driven by compound-wound electric motors. The shunt circuit breaks, owing to the fusing of the shunt winding. The motors thus become series wound and a greatly increased speed results under "no load" conditions. Means of prevention are now under consideration.

* H.M. Stationery Office, Kingsway, W.C. 2. Cmd. 1403; price 1s. 6d. net.

† Principal numbers are those of accidents; small figures are those of fatal accidents only.

Explosions.—An explosion in an india-rubber factory, which caused the deaths of seven men and injury to nine others, is thus described: Cotton fabric impregnated with a solution of rubber in naphtha and rolled into bundles is taken to the naphtha recovery plant, where the excess of naphtha is removed, before being taken to the steam heating frame. Owing to an oversight, a roll of solutioned fabric was conveyed directly to the warming frame from the spreading shop with the result that, when a certain amount of cloth had passed over the frame, a violent explosion took place. Elaborate precautions are taken with regard to ventilation and the prevention of fire; the place is lighted electrically, safety globes being placed round the lights, and the machines are operated electrically. It is presumed that the explosion was caused by a spark from the calendar motor or by a spark of static electricity generated by the passage of the cotton fabric over the steel frame of the warming machine, and shows the necessity for taking all possible precautions to prevent sparking in an atmosphere charged with inflammable vapours.

A curious accident occurred in a large boiler shop where 16 smiths' hearths received their air supply from an electrically-driven fan. The air blast was fed to the coke fires through pipes from a main. While the fires were in full blast the fuse "blew" on the fan motor circuit and the fan stopped. The heat of the fires then caused a reverse current in the pipes, and air was drawn through the fires forming carbon monoxide as it passed through the hot fuel. When the blast came on again the oncoming air formed an explosive mixture with the carbon monoxide and this ignited at one of the fires. The resulting explosion ruptured the blast pipes, but nobody was hurt. Safety flaps have since been fitted in the blast pipes.

Dangerous Trades.—The high incidence of lead poisoning in the electric accumulator industry—48 cases in 1919 and 47 in 1920—emphasises the need for the most meticulous attention to the detailed observance of the statutory precautions, and suggests, indeed, the desirability of an even higher standard of working than the code demands. A very considerable expansion of the accumulator trade has followed the great development of the motor industry. The Women and Young Persons (Employment in Lead Processes) Act, 1920, it should be noted, forbids—section 1 (e)—the employment of women, and young persons of both sexes, in mixing and pasting both in manufacture and repair of accumulators.

Some of the works under the code are quite small. Several came into existence during the war, when the premises taken were in many cases far from satisfactory for the purpose. Considerable pressure had to be put on some of the firms concerned to ensure the necessary remedies, or failing this, the closure of the works was ordered.

The reports show that the standard of compliance varies considerably, and the following notes indicate the requirements which were found to be the most neglected:—

Regulation 3.—Constant maintenance of floors of pasting rooms and those in which dry compounds of lead are manipulated in moist condition, and daily hosepipe washing of same.

Regulation 4.—Provision and use of suitable receptacles for lead ashes and old plates. The receptacle for the dross and ashes, from which most harm is to be feared in the lead melting process, should be under exhaust.

Regulation 5.—Any manipulation of dry compounds of lead, whether in connection with paste mixing or otherwise, except when carried on in a dust-proof machine, must be done under the prescribed conditions of exhaust ventilation. Such manipulations would include, for instance, scooping from barrels of lead compounds; weighing of lead compounds; breaking-up and remixing of unused dried paste. It has been noted that a narrow view of the scope of the regulation is sometimes taken, and that such processes as mentioned are carried on without the specified precautions.

Regulation 15.—This requires the daily cleansing of floors and benches, and is often seriously neglected. Cleansing should be done with the scattered lead material properly moistened, or a suction cleaner should be used.

Some important health matters are not specifically dealt with by the code, but under the more general requirements of the Acts. Thus, the small power-driven saws used for plate trimming should be provided with exhaust ducts. Filing and brushing operations should also be carried on at benches provided with localised exhaust. Sheets of brown paper or cloths are used in some places in connection with paste operations, i.e., between the pasted plates. It is important that the risk from the paste which dries on these should be recognised. The paper is thrown away. In either case proper receptacles are required.

Suitable warming arrangements should be provided at the fresh air inlets to the room to ensure that the ventilation will not be interfered with in winter time, and that the workers will not block up the inlets in order to prevent draughts.

Special inquiries have been made during the year in connection with the overloading of cranes, and although there is very little evidence to show that deliberate overloading often occurs, a great lack of care is exhibited by some firms. Electrically-driven cranes are very liable to be over-loaded, owing to the crane drivers and others interfering with the fuses in the hoisting motor circuits.

The increased use of electric lighting has effected a considerable improvement in the standard of lighting provided on ships under construction or repair and also in the ship-

yards generally. Very few complaints have been made as to the inadequacy of lighting.

Lighting in Factories and Workshops.—There is evidence that the importance of adequate and suitable illumination is being increasingly recognised by employers, and that a high degree of brilliancy, not only on the field of work but in the general lighting of the room, is appreciated by the workers. Improvements are reported both as regards natural and artificial lighting; there is reported, too, from all parts a wider adoption of electric lighting in substitution for gas.

The most obvious defect in many new installations is that of *glare*, chiefly due to the increased use of gasfilled lamps which are substituted for the ordinary vacuum electric globe, and used with inadequate shades. The rival claims of general diffused lighting and localised lighting confront the employer. The former is gaining in favour for factory use. Localised lighting is the more expensive. High-power lamps increase the illumination for the same consumption of electricity, and enable the employer to provide for the general illumination of his workrooms an intensity of light previously restricted to the small area of an individual operator's work. Such general lighting is in practice usually obtained by means of gasfilled lamps distributed over the room at very varying heights with shallow shades, or far too often, without any shade whatever. The "indirect" lighting obtained by means of an opaque bowl, which causes the whole of the light to be received by reflection from the ceiling, is more suited to restaurants and places of entertainment than to factories. For processes requiring brilliant light on the field of work a combination of general and of localised lighting seems to be the most suitable.

While progress in lighting is reported by the inspectors, the other side of the picture is unfortunately equally prominent, as are also defects in both natural and artificial lighting. In this connection the result of investigations made by the Fatigue Research Board on output in silk weaving is of special interest. It was found that "every unnecessary hour under artificial light means a direct loss of production and makes the task of the worker more difficult than it need be." It was proved that "under artificial illumination production falls even if electric light of sufficient intensity is provided. The magnitude of the fall is of the order of 10 per cent. of the daylight value of the output."

Seeing that daylight is so superior to artificial light, and, moreover, saves the cost of an illuminant, it is surprising that more care has not been taken to admit it into workrooms as fully as possible, and that so little use has been made of devices whereby daylight may be secured or conserved. A word of caution may not be out of place, in view of reports of artistic "colour schemes" for factory walls, adopted with the object of relieving the drabness of industrial employment, namely, that care should be taken to choose colours which will not absorb the light.

In some industries daylight is essential for colour work, and use is being made by some firms of "artificial daylight," when natural light is not available. The effect produced is reported to be highly satisfactory to those who have installed the necessary fittings, but the expense involved, owing chiefly to the amount of electric light necessary to obtain a sufficient illumination, is too high to permit at present of more than a very restricted use. The principle in each case is that of reducing the red and orange rays which preponderate in artificial light, until they bear the same proportion to the blue-violet rays as in daylight; the result is reached by different methods.

The relation between the safety of the workpeople and the efficient lighting of every part of the factory has not yet been sufficiently appreciated by many employers.

The many and varied problems involved in industrial lighting are to receive further consideration in the coming year.

(To be concluded.)

Swedish Transformers for Russia.—About a year ago an order for eight transformers, representing a value of over 1,000,000 kronen, was placed with Luth & Ropens Elektriska A.B. by M. Krassin and Prof. Juon on behalf of the Centrosojus. Three of the transformers were delivered some weeks ago, two have just been shipped, and the remaining three are expected to be ready by the end of the present month. Payment for the transformers is said to have been made in Swedish currency. The transformers already completed have been inspected and approved in Stockholm by Soviet experts, and four of them are destined for erection at Kaschira, about 43 miles from Moscow, while the others are for a step-down station in Moscow. There is a steam power station at Kaschira where local lignite is used as fuel. The generation pressure is 2,800 V, which is raised to 115,000 V, and about 12,000 kW is transmitted to Moscow, where the pressure is reduced to 1,000 V. The weight of each transformer, including oil, is stated to be about 29 tons; they have been constructed on the mantle type, which possesses great power of resistance against electrical and mechanical strains, and they are the first which have hitherto been constructed in Sweden for this high pressure.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to send particulars of new or improved devices, and apparatus, which will be published if considered of sufficient interest.

Mosaic Fittings.

A type of fitting which is quite new to the British market has been introduced by the MOSAIC FITTING CO., LTD., of 31, Newman Street, W.1. It is made in the shape of bowls, globes, or shades, in mosaic patterns composed of variously



FIG. 1.—MOSAIC FITTINGS.

shaped pieces of coloured glass, which, we understand, are put in position whilst molten or plastic. Obviously, very beautiful and artistic designs can be produced in this way, and the light passing through them gives very pleasing effects. Examples are shown in fig. 1, but a black and white reproduction naturally fails to do justice to the originals.

A Traffic Regulator.

MR. ALEXANDER ZARKY, 930, W. Temple Street, Los Angeles (Cal.), U.S.A., has sent us some particulars of his traffic-



FIG. 2.—TRAFFIC REGULATOR.

regulating device which, he states, has already been employed with success. This regulator consists of a pedestal mounted on a box. On the top of the pedestal is a glass globe, con-

aining a lamp, on which are painted four circles—two red ones bearing the word "Stop," and two green ones in which the word "Go" appears. The box at the pedestal's base contains dry cells or accumulators. Fixed half way up the pedestal is another box containing an adjustable clockwork-operated timing device which operates small contactors which are housed in the column between the clockwork box and the globe. The globe does not revolve but turns and reverses

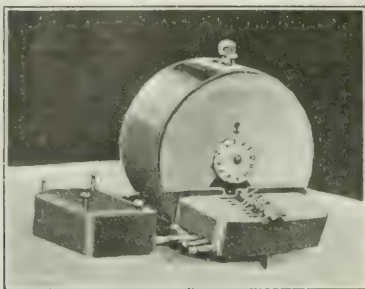


FIG. 3.—CLOCKWORK MECHANISM.

in periods depending upon adjustment. If desired, the one control can be employed for operating other synchronized lights by means of relays. The column is shown in fig. 2. Fig. 3 illustrates the clock mechanism. The contactors are seen mounted on a shaft revolved by the "second" movement of the clock; these dip into mercury in which the terminal screws, seen at the side, are immersed. The inventor states that if overhead trolley wires are already in existence the device can be inverted and suspended.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Oil Consumption and Prices.

In your issue of July 29th we note that your correspondent, Mr. E. F. Butler, refers to the lubricating oil consumption of the Vickers-Petters oil engines. A comparison is made of the performance of a 1,000-h.p. engine using, according to the statement in the *Daily Mail*, 4,000 gallons of lubricating oil in the course of a year's working, and a 1,000-kW turbine using 350 gallons.

The Vickers-Petters oil engine is made in sizes up to 500 b.h.p., and within that range great economies can be shown in comparison with steam engines. It does not, however, profess to enter into competition with large turbines such as the 1,000-kW set referred to by Mr. Butler. A turbine certainly has the advantage of only requiring to make up for lost oil due to leakage and atomisation.

As a matter of fact the new Vickers-Petters oil engine is lubricated on a patent system which effects a great economy of oil, and makes the comparison favourable with Diesel, horizontal, and other types of oil engines. The lubricating oil consumption on an average amounts to 0.006 pint, or, say, 3 grams per b.h.p. per hour.

For Vickers-Petters, Ltd.,
G. B. PETTER, Director.

Ipswich.
August 12th, 1921.

Country House Lighting Plant.

Mr. Taunton's very able and interesting article in your last week's issue shows some of the disadvantages of automatic and semi-automatic electric lighting sets, but I do not think he gives enough emphasis to the fact that even the largest of these sets is too small for quite moderately sized country houses. The average owner, usually, has no idea how much light and power he needs until the plant has been installed; then, as his ideas and experience increase, he proceeds to add lights and accessories to the installation without any thought as to the size of his plant. This becomes overloaded and, finally, "gives up the ghost," greatly discrediting electric light in the neighbourhood. The only way to avoid this is to install ample engine and dynamo capacity at the beginning. The battery is not so important, as it can be worked continuously at full load with less harm, in the long run, than an oil engine.

If the 3-b.h.p. set, which Mr. Taunton favours, is viewed from this standpoint, it does not show up very well, and I

should doubt very much if it would be adequate for a 50-light installation.

Personally, I have found that an installation, comprising a low-speed horizontal oil engine, a dynamo, battery, and switchboard, costs very little more than these 3-b.h.p. sets. The low-speed set is certainly more difficult to start, but it can easily be run by unskilled labour. Have these small semi-automatic sets been installed for a sufficient number of years to enable a satisfactory estimate of their reliability to be formed?

Bexley.
August 15th, 1921.

C. E. Atkinson.

The Electrical Trades Union and Non-Union Labour.

Having read with annoyance the attitude taken up by the above Union in London with regard to connecting up installations carried out with non-union labour, the writer is wondering how the organisation (or disorganisation) gained its great power. By experience he has proved that it certainly isn't due to the practical qualifications of the average member of the E.T.U. I am told by several of its members that they joined up for peace, but not by choice, and I believe that that is exactly the position taken up by the minority of really practical electricians in the E.T.U. I am also surprised that no trade test is carried out before admitting a prospective candidate or "would-be" electrician as a member, and that anyone who comes along (or is dragged along) with the slightest knowledge of electrical work is admitted a member. My information has been furnished by so many members of the Electrical Trades Union that I have no reason to doubt it. I also think, like the *ELECTRICAL REVIEW*, that sooner or later the meddler burns his fingers, and not only will the E.T.U., London, one day have its lesson, but the E.T.U. as a whole.

August 15th, 1921.

Draughtsman.

I have read with interest your editorial comments on "The E.T.U. and Non-Union Labour." It seems clear that there is something radically wrong with the methods adopted by the Union to protect its members, as it has never enjoyed the reputation and status of the A.S.E. or, later, the A.E.U. The electrical industry is flooded with all sorts of intruders who have never served any apprenticeship at all, a condition which is almost absent in mechanical engineering. Can you, Sirs, or any reader, explain why electric wiring is included in the standard recognised course to qualify for a registered plumber? It may not be objectionable for a firm of plumbers to have an electrical branch so long as it employs practical wiremen or electricians to do the work, but if electricians were to erect gas and water pipes, &c., I think the plumbers would have something to say against it. Until all this is stopped, it is doubtful if the E.T.U. will ever be able to give its members the protection it ought to.

August 13th, 1921.

Fair Play.

Abnormal Meter Records.

In line with Mr. Southgate's letter in your issue of August 5th on the above subject, I quite agree that it is very difficult to understand how the readings were taken, and continued to be taken, without the error becoming apparent and the matter cleared up.

In order to do this, more information and details are required from India, giving a complete list of readings from January, 1920.

I am, however, perfectly satisfied that a mistake was made by someone, and I gave what I considered the most likely solution on the data supplied.

One other solution did occur to me which would only be possible if the "records" were kept carelessly. That is, that the February, 1920, readings were subtracted from the March, 1921, readings, thus giving a year's consumption, instead of one month's.

Assuming that the summer units consumed were less than the winter units consumed, the total units shown for March, 1921, would represent a year's consumption for that class of consumer. Any change of meter during the period would, of course, show up the mistake.

Still it is just possible, and it certainly would account for the error not being discovered by the reader who took the April, 1921, readings, assuming the mistake was made by the meter-reader of March, 1921, in line with my solution.

Pontypool (Mon.).
August 13th, 1921.

Theo. R. Kernick

Testing and Repairing Magneto.

A controversy upon the subject of magneto repairs is about as deep as one upon religion, and leads to the same place—usually nowhere. Robert Bosch is reputed to have termed the magneto "a box of tricks," and this would appear to be borne out by the fact that no electrical genius has ever attempted a work of any great proportions on the subject. The application of any fixed theory in magneto repair work is as abortive as the application of theory to horse-racing. It invariably comes "unstuck."

With regard to ball-race "pullers," the writer knows of two distinct designs in everyday use which are infallible, even in the case of a tight race.

Dealing with the standardisation of magnet tests, there can obviously be no standardisation of test until we have a standard magnet-steel and a standard magneto design.

Concerning armature tests, the invariable practice is a stationary test with d.c. supplied from an accumulator to the primary winding with trembler action (either a "master" tumbler or a tumbler actuated by the magnetism of the core itself). This is a totally different state of affairs from what actually happens in the armature under working conditions, where the current is a.c. with a high crest voltage which immediately collapses to zero; also where the current is solely dependent upon the strength or weakness of the magnets. Why not start from the other end and apply a h.p. current (with a spark gap) of approximately the output voltage of the machine, to the secondary winding? This should immediately detect an earth leakage. A bell test disposes of any doubt as to continuity of windings.

The slip-ring should be tested with the same h.p. current, an earth "search" lead being provided, which will immediately detect a "burn out."

The only hope for a practical condenser test is a comparative capacity test based upon manufacturers' standards, together with a "breakdown" test.

The only really positive and conclusive "running" test is to arrive as nearly as possible at road conditions, viz.: heat (approx. 120° F.), vibration, and speeds; the spark itself to occur in compressed air—say, at 100 lb. pressure.

Although an ex-Service electrician myself, and having had experience of i.c. ignition under very adverse conditions in France, I can scarcely agree with Mr. J. H. Owen, for, personally, I found the average Service electrician with a magneto in a similar predicament to the proverbial "cow with a musket."

Leytonstone, August 14th, 1921.

J. Perry.

ELECTRIC HEATING BY "HEAT ACCUMULATION."*

THE following notes are abstracted from a translation of a lecture by Herr Paul Beuttner to a Society of Engineers in Switzerland.

After preliminary notes on the high cost of coal in Switzerland and the possibilities of water-generated electric power for heating, and even steam raising, kiln firing, &c., particularly during hours of light load, the lecturer referred to electric heat accumulation. Accumulator stoves are now made according to three different systems: 1. Heat accumulation by means of hot water. When the water is heated to 120 deg. C. and cooled down to 40 deg., an accumulating capacity of 71,000 heat units is produced per cubic metre of accumulator storage capacity. 2. Heat accumulation in the form of steam with a 13-atmosphere pressure. When cooled down from 190 deg. to 110 deg., an accumulating capacity of 68,000 heat units is produced per cubic meter of accumulator storage capacity. 3. Heat accumulation in a solid block, heated to a temperature of 500 deg. When cooled down to 200 deg. an accumulating capacity of 90,000 heat units is produced per cubic meter of accumulator storage capacity.

The accumulator stoves constructed by Herr Paul Beuttner are based on the principle of heat accumulation. The heating stoves at present in use require during a short space of time a large amount of electricity, particularly in the morning and evening; this is a great drawback on technical grounds. The modern accumulator stove is continuously heated for 15 hours (excepting the hours during which the energy is used for lighting). The rate of use of electricity during the time mentioned is small, and the temperature available in the stove is so high that at any time meals can be cooked. Experiments which were made under the supervision of the Swiss Electrical Society proved that the following amounts of electricity were used for cooking the meals of an average large family:—

For the morning meal	0.87 kWh.
For the mid-day meal	3.00 kWh.
For the evening meal	1.95 kWh.
Amount allowed for losses in current	6.50 kWh.
Total	12.32 kWh.

In addition, water is heated at the same time for washing up. This consumption of 12.32 kWh entails a demand rate of 0.8 kW during 15 hours (outside of the time during which electricity is used for lighting). In this way it is possible to attach the accumulator stoves to any circuit used for lighting purposes. At rates charged in Zurich, the actual cost per day is 1.25 fr. where electricity is used directly for cooking the meals of an average family; where used in an accumulator stove the cost would be 0.79 fr. per day; or, assuming a night energy price of 2 cts. the cost with an accumulator stove would be reduced to 0.45 fr. These accumulator stoves can

be arranged to burn wood or coal, in case the power is cut off owing to a scarcity of water or other reasons. These stoves are heated by warming rods of silicium carbonate.*

The use of electricity for heating has spread rapidly in certain industries, particularly in the case of baking ovens. These ovens are also made to use the silicium carbonate rods.

Every variety of baking oven is adaptable for electrical heating. The alterations necessary can be carried out in a few days, and in such a way that, although it is intended to use electricity regularly, the oven may be stoked with coal or wood should it be found necessary.

The electricity supply undertaking in the Lyons (France) district has now agreed to a special tariff (about 1d. per unit) for heat accumulating appliances operated during the night.

THE THIRD FACTOR IN PRODUCTION.

A LECTURE which attracted considerable interest was given at Birmingham some time ago by Mr. F. L. Impey, managing director of Messrs. Moreland & Impey, Kalamazoo Works, Northfield, on "Management's Responsibility for Restriction of Output." The meeting was representative of the Birmingham branches of four staff trade unions—the Society of Technical Engineers, the Electrical Power Engineers' Association, the Association of Engineering and Shipbuilding Draughtsmen, and the National Foremen's Association—and was presided over by Mr. W. Wilson, M.I.E.E.

In the course of his address, Mr. Impey said that any attempt at better production was largely dependent upon management for success. Management he defined as the third leg upon which industry stood. Capital and labour were the other two, neither of which could achieve much unless brought together by the brains and skill of management. It had become customary for the whole of the blame for under-production to be thrown upon labour; this, however, was false, for capital and management could regulate production, whereas labour could only check it. It had been suggested that labour refrained from blaming management for its inefficiency because of its fear of payment by results, but he believed that labour's failure to blame management had been due to ignorance of the actual facts.

Efficient production, he urged, was recognised as the supreme need of industry to-day, yet everywhere plant and machinery were working wastefully and not yielding sufficient output. Though it was true that labour, if it so willed, could increase production to an appreciable extent, most of the blame for the present backward state of industry was attributable to management through lack of organisation. On the other hand, certain trade unions had, during the war, encouraged their members to restrict output, and this had been reflected in the work of large bodies of men. Capital could only overcome the hostility of labour by taking workpeople into its confidence in a just and open manner.

Mr. Impey gave twelve factors as being responsible for poor production. For seven of these, he contended, management was directly blameable; in four the blame was shared by management and labour, and only for the remaining one was labour responsible. In the first group were classified congestion of work in the factory, obsolete machinery and tools, unsuitable materials, bad working conditions, frequent changes in design, inadequate costing, and bad salesmanship. The failure in obsolete machinery was obvious, but there were many firms which could not afford to scrap their plant. The remedy lay then in working such machinery to the best of its capacity and making renewals gradually. Concession of work in the factory was due to failure to take jobs consecutively, failure to collate requirements for a job before commencing it, lack of space, fixing machines in the wrong place, and overworked foremen. The cure for this was general reorganisation and the introduction of a planning office. When the planning office functioned properly it would have absolute control of the factory.

The remedy for unsuitable materials lay in efficient store-keeping, intelligent purchasing to standard specifications, and the inspection of goods on arrival.

Darkness, dirt and damp, poor floors, and narrow stairways were cited as bad conditions which proved the awful lack of imagination among the factory owning classes, who had not realised that such a state of things not only was inhuman, but created low production and poor quality. These things could be removed and lessened at very small expense.

Changes in design, the lecturer urged, should be saved and introduced when the output was so well in advance of the selling organisation that a temporary fall in output would have no serious consequences.

As to inadequate costing few firms could compare their actual output with the standard output that could have been obtained had the functions of management and labour been exactly co-ordinated. A cost system should serve as a test of quality and quantity, and should as far as possible forecast the future.

On the subject of bad salesmanship, the speaker thought the success of a business depended on the factory's making

* B.D.A., No. 156.

* Silicon carbide ("Silundum") or silicon oxycarbide?

as small a variety of articles as possible, and the salesman selling this limited number in large quantities. The salesman's aim should not be to sell the highest value in pounds, shillings, and pence, but the largest number of articles his factory could economically turn out.

In the second group untrained workmen constituted the first cause for low production and discontent. One person should be responsible for engaging all staff and workpeople, for seeing that they were properly trained on arrival, and for the education and comfort of all the employees.

Excessive reduction in hours was to be guarded against, for while it had been proved that a gradual reduction often resulted in improved efficiency, a drastic reduction was a mistake, in that it did not give management or labour time to readjust themselves to new conditions.

Antagonistic labour was the third factor in the group. Labour must put aside the past mistakes of management, and management must take a wider and more humane view of the demands of labour. If management acted the nigger driver, labour would remain sullen and hostile, and might even try to absorb management into its ranks by force. But management could not be efficient if fettered either to capital or labour, its mentality and duties were quite different, and it must maintain a separate entity, nevertheless meeting labour in a friendly spirit in all disputes.

Strikes, declared the speaker, could only be avoided by honourable dealing on both sides. Management could nip

disputes in the bud by arranging for the discussion of matters in which it and labour were jointly concerned. Labour's opposition to any form of payment by results was due to the past unfairness and laziness of management in handling the work.

It was now a commercial axiom that poor service was suicidal to industry. The true product of labour was skilled work. Labour, then, should encourage the useful and eliminate the wasteful, and should put itself in a position to demand the best price. Trade unions should have a research department to study the methods of payment, and they should at least share the responsibility of promoting a wages system which would bring about economy in production.

Concluding, the lecturer said he looked forward to the time when management's responsibility would be recognised by the public. Old prejudices must be overcome, capital, labour, and management must pull together for a better state. His chief fear was the hot-heads on each side, but surely there were enough level-headed, peace-loving men to bring about the changes in organisation that were necessary for the evolution of industry alongside of the security and well-being of labour.

That the lecture had provoked much keen thought was evidenced by the discussion which followed. A representative of each society spoke, and several members of the audience expressed their appreciation of Mr. Impey's address, one characterising it as the laying-down of first principles for the reorganisation of the industry of the country.

BUSINESS NOTES.

Bankruptcy Proceedings.—C. H. STEEL, electrical engineer, 1, Nelson Square, Bradford.—Last day for proofs for dividend August 27th. Trustee, Mr. E. Owen, O.R., 117, St. Mary's Street, Cardiff.

J. W. GLADWIN, electrical engineer, Meersbrook, Sheffield.—Last day for proofs for dividend August 27th. Trustee, Mr. C. Turner, 155, Norfolk Street, Sheffield.

C. T. STANTON (Southern Electrical Engineering Co.), 25, Beckenham Road, Penge.—First and final dividend of 7ad. in the £ payable August 29th at the Official Receiver's offices, 133, York Road, S.E. 1.

Company Liquidations.—PORTABLE ELECTRIC MOTORS (1919), LTD.—In the summary of the statement of affairs the gross liabilities stand at £22,857, estimated by the officers of the company to rank at £11,114. The estimated total assets are £17,987, less £73 preferential creditors for rates, taxes, &c. The estimated amount available to meet the claim of debenture holders is £17,914. From this there are deducted loans on debenture bonds secured on the assets, £10,409. The estimated amount to meet unsecured creditors (subject to cost of liquidation) is £7,504, leaving an estimated deficiency of assets to meet the liabilities of the company, subject to the cost of liquidation, of £3,609. The statement as regards contributories shows a total deficiency of £30,962. It appears that the company was registered as a private company on April 3rd, 1919, with a nominal capital of £50,000 in £1 shares, its objects being to acquire and carry on the business of manufacturers of portable electric motors for cutting metals, stone, &c. The first directors were George Fryer and Lord Clifford of Chudleigh. The latter resigned in July, 1919. H. E. Sadd, F. Bright, and C. de F. Myburgh were appointed directors in July, 1919, and resigned in February, 1920. John Cooper and Stanley Lingard were appointed in February, 1920. No remuneration was fixed, and none appears to have been paid. Fryer was appointed managing director in April, 1919, with a salary of £12 per month, and ceased to act as such in February, 1920, from which date Cooper acted as managing director. No remuneration was fixed at the time of Cooper's appointment, but according to the minutes he and Fryer were to receive £500 per annum for their services as from October 1st, 1920, but nothing appears to have been paid to them on this account. Fryer states that he was the inventor of a portable electric motor for cutting metals, stones, &c., that he sold the patent to a company called "Portable Electric Motors, Ltd., for a consideration of £1,500 in fully-paid-up shares, the remaining capital of that company, £1,000, being issued to cash subscribers, and that, with a view to exploiting the patent, a new company was formed. On December 30th, 1918, an agreement was entered into between the shareholders of the old company and Miss Nona Small, for and on behalf of the new company then about to be formed, which provided that each shareholder of the old company should receive ten shares in the new company for each share in the old company; this agreement was adopted by the company on April 17th, 1919, and 25,000 shares were issued to the shareholders of the old company. By a further agreement dated April 17th, 1919, between the old company, its liquidator, and the new company, the latter acquired the goodwill and assets of the business of the old company, including the letters patent in connection with the invention connected with the portable electric motor previously referred to. The consideration was fixed at £1,000 payable out of profits only, but as no profits were made no part of the consideration had been paid. The company entered into contracts with one H. P. Girling for the supply of motors and drills, which continued down to

October, 1920, when the directors decided that it would be better for the company to manufacture its own motors and drills. For this purpose the company acquired from Girling land, buildings, and machinery for a consideration of £4,500, payable as to £2,500 in cash and 2,000 fully-paid-up shares of the company. Additions were made to the buildings at a cost to the company of about £2,000. On June 16th, 1920, a debenture was issued to secure a loan of £5,000, and on October 21st, 1920, further debentures for £10,000 were issued for the purpose of paying off the above-mentioned debenture of £5,000 and to secure an overdraft and moneys to be advanced by the company's bankers. Cooper, who has financed the company to the extent of about £3,500, had control of the company's factory, and states that he aimed at manufacturing 500 motors and drills and ordered the necessary material for that number. The company, however, appears to have been hampered by want of capital, and on March 24th, 1921, the debenture holders appointed R. B. Petre, chartered accountant, of 11, Ironmonger Lane, E.C. 4, receiver and manager on their behalf on the ground that execution had been levied upon the company's property. The receiver reports that he is not yet in a position to state whether the assets will realise sufficient to satisfy the debentures. The unsecured liabilities in the statement of affairs £9,981, include £3,509 and £925 advanced by Cooper and Lingard respectively, the balance being mainly in respect of goods supplied. The partly secured creditor for £3,393 for work done and goods supplied has a lien on assets valued at £1,260. The trading account lodged with the statement of affairs shows a gross loss of £17. Cooper states that this is accounted for by the fact that part of the stock has been valued at less than its actual cost to the company. The directors attribute the failure of the company mainly to the slump in trade and lack of sufficient capital. Fryer and Lingard also attribute the failure to the over-purchase of material, but Cooper does not agree with this. As a result of the meeting of creditors and contributories, held on July 19th, 1921, the Senior Official Receiver has become liquidator of the company.

HUDSON'S ELECTRICAL ENGINEERING CO., LTD.—Meeting of creditors called for August 29th at the Griffin Hotel, Boar Lane, Leeds. Mr. M. Emmerson, liquidator.

SUTTON-IN-ASHFIELD MOTOR & ELECTRICAL ENGINEERING CO., LTD.—Winding up voluntarily. Liquidator, Mr. J. Kestley, King John's Chambers, Bridesmith Gate, Nottingham.

OLDHAM, ASHTON & HYDE ELECTRIC TRAMWAYS, LTD.—Winding up voluntarily. Liquidators, Mr. P. M. Rosedale and Mr. T. H. Underhill, 88, Kingsway, W.C. Meeting of creditors called for August 26th.

Dissolutions of Partnership.—HARTLAND & RIDGWAY, electrical and mechanical engineers, 266, Monument Road, Ladywood, Birmingham. Mr. H. Hartland and Mr. V. T. Ridgway have dissolved partnership.

KILBURN MAGNETO & ENGINEERING CO., electric magneto and general engineers and dealers in electric lamps, 238, High Road, Brondesbury.—Messrs. F. Gladian and E. J. Lord have dissolved partnership. Debts will be attended to by Mr. E. J. Lord.

Trade Announcements.—MESSRS. PERRY, SAVAGE & CO., electrical engineers and power specialists, have opened premises at 28, Conway Street, Birkenhead.

MESSRS. SMITH & GILL, electrical engineers and contractors, have opened new showrooms at 46, Cross Street, Nelson. We are informed that Mr. A. Smith is now the sole proprietor of the business.

MESSRS. PONSFORD & MACHARDY, LTD., are opening a branch at 165, High Street, Arbroath, on September 1st, and they wish to receive price lists and catalogues from manufacturers, factors, &c.

Catalogues and Lists.—**MESSRS. MARRYAT & SCOTT, LTD.,** 28, Hatton Garden, E.C. 1.—A catalogue which, in addition to details and prices of many types of lifts and accessories, gives a great amount of information of value to those interested in lift engineering. The first part of the publication deals with various types of control apparatus such as switches, relays and control panels. The winding engine is treated of very fully, such details as gearing, lubrication, braking, &c., being described. The choice of position for the winding engine is discussed, and helpful suggestions are made. The last part before the catalogue proper describes various kinds of cars and explains the methods of calculating the total cost of an installation. A number of ordering codes is given. The book (which has 84 pages) is profusely illustrated, the coloured views of a number of cars and enclosures being especially excellent. The producers claim that a study of this volume will enable any engineer to design his own installation.

MESSRS. JOHN PHILLIPS & Co., 166, Walworth Road, S.E. 17.—An illustrated leaflet giving details and prices of curved back-saw blades.

MESSRS. LANDIS & GYR, LTD., Windmill Road, Hampton Hill, Middlesex.—An illustrated leaflet dealing with patent induction-type indicating wattmeters.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Circulars Nos. 1,266/1 and 2, giving very complete details, with illustrations, of large oil circuit-breakers for extra-high pressures. Also a reprinted article from the "Metropolitan-Vickers Gazette" containing valuable information on the breaking capacities of oil switches and circuit breakers. (Circular No. 1,254/1).

THE SUN ELECTRICAL CO., LTD., 118 and 120, Charing Cross Road, W.C. 2.—Five illustrated pamphlets dealing with the "A.B.C." "electric laundress" and ironer. One, "The A.B.C. of wash-day," points out advantages and gives some useful operating details.

MESSRS. E. P. ALLAM & Co., 107-109, Gray's Inn Road, W.C. 1.—Monthly Stock List No. 11, giving particulars of d.c. motors rated at from 1 to 50 h.p.

SIMPLEX CONDUTITS, LTD., Garrison Lane, Birmingham.—"Disposal List," No. 890, giving prices and illustrations of electric heating and cooking appliances.

For Sale.—Ormskirk Board of Guardians invites offers for one 50-h.p. National gas engine coupled to a 220-V Witton multipolar dynamo.

By direction of the Disposal Board, Messrs. Fuller, Horsey, Son & Cassell will sell by auction on September 6th, at Purfleet, plant and machinery, including generating sets, electric winches, &c. Messrs. H. & R. L. Cobb will sell by auction on August 29th and following days at H.M. Explosive Factory, Lower Hopepoint, Cliff-at-Hoo, Rochester, machinery, plant, general stores, &c., including generating sets, electric motors, wire and cable, fittings, &c.

Messrs. Thomas Whitfield & Son will sell by auction on September 6th and following days at the Shawbury Aerodrome, near Shrewsbury, the whole of the electric light and power plant, 165 buildings, fittings, stores, &c. For full particulars see our advertisement pages to-day.

Wages Reductions at Dowlais.—Fitters and turners at the Dowlais works, Cardiff, have accepted a reduction of 30s. on their former wages of £6 a week, and agreed to a further cut of 5s. later on.—*Times.*

Produce for Germany on Nine Months' Credit.—Interesting details have reached us regarding the long-credit transactions which were arranged for the export of wool and hides from Uruguay to Germany. Nine months was the term accorded. Bills at 270 days were drawn on the Deutsche Bank at Berlin to the order of the German Bank of Montevideo, the currency being Uruguayan gold pesos. The drafts were accompanied by B/L's, invoices, insurance policies, and all other documents relative to the shipments of wool and leather. The German Bank of Montevideo discounted the drafts at the Bank of the Republic at the rate of 6 per cent. per annum, the latter sending them to its Berlin correspondent for acceptance. Directly the bills were accepted the shipping documents were forwarded to the Deutsche Bank.

Coal v. Oil.—Tests carried out at the Crown Point power station of the Leeds City Council indicate that oil fuel can only compete with coal if it costs 57s. per ton with coal at 36s. per ton, or 57s. with coal at 37s. 6d.

E.D.A. Activities.—The British Electrical Development Association has pressed into the service of electricity that popular modern vehicle of fiction, the short story. "The Awakening of Peterkin" (E.D.A.; 182) tells of a salesman who was galvanised into activity and "brought off" a big "deal" by the enthusiasm of his wife for electrical methods. *Cherchez la femme!*

Copper and Lead Prices.—Messrs. F. Smith & Co. report August 16th: Copper (electrolytic) bars, £76. 10s. increase. Ditto, electrolytic sheets, £145 10s., 10s. increase. Ditto, electric wire rods, £92, 10s. increase. Ditto, H.C. wire, 11 9/16d., 1/16d. increase. Messrs. James & Shakespeare report August 16th: Copper bars (best selected) sheet and rods, £103, £2 decrease. English pig lead, £24 15s., 5s. decrease on last week's figures.

Electrical Wages reduced in America.—A wage reduction affecting 12,000 employees of the General Electric Co.'s plant is announced. The cut will vary according to the several classes of employees, unskilled workers' wages showing the greatest reduction. The announcement followed conferences between the management and a committee of employees at which means to assure continued operation of various departments were discussed.—*Reuter's Trade Service*, Lynn, Mass., August 4th.

Book Notices.—We have received from Messrs. Mavor and Coulson, Ltd., the first issue of a magazine which is to appear monthly. This bears the title "M. & C. Machine Mining," and is devoted exclusively to the application of machinery to the economic winning of coal; it claims to be the first of its kind. In this first number "Universal" coal cutters are dealt with fully, and notes connected in various ways with machinery in mining are included.

"The Journal of Industrial Welfare," Vol. III, No. 8, August, 1921. Price 9d.—Among a number of interesting articles included in this issue is one upon the artificial lighting of workshops and factories.

"Income Tax Up-to-Date." By H. J. Gully. Published by the *Financial News*. Price 9d.

The *Times* issued a special railway number on Monday last to celebrate the end of Government control of the systems of the United Kingdom. There are numerous interesting articles, including one on railway electrification, one on equipment arrears that have to be met, and another on signalling.

"Metropolitan-Vickers Gazette," Vol. VI, No. 100, July, 1921. Price 1s., post free.—Premier place is given in this issue to a description of the visit of the Prince of Wales to the Trafford Park works. The technical articles include: "High Efficiency Steam Turbines"; "A.C. Electrical Equipment of Mine Haulages," by Charles E. Raeburn; and "Breaking Capacity of Oil Switches and Circuit Breakers," by W. A. Coates, M.I.E.E.

"Liquid and Gaseous Fuels." By V. B. Lewis (pp. xiv+354; 59 figs.). London: Constable & Co., Ltd. Price 12s. 6d. net.

British Engineering Standards Association.—The latest specification (No. 101—1921, 1s. net) issued by the Association lays down standards for tramway tires.

The profile of tread and flange originally standardised and issued in the British Standard Specification for Tramway Rails in 1903 has been retained, but in place of the varying widths of tire then provided to suit the British Standard Sections Nos. 1 to 5, one uniform width has been adopted suitable for rails having a tread of 2½ in., which dimension, we understand, is being recommended for the revised rail sections now under consideration and approaching issue. This width is that of the B.S. Section No. 4, probably the most extensively used of the standard sections. Three diameters of tire are provided for, namely, 32 and 33 in. (with thicknesses of 2½ and 3 in. respectively) for tramway driving wheels, and 22 in. (with a thickness of 2½ in.) for pony wheels, and the plate attached to the specification gives the finished sizes of these and the rolling allowances for machining.

Electricity in the Textile Industry.—Mr. Arthur Charles, managing director of Components, Ltd., of Burnley, told a Burnley gathering last week that electrical plant, correctly installed, was safer than any other agent, and it was economical. He pointed out that in 1910, 998 consumers in Burnley paid for 3,249,287 units, as compared with 3,000 consumers and 7,591,107 units last year. Coun. L. Thorburn, a prominent cotton manufacturer, said the application of electricity to textiles was all a question of cost. So far as he could gather, electricity for mill power could not be supplied cheaper than steam could be produced. Electricity would have to be produced under at 1d. per unit to be profitable in the running of cotton mills, though he was prepared to admit that electricity would ensure a better and steadier drive.

Mr. J. Holden, chairman of the Electricity Committee, stated that electricity was produced in Burnley more cheaply than in most places in the country. In fact, there were only eight towns in England where it was produced at lower cost.

New Italian Company.—La Società d'Elettricità della Venezia is the name of a new company which has recently been organised in Padua with a capital of 10,000,000 lire.

Applications for British Trade-marks.—Appended is a summary of the recent applications for British trade-marks in respect of goods and productions connected with the electrical trades and industries:—

The Limpet Magnetic Hand Lamp (lettering and design), No. 414,667, Class 13. Magnetic hand lamps. William Barton & Sons, 11, Forrest Road, Edinburgh. April 27th, 1921.

Instarter, No. 414,631, Class 8. Electrical resistances adapted for use with induction and air supply pipes of internal-combustion engines. E.D. Motors, Ltd., Empire House, 175-6, Piccadilly, London, W. April 26th, 1921.

Superforma, No. 415,539, Class 50. A preparation of oils for electrical insulating purposes. O. C. Wakefield & Co., Ltd., 30-2, Cheapside, London, E.C. May 26th, 1921.

Rickite, No. 415,435, Class 40. Covering, insulating, and like material manufactured from india-rubber. Edwin Rickard, 7, Parkinson's Chambers, Hurlstergate, Bradford. May 24th, 1921.

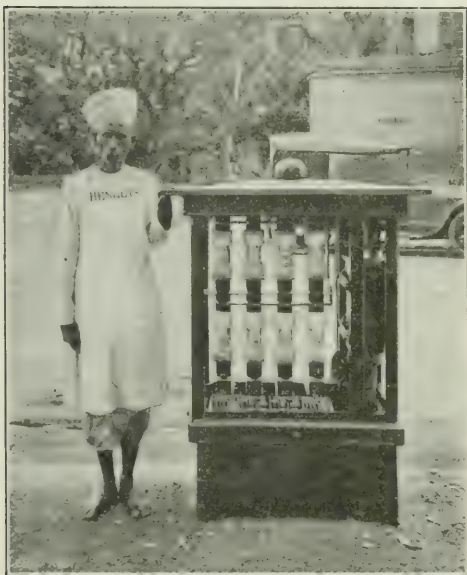
Lead.—Messrs. James Forster & Co., reporting under date August 13th, state:—"The intrinsic position is unchanged. Consumers have bought sparingly and export is quiet, although France is still a buyer this week. Arrivals are short, and to fulfil July contracts a heavy call has been made on lead in store. . . . The whole of the Government stock of lead has been disposed of privately. The Board of Trade returns for July are:—

Imports	12,718 tons
Exports	2,042 ..
	10,676 ..
Taken out of stores	882 ..

Total left for home consumption ... 11,558 ..
Of the above, 8,011 tons came from Spain."

Swiss Exports of Energy.—The anger of the Swiss Federation of Consumers of Electrical Energy, which is said to be composed of the largest customers of the supply works in Switzerland, has been aroused by the fact that the Federal Council has authorised the export of 6,000 kW at an exceedingly low price to the Lonza Electro-Chemical Works at Waldspüt, Germany. It is pointed out that a veto is imposed on the import of Swiss carbide into Germany, and the Federation has asked the Federal Council to withdraw the authorisation in question until Germany removes the obstacles in the way of the importation of Swiss products into that country.

Calcutta Distribution Pillars.—The accompanying illustration shows one of a large number of distribution pillars



CALCUTTA DISTRIBUTION PILLAR FITTED WITH HENLEY UNITS.

erected in Calcutta by the Calcutta E.S. Corporation, Ltd. They are fitted with Henley patent pillar units, and one of Henley's durwans, who has apparently taken paternal interest in the erection of the pillar, is shown in the picture.

Parcels by Air.—The Postmaster-General announces a reduction in the rates for the carriage of parcels by aeroplane to Paris. The new charges range from 1s. 6d. for packets weighing up to 1 lb., to 9s. 9d. for parcels of 11 lb. weight.

Swiss Electro-Chemical Production.—During the war the output of German electric furnaces was strongly developed, especially by power stations, electro-chemical works, and the various groups interested in lignite mines. So long as coal was cheap those industries could easily compete with Swiss products, not only in Germany, but also in other Continental countries. A serious crisis consequently overtook Swiss producers, and most of their factories were closed during 1920. Fortunately, however, the high price of imported coal resulted in such an increased production of hydro-electric power all over Switzerland that the electro-chemical works soon began to recover. To this export statistics for January to May bear witness. The export of aluminium, which during the first five months of 1920 averaged only 406 tons, rose to 633 tons. This figure is even higher than the average of 1913. The Swiss export of calcium carbide amounted in 1913 to a monthly average of 2,500 tons, during the first five months of last year to only 283 tons, but in January to May of 1921 to 665 tons.—*The Times Trade Supplement.*

Insulated Conductors in Finland.—A petition has been presented to the Finnish Council of State on behalf of the engineering firms of Zitting & Co. and the Finnish Cable Works Co., asking for an increase to be made in the import duties on insulated electrical conductors, as the Finnish makers in this branch are unable successfully to compete with German works. It is stated that the duties on these conductors are 7½ times greater in Germany than those applied for the protection of the Finnish works.

Foreign Trade. JULY FIGURES. The following were the values of imports and exports of electrical goods and machinery during July, 1921:

	July, 1921.	Inc. or dec.	7 months, 1921.	Inc. or dec.
IMPORTS.				
Electrical goods, &c.	114,752	— 27,506	+ 616,796	
Machinery	853,707	— 3,053,190		
Electrical machinery (included above)	55,921	— 39,319	+ 94,191	
EXPORTS.				
Electrical goods, &c.	1,157,591	+ 192,755	+ 2,617,920	
Machinery	6,130,712	— 1,213,345	+ 16,084,117	
Electrical machinery (included above)	407,954	+ 205,992	+ 1,714,806	
RE-EXPORTS.				
Electrical goods, &c.	12,775	+ 1,688	+ 81,009	
Machinery	112,315	— 42,814	— 200,163	
Electrical machinery (included above)	4,267	+ 2,318	+ 7,345	

Austrian Electrical Industry.—The *Economic Review*, quoting the *Neue Freie Presse* for July 17th, says that the latest reports regarding the state of the German electrical industry are somewhat pessimistic, but this is no doubt due to the disturbing political conditions of some important areas. The Austrian industry cannot complain of any lack of business. From all the big firms come cheerful reports, recording an amelioration of all facilities for work and an improved quality in the work done. The State projects for the electrification of the railways are in full progress, and orders for the construction of water-works under the partial control of local government authorities become increasingly frequent, while there is no lack of private orders for agricultural, manufacturing and household purposes. As soon as the projected building schemes are put into operation there will be a large increase in orders for all kinds of household installations. Without exception, all the principal firms have recently greatly increased their capital, e.g., the Siemens-Schuckert Werke have increased their joint-stock capital by Kr. 75 mill., making a total of 200 mill., and the A.E.G. Union Electrical Co. by Kr. 100 mill., making a total of 225 mill. This is not due only to increased price of materials or falling off of the exchange, but chiefly to the decision of German parent firms to enter into closer relations with Austrian establishments. The tendency to close Austro-German collaboration has been greatly enhanced by the application of the "Sanctions" against Germany. The introduction of the Bill for the favourable treatment of hydro-electric enterprises, giving special exemptions to the electrical industry from certain taxes, has created a very favourable atmosphere.

Japanese Export Trade.—Japanese exporters have been agitating for Government assistance to their trade. It seems from the *Board of Trade Journal* that at a combined meeting of Tokio and Yokohama exporters, which was attended by the Director of the Commercial Bureau of the Department of Agriculture and Commerce, and many other prominent persons, the following resolutions were passed:—

1. That the Railway Bureau give special reduced rates and special facilities to goods destined for export.
2. That the Government take steps to lower prices.
3. That the Government grant special exchange rates in the cases of export transactions.
4. That the Government provide some sort of an institution for the benefit of both producers and exporters.

The Production of Aluminium.—The world's production of aluminium has increased nearly three-fold during the past eight years. The following figures are given in a French contemporary:—

Country.	Production in	
	1913.	1920.
	Tons.	Tons.
Germany	1,000	40,000
Austria and Switzerland	11,000	25,000
France	15,000	20,000
Great Britain	7,500	12,000
Italy	1,000	7,000
Norway	1,500	16,000
United States	28,000	73,000
Total	68,000	193,000

Contractors' Registration in Australia.—The Electrical Contractors' Association has asked the Minister for Labour and Industry to secure registration of contractors, principally, it is stated, to prevent the risks of fire and shock caused by faulty installations. A deputation said that anybody could call himself an electrical contractor at present whether he knew anything about the business or not.

Electric Furnaces in Belgium.—The Cockerill Works at Seraing is reported to be making progress in reconstruction after the damage caused by the war, and has now started working its electric steel furnaces for the making of motor-car and other machine parts, delicate and complicated pieces of unusual thickness calling for a quality of steel only turned out by the electric furnace. The Ugrière Maribaye Co., which added in 1914 to its other manufactures that of "special steel," has also set up two electric furnaces, a rolling mill, and a machine hammer, which enables it to produce twelve qualities of carbon steel, four of nickel steel, and three of silicon steel, the last-named being for use in the making of sheet steel for dynamos and transformers.

The German Electrical Industry in July.—The improvement in business in the German electrical industry is reported to have continued in July. According to information received by the Prussian Ministry for Commerce, the orders for installation materials increased in consequence of the revival in building activity, and the demand also improved for small and medium-sized motors for agricultural purposes. Orders from industrial circles remained on the favourable level of the previous month. A number of orders for telephone apparatus was placed by the Government, and the cable branch also improved slightly. Raw material prices increased to some extent, but those of manufactures showed a falling tendency. Despite the general improvement, it is impossible to utilise the full capacity of the works in certain branches, particularly in the production of measuring apparatus in the district of Frankfurt-on-Main. Concerning the foreign trade, it is stated that the export of electrical manufactures left something to be desired, being hampered, as reported for the district of Berlin, by the large increases in Customs duties in other countries.

Belgian Electrical Construction Co.—The directors of the Constructions Electriques de Belgique, reporting on the year ended April 30th, 1921, stated that the report was the first submitted since the absorption of the Anciens Ateliers Van den Kerkhove, of Ghent, and the year was necessarily a period of starting the new organisation of the works. The results obtained were satisfactory, and would have been even more so had it not been for the crisis affecting all industries. The orders booked had permitted of the works at Liège and Ghent being sufficiently supplied with work, and the general course of the industry led to the hope that the company would traverse the period of scarcity of business without great difficulty. However that might be, advantage had been taken of the period of quietness to push on the development of the works and the construction of a new foundry. The understandings which had been reached with French and English groups, particularly with the Société des Constructions Electriques de France and the English Electric Co., not only assured the company the working of patents and processes held by these groups and their technical co-operation, but also permitted of the hope of obtaining good customers for the production. During the year the company acquired most of the assets of the Société Auxiliaire de Constructions Electriques. The gross profits earned in 1920-21 amounted to 4,625,000 fr., permitting of the extinction of the remainder (1,372,000 fr.) of the deficit arising from the years of war. The final result was a net profit of 1,918,000 fr. and a dividend at the rate of 6 per cent. on a share capital of 40,000,000 fr. As a consequence of the interests assumed in the company by the English Electric Co., it is proposed to elect a representative of the latter on the board of the former.

Unemployment.—The latest Ministry of Labour unemployment statistics show that the total number of persons out of work on August 5th was 1,738,000, a reduction of about 42,000 on the previous week's total. There were also 63,400 fewer on "short time."

Withdrawal from District Council.—Sunderland Town Council has decided, on the advice of its Electricity Committee, to withdraw from the District Council (No. 1) North-East Coast Area (Electricity Supply Industry), but it has agreed that the terms and conditions of employment laid down by the District Council shall be adhered to except (a) as regards mechanical and electrical fitters, blacksmiths, and building trades employes, who will continue to be employed on terms and conditions for the time being agreed between the recognised local employers' and employes' organisations, and (b) that the terms of Award No. 579 of the Industrial Court with reference to holidays for skilled men and their assistants shall be strictly observed.

Duties on Electrical Imports into Spain.—The Association of Producers of Electric Power has protested against some of the duties in the new draft tariff on material used in the electrical industry. The Association points out that certain articles, as, for example, tubes for pressures of over 25 atmospheres, cannot be obtained in Spain. One of the members of the Association has ordered 1,000 tons of these tubes in Germany at about 1,000 pesetas per ton; if the customs duties proposed in the draft tariff are brought into effect without reduction these goods would have to pay 1,600 or 800 pesetas a ton, according to whether they are admitted under the first or second column of the tariff. Purchasers of large parts and very high-pressure apparatus will be similarly affected, the Spanish market for these goods being too small to warrant the setting up of works for their manufacture in the country.—*Reuters' Trade Service* (Madrid).

Wages Reductions.—The general manager of the Sheffield Corporation Electricity Department reports that the wage reductions recently agreed upon will reduce the department's expenses by £12,000 per annum. Reductions in the salaries of the technical staff will effect the saving of an additional £13,444.

Germany and Australia.—The *Sydney Morning Herald* quotes, as a typical example, a letter received by an Australian firm from a Charlottenburg manufacturer of electric lighting fittings. If the business proposed were done under the present conditions of exchange and tariffs, effective competition by any Australian, British, or American manufacturer would be out of the question. The letter says: "I am prepared to concede to you a rebate of 10 per cent. for orders of not less than £100 value. I would particularly draw your attention to the fact that the goods quoted for are of high-class quality and finish, equal to British make, and must not be confused with cheap Continental manufactures. The prices quoted include packing and delivery f.o.b. Rotterdam or Hamburg."

Electrical Trade in China.—The *Chamber of Commerce Journal*, in the course of an article on Chinese markets for general hardware, quotes a Canadian review of the situation. It is reported that the general extension of electrical development has created a large demand for electrical equipment of every description, and in China the trade is very active; electrical fittings of all kinds are required, also wiring, cables, switches, plugs, insulators, door bells, &c. A large demand also exists for fans, both desk and ceiling, as such are universally in use during several months of the year. With the further extension of electrical installations throughout the cities of China this trade will probably greatly increase in the future. "Large quantities of pipes and tubes and pipe fittings are annually required in China. These include wrought iron and galvanised steam and water pipes and boiler tubes. Cast iron pipes for waterworks and gas companies are also imported in considerable quantities. The greater portion of the above formerly came from England, but since the war, the United States and Japan have been furnishing the bulk. The present-day condition of the hardware trade is no index of what the future will have to offer. Industrial enterprises in China must soon be put under way. Railways must be built, and agricultural methods vastly improved if China is to make any headway at all, and the hardware trade must also expand through the needs of these enterprises."

Belgian Activity.—In addition to the order for 36 locomotives which Belgian engineering works recently received from China, they have just received a further order for 425 trucks. A Liège firm has obtained an order for 20 locomotives for Spain.—*The Times*.

New French Companies.—La Compagnie Radio-France (Installations Radio-Electriques) is the name of a new company which has recently been formed in Paris (79, Boulevard Haussmann) with a capital of 60,000,000 fr.

Among the new companies recently formed in France in connection with the utilisation of water power for generating electricity are the Société des Forces Motrices de la Vallée d'Aspe, Paris (16, Rue de la Pepinière), capital 10,000,000 fr.; and the Société Hydro-Electrique de la Basse Romanche, Paris (27, Rue de Turenne), capital 1,000,000 fr.; the last-named concern will devote its attention to developing the water resources of the Department of Isère.

The Germans in Jugoslavia.—The Siemens-Schuckert group is reported to have formed, with the co-operation of the Croatian Discount Bank, a company at Agram for the import of semi-finished electrical materials on a large scale for conversion into manufactures in a works at Agram.

LIGHTING AND POWER NOTES.

Aldershot.—BELGIAN TENDER REFUSED.—It is reported that the Council recently rejected a Belgian tender for electrical plant, although the price quoted was £600 less than that given in the lowest British tender.

Australia.—BRISBANE (Q.).—The City Electric Light & Power Co. has recently installed new plant at a cost of £600,000, and now controls practically the whole of the Brisbane supply. The suburban districts of Hamilton, Stephens, Balmoral, Coorparoo, and Sherwood are already receiving supplies, while extensions are being made to Toowong, Windsor, Toombul, and Sandgate.

Ayr.—CONSULTANT'S REPORT.—At a meeting of the Town Council, on August 8th, consideration was given to a minute of the Lighting Committee, which stated that a report had been received from Mr. Rider, consulting engineer, with regard to a proposed scheme of electricity supply for the Burgh of Ayr at Loch Doon. Mr. Rider was of opinion that the Loch Doon scheme was of such a promising character and involved such a small amount of engineering work that it should be put in hand at the earliest possible moment. In the course of discussion one member stated that the proposed scheme would entail an expenditure of approximately £250,000. The Council resolved to proceed with the scheme.—*Scotsman*.

Bangor.—**NEW PLANT.**—As a bulk supply will not be available for some time, and to meet the demands of consumers for the next two years, a 200-kW Diesel engine generating set is to be installed at a cost of £1,000.

Beckington (Somerset).—**PROPOSED LIGHTING SCHEME.**—A public meeting was recently held to discuss the question of a scheme of electric lighting for the locality. A representative of Edmundsons' Electricity Corporation attended and stated that it was proposed to utilise an old mill on the river for the generation of electricity, and the price per unit would be about 10d.

Carlisle.—**YEAR'S WORKING.**—The report of the city electrical engineer (Mr. C. W. Salt) for the year ended March 31st, 1931, states that the undertaking had a revenue of £54,617, as compared with £48,971 in 1919-20. Working costs amounted to £41,491, as against £34,655, leaving a gross profit of £13,126 (£11,416). After payment of capital charges, &c., a net profit of £455 remained; the net profit in the preceding year was £2,301. The number of units sold was practically the same as in the previous year, the greater revenue being derived from increased prices.

Clacton-on-Sea.—**LOAN.**—The Urban Council is applying for sanction to borrow £2,000 for electricity purposes.

Continental.—**FRANCE.**—A *Reuter* (Paris) message states that a group of American engineers and financiers has undertaken to experiment with the tidal power in the Bay of St. Michel where the rise and fall is considerable. The experiments are estimated to cost 2,000,000 fr. A barrier will be erected from the Point du Roc to Le Ligouet, a distance of 12½ miles. There will be special outlets through the barrier for rivers emptying into the bay and for shipping. By this means it is hoped to secure an annual output of 6,000,000,000 kWh.

The French Commission proposes to erect a barrage at Aber-Wrach. This will be 150 m. across the estuary and 13 m. above the spring tide level. The barrier will be constructed of hollow reinforced-concrete blocks; the centre block, which will be 35 m. long and 22 m. broad, will contain turbo-alternators. Arrangements will be made to utilise both rising and falling tides, a difference in level of 2½ ft. being sufficient to keep the turbines running. Four turbines and two alternators will be used capable of producing from 75 to 1,200 h.p. each. To equalise the power, a storage dam of 12,000,000 cu.m. is to be constructed in such a manner that a fall of 8 m. will be obtained at high tide and 29 m. at low tide. The regular output is estimated at 1,600 h.p. with a maximum of 4,800 h.p. According to M. Moreau, Dean of the Faculty of Sciences at Rennes, the French coast from Boulogne to Brest could yield some 6,000,000 h.p. by the utilisation of the tides for power generation. The Breton shore alone could furnish 1,000,000 h.p., a huge figure when it is recalled that Paris consumes only 250,000 h.p. This immense source of energy should not, he contends, remain neglected, for in Brittany alone there are extensive beds of iron of a quality equal to that of the Briey product, if not better. Brittany would be able to supply the raw materials to the French iron-working industry for several centuries.

A *Central News* message reported, last week, that while a party of men were laying a cable at Argeles they received a severe electric shock, four being killed instantly and eleven badly burned.

ITALY.—The Sila hydro-electric scheme whereby between 150,000 and 300,000 h.p. would be obtained, yielding 800,000,000 kWh yearly, successfully started, has had to be suspended owing to the present financial crisis in Italy. With it are hung up the scheme for a local electro-chemical industry and the projected transmission of energy in the province of Puglia and across the straits of Messina into Sicily. The delay will probably serve to benefit the last-named project, by allowing of a more complete study of the obstacles to be met with on its realisation. According to the Italian engineer, Vismara, the distance to be covered to Messina, 180 kilometres, will be traversed by submarine cables. The currents are very strong in the narrowest part of the channel, the bed is rocky, and the cables would be liable to serious deterioration from the stony fragments churned up by the currents. The best parts of the coastline, where the currents are less strong, are already occupied by telephone and telegraph cables, the only alternatives being points to the north or south of this belt, where the bed is sandy and the currents weaker. Earthquake shocks have been reported in the neighbourhood.

The projected scheme of the Banca Conti e Ca., of Florence, for generating electricity by means of the lignite beds at Nestore, in the province of Perugia, has secured special Government subsidies towards its fullest realisation. The company is authorised to install a plant of a capacity of 12,000 h.p. and to generate 100,000,000 kWh per annum, also providing for the transmission of the electricity to the Government and the Government's subsidy is fixed at 150 lire per kW installed, for a period of 30 years.

ESTHONIA.—Negotiations are reported to be proceeding between the Government of the Republic and the Royal branch of the Siemens-Schuckert Works with regard to the establishment of hydro-electric works on the Narva for the utilisation of 50,000 h.p. The scheme is a revival of a plan projected by the late Imperial Government of Russia.

SPAIN.—Data collected in 1920 gave the amount of developed water power as 618,756 h.p., of which 577,192 h.p. was produced by the larger installations, nine of which were of over 10,000-h.p. capacity. There were also under construction hydraulic works totalling over 300,000 h.p., the largest of which were those of the following:—Sociedad Hidraulicas Iberica (50,000); Soc. Riegos y Fuerzas del Ebro (50,000); Soc. Hidroelectrica Española (40,000); Soc. Electrica del Viesgo (22,000); Soc. Saltos del Cantabrico (15,000); Soc. Hidro-electrica de Castilla (15,000); Soc. Mengemor (7,000); Soc. Saltos de Somiedo (6,000); Soc. Sevillana de Electricidad (5,000); Soc. Electrica de los Almadenes (9,000); Soc. Productora de Fuerzas Motrices (15,000); and Soc. Wenceslao Garra (18,000). As the output of coal will tend to decrease by the exhaustion of the beds, the day is not far distant when the water power will wholly replace coal in the generating of electricity.

Dorchester.—**ELECTRICITY SUPPLY ORDER.**—The *London Gazette* gives notice that the Borough Council has applied for a Special Order permitting it to generate and supply electricity within the borough.

Dublin.—**PUBLIC LIGHTING.**—Contrary to expectation, the full public electric lighting service was not given by the Corporation for Horse Show week, but on one or two nights an extended service was given in some central areas. The economy regulation provides for the extinction of all public lamps at 12.15 a.m.

Federated Malay States.—**PROPOSED PUBLIC SUPPLY.**—At a meeting of the Council of the Federated Malay States, held at Kuala Lumpur during April, writes the United States Consul at Penang, it was decided to engage an electrical staff to investigate the question of a public power supply. The sum of £150,000 (Straits currency) was voted to defray the salaries and expenses of this staff, which included ten engineers, surveyors, and draughtsmen. A preliminary survey had already been made by the Government Electrical Adviser, which called for an expenditure of approximately \$40,000. The development of a comprehensive electric power scheme would be of tremendous value to the industrial facilities of the Federated Malay States, and the application of low-cost power to the mining of tin should greatly stimulate that industry.—*Commerce Reports.*

Glasgow.—**ANNUAL REPORT.**—The report of the engineer of the electricity undertaking (Mr. R. B. Mitchell) for the year ended May 31st last contains a great deal of interesting information. The total number of units sold was 151,688,636, the proportion of lighting energy to power supplies being as one to five. This total is an increase of 3,193,546 upon the previous year's sales. During the year 3½ miles of low-pressure feeders were laid and 18½ miles of high-pressure feeders, as well as 14½ miles of distributors. The generating plant at the Govan station, which is now to be used as a sub-station, is being disposed of to make room for converting plant. There are five sub-stations in course of construction. During the year under review the first two 18,750-kW turbo-alternator sets were installed at Dalmarnock and two more sets will be in commission for the coming winter. In future the Port Dundas station is only to run ten hours a day, and no further plant will be installed in this station. The maximum load on the system rose during the year from 66,200 to 76,964 kW.

Hastings.—**YEAR'S WORKING.**—The accounts of the Corporation's electricity undertaking for the year ended March 31st last, show a total revenue of £42,309, as compared with £32,604 in the preceding year. Working expenses amounted to £54,277, as against £21,444, leaving a trading balance of £8,032 (£10,620). After the payment of capital charges, &c., the net result was a deficit of £247; the result in 1919-20 was a profit of £3,552. The total number of units sold increased from 1,214,050 to 1,521,660.

Japan.—**NEW HYDRO-ELECTRIC PLANT.**—A plan for the construction of nine hydro-electric plants to use the waters of the Sho and the Chigusa Rivers, is being considered by the Hyogo Prefectural Assembly. It is proposed to begin construction in 1921 and to complete three plants every two years until 1926.—*Commerce Reports.*

Liverpool.—**AMALGAMATION OF UNDERTAKINGS.**—At a conference between the representatives of the Liverpool and Bootle Corporations, it was agreed that the town clerk of Liverpool should forward to the town clerk of Bootle the draft heads of a proposed agreement for the amalgamation of the two electricity undertakings. This the Bootle Electricity Committee has received, and after considering it, reports that it is prepared to agree to the amalgamation of the undertakings subject to satisfactory terms being arranged.

Llandoverly.—**ELECTRIC LIGHTING NOT DESIRED.**—At a meeting of the Town Council on August 9th, it was moved that a public meeting be called to consider the adoption of electric lighting in the town. An amendment to take no action in the matter was, however, carried.

London.—**STAFFING.**—The annual report of the engineer and manager (Mr. W. C. P. Tapper), and the statement of accounts of the electricity undertaking for the year ended March 31st

last, have come to hand. The total income was £229,321, as compared with £206,106 in the previous period. Working expenses amounted to £170,942, as against £168,421, leaving a gross profit of £58,379 (£56,705). After paying capital charges and taking in sundry credits, the net result was a profit of £23,376, a considerable reduction on last year's profit of £25,376. The total number of units sold, 25,000,611, represented a decrease of 229,404, accounted for by the trade depression. The net profit was transferred to the appropriation account, but the heavy charges against this, including income tax, £7,161, necessitated the transfer of £8,417 from the reserve fund.

Monaghan.—ELECTRIC LIGHTING.—The Urban Council is in communication with the Lighting Co. regarding the lighting of the town by electricity during the coming winter.

New Zealand.—LAKE COLERIDGE.—The past year's working of the Lake Coleridge hydro-electric undertaking was again satisfactory. This scheme, which supplies Christchurch, had a total revenue of £31,373, an increase upon the previous year's revenue of £9,540. Working expenses increased by £3,052 to £21,341, the gross profit thus being £10,032, as against £25,044. Most of this was absorbed by interest and depreciation charges, but there was a net profit of £3,447. The actual result for the whole of the period during which the plant has been running has been a loss of £30,647. The output increased by about 10 per cent. to 36,309,680 units. The plant, whose rated capacity is 8,000 h.p., has been sustaining a daily overload of 20 per cent.

ELECTRICAL DEVELOPMENT.—During the past twelve months 20 miles have been reticulated and 2,000 new customers added in connection with the extension of the Auckland City Council's electricity scheme. The profit for the year ending March 31st aggregated £17,000. The city engineer forecasts the following requirements during the next two years: Meters, £10,000; 60 miles of reticulation, £50,000; and sub-station and feeder extensions and switchgear, £25,000. The Council has accepted contracts totalling £28,000, which will be provided for in the recent loan of £500,000.—*Reuter's Trade Service* (Melbourne).

Oswestry. — PROPOSED PURCHASE OF UNDERTAKING. — The General Purposes Committee has recommended that, provided satisfactory terms could be arranged, it would be to the interests of the borough that the Council should acquire the undertaking of the Electric Light & Power Co. The company is to be approached with a view to ascertaining the purchase price of the undertaking.

Portishead.—PRICES.—On August 9th, Col. T. E. Ekin held an inquiry into the application of the North Somerset Electric Supply Co. for permission to increase its maximum charge to 1s. per unit. It was explained that it was not intended to charge more than 3d. per unit at present, but the company wished to be prepared for any eventualities. It at present had a contract for large supplies to the Portbury shipyard and a local company. The first contract was determinable by six months' notice, and the other customer might cease to take electricity at any time. These two consumers took three-quarters of the output. Expenses were heavy, as the company had a wide, thinly-populated area of supply. A number of local bodies opposed the application.

Portsmouth.—YEAR'S WORKING.—The accounts of the electricity undertaking (Mr. B. Handley, engineer) for the year ended March 31st last show a total revenue of £114,384, as compared with £91,665 in 1919-20. Working expenses were £91,405, as against £68,623, leaving a gross profit of £22,979 (£23,062). The payment of capital charges left a net profit of £2,072, which was considerably less than the previous year's net profit of £5,754. The running deficit on the undertaking has now been reduced to £1,303. The number of units sold was 4,885,782, and the maximum demand during the year was 3,410 kW.

Salce (Cheshire).—BULK SUPPLY.—Subject to the approval of the Electricity Commissioners, the Council has agreed to take a supply of electricity in bulk from the Manchester Corporation.

Sheffield.—OPENING OF NEW STATION.—The Duke of York has promised the Lord Mayor of Sheffield that on the occasion of his visit to the city in October, for the Cutlers' Feast, he will stay to open the new power station of the Corporation at Blackburn Meadows.—*Sheffield Independent*.

ELECTRICITY FAILURE.—On the night of August 11th several districts were affected for half an hour by the failure of the electricity supply. It was discovered that water had got into a faulty main.

Stretford.—ROTARY FROM SALFORD.—The Electricity Committee has confirmed the purchase of a 500-kW rotary converter set from the Salford Corporation to be delivered and handed over in complete running condition for the inclusive sum of £2,170, or any lower figure which the chairman may be able to negotiate.

Strichen (Aberdeenshire).—LIGHTING SCHEME.—It has been decided to light the village electrically. A company is to be formed with a share capital of £3,600.

Taunton.—DEFICIT.—The deficiency of £1,073 on the year's working of the electricity department is mainly due to the increase in the price of coal, wages have increased from £20 per week in 1914 to £100 per week this year. During the 2½ years' municipal ownership of the undertaking it has cost the rates only £500, and of £100,000 loan capital, £60,000 has been redeemed. The Town Council has authorised the electricity Committee to increase, if necessary, the charge for electricity from 110 per cent. to 120 per cent. above the pre-war scale, the price not to exceed 1s. per unit.

Warrington.—WATER-POWER REPORT.—It will be remembered that in a recent issue mention was made of the fact that the electrical engineer (Mr. F. V. L. Mathias) had been instructed to prepare a report upon the possibility of utilising the water power of Woolston Weir for the generation of electricity. The report states that the maximum fall at Woolston Weir is approximately 8 ft. with small quantities of water passing over the weir. Definite figures at this stage could not be put forward as to the relation between the levels and the flows, but it was quite certain, stated Mr. Mathias, that the power derivable from Woolston Weir would be very small compared with the power required in Warrington, either at the present or in the future. The maximum load in Warrington was over 5,000 kW, with the certainty of a considerable increase in the near future; possibly an average of 150 kW with a load factor of 50 per cent. would be the figure for Woolston Weir. This would represent about 600,000 kWh per annum, and the capital cost, provided no exceptional difficulties were encountered, would be about £25,000. The total expenses would be about £4,000 per annum, representing 1.46d. per kWh generated. This figure was comparable with steam costs at the present prices of coal. Mr. Mathias pointed out that if the Corporation embarked upon the scheme it would assume responsibilities with doubtful financial benefit. The records of low-fall water-power plant in this country at pre-war constructional costs compared with pre-war coal prices were not encouraging. New works would have to be constructed at post-war figures, with the probability of a fall in coal prices. It is thought that the present moment is hardly opportune for the further consideration of the project, and it should be deferred until conditions become more established.

YEAR'S WORKING.—A remarkable improvement is evident in the report upon the electricity undertaking for the year ended March 31st, 1921. The revenue rose from £90,188 to £123,365, and expenditure from £80,613 to £92,212. The gross profit thus increased from £9,575 to £31,153. Capital charges were heavier than those of the preceding year, but the net result was a profit of £12,037, as compared with a deficit of £1,850.

Whitehaven.—LOAN.—The Town Council has applied for sanction to a loan of £1,300 for the laying of a main in connection with the extension of supply to Kells.

Willesden.—YEAR'S WORKING.—The report upon the electricity undertaking for the year ended March 31st last shows a total revenue of £98,651, as compared with £77,000 in the preceding year. Working expenses totalled £71,347, as against £50,738, leaving a gross profit of £27,304 (£26,292). After payment of capital charges a net profit of £4,503 remained, as contrasted with £3,314 in 1919-20. The total number of units sold rose from 7,189,091 to 8,362,787. In presenting the report, the chairman of the Committee expressed his appreciation of the efforts of the electrical engineer (Mr. A. W. Blake) and his staff, which ensured the satisfactory result.

Winchester.—LOAN SANCTIONED.—The Electricity Commissioners have sanctioned the borrowing of £17,800 for the following purposes: Plant, £11,000; mains and services, £5,600; and meters, £1,200.

Wolverhampton.—YEAR'S WORKING.—We have received from the borough electrical engineer (Mr. S. T. Allen, M.I.E.E.) a copy of the annual report and accounts of the Electricity Committee for the year ended March 31st last. The total income amounted to £193,619, as against £140,830 in 1919-20, and working expenses to £119,932, as compared with £87,145, leaving a gross profit of £73,687 (£53,685). After payment of capital charges, the net result was a profit of £27,064, of which £5,000 was transferred to the Improvement Rate Fund and the balance to reserve. Last year's profit was £14,186. The number of consumers increased from 3,182 to 4,329, making total connections 23,130 kW. The total units sold rose from 17,942,935 to 21,559,351. The amount of coal per unit generated was reduced from 3.258 lb. to 3.124 lb., but the coal cost per unit sold increased from .583d. to .717d. The report shows the preference of consumers for the two-part tariff system in vogue; in fact only 4 per cent. of the total sales was effected under the flat rate system. It is proved that the former system is the more advantageous to the consumer.

Workshop.—LOAN SANCTIONED.—The Urban District Council has received sanction to borrow £25,000 for electricity purposes.

Wrexham.—DEFICIT.—In reporting a loss of £2,016 on the electricity undertaking for the year ended March 31st last, the Mayor stated that the wages of the staff had risen from £29 in 1915-16 to £140.

TRAMWAY AND RAILWAY NOTES.

Australia.—NEWCASTLE (N.S.W.) TRAMWAYS.—The New South Wales Electric Commissioners have been asked by the Government to estimate the sum of £120,000 on their estimates for the next financial year as an instalment towards the carrying out of the work of electrifying the tramway system at Newcastle.—*Reuter's Trade Service* (Melbourne).

Blackpool.—COLLISION.—Through the wrong setting of points at Blackpool, last week, a St. Annes car collided with a Blackpool car, and a number of passengers complained of shock. The damage was slight.

Continental.—SWITZERLAND.—The power required for the electrification of the entire Swiss railway system amounts to approximately 1.3 milliard kWh, that is to say, one-third of the present hydro-electric power output of the country. The maximum output of the power works required must be in the vicinity of 800,000 h.p. and the average output 300,000 h.p. The necessary power stations have been foreseen by the authorities of the Swiss Federal Railways and have in certain cases already been started on. Among the latter are the power stations of Ritom, Amsteg, and Barberine. After several years' investigations and studies, single-phase, 164-cycle alternating current has been chosen. The Swiss Federal Railways have drawn up an electrification programme according to which the entire work of electrification will be terminated within the next 20 or 30 years. The Erstfeld-Bellinzona section of the former Gotthard line is already working electrically.—*Anglo-Swiss Review*.

In connection with the electrification of the Bernese railways the report of the works and railway authorities of Berne contains the following statement:—

"In view of the falling tendency of coal prices the intended electrification of the Berne-Neuchâtel direct line and of the Emmentaler railways has been postponed. The price of coal has already fallen to such an extent that it is no longer practicable to face the increasing costs of electrification, and especially of electric locomotives. It is, however, to be hoped that within a reasonable period of time the cost of construction will fall sufficiently to make it possible to undertake the work of electrification and that it will then be possible to complete the proposed work."—*Financial Times*.

Cuba.—RAILWAY ELECTRIFICATION.—The *Tramway and Railway World* recently described the electrification of the Hershey Cuban Railway. The original steam-worked line was 35 miles long; this is being extended to maintain service between Havana and Matanzas, a distance of 56 miles, for the transportation of sugar and other freight, as well as passengers. Including spurs, sidings, and extensions, the railway will consist of about 80 miles of track. The passenger cars will be 37.3 ft. in length, with steel underframes. Baggage and postal cars, 49 ft. in length, are also to be put into service.

Leamington.—NOISY CARS.—In consequence of numerous complaints received from residents regarding the noise made by the local tramcars, the Town Council has threatened to apply for powers to run motor omnibuses if the company does not take steps to remedy the nuisance.

London.—CHEAPER "TUBE" TRAVEL.—As an experiment, the City and South London Railway commenced issuing cheap return tickets on August 15th between stations on this tube. The tickets will be issued daily (except Saturdays and Sundays) between 10 a.m. and 4 p.m., and will be available only on the day of issue. There will be a considerable saving in the fares. "A return ticket from Euston to Clapham Common will be 9d., as against the ordinary fare of 1s.; between Moorgate and the Oval the fare will be 4d., as against 6d."—*Daily Mail*.

TRAMCAR DERAILED.—On August 9th an L.C.C. tramcar proceeding to Catford left the track in High Street, Lewisham, and mounted a pavement. A cyclist was slightly injured, and one of the passengers sustained shock.

Newport (Mon.).—THE FEMALE EMPLOYEE.—Defending the retention of one female employé in the tramway department when all the others had been discharged, the Chairman of the Electricity and Tramways Committee, at a Council meeting on August 9th, described her as a most valuable servant. "She carries out delicate duties in a very tactful manner," he said, "knows how to keep her mouth shut and at other times when to say 'No.' A young woman of that class is cheap to our department at 50s. a week." A motion to discharge her was defeated by a large majority.

South Africa.—DURBAN STRIKE ENDED.—Durban tramway-men, who had been on strike for two months with the object of obtaining a 10 per cent. wage increase, agreed on August 13th to resume work on the old terms, on the understanding that there would be no reduction before the end of the year.—*The Times*.

Sunderland.—REDUCED RECEIPTS.—The Corporation tramways are feeling severely the depression in trade and industry in the town, and their receipts for the past few months have been reduced by something like £300 a week as compared with the corresponding figures a year ago.

St. Helens.—"BUSES AS STOP-GAPS."—The Corporation has decided to run motor "buses" while the tramway track is being

re-laid. The quotation of the Bristol Tramways and Carriage Co., Ltd., for the letting of two motor omnibuses, for a period of two months, has been accepted.

The Railways Bill.—DEFINITION OF "LIGHT RAILWAYS."—It has been decided that for the purposes of the Railways Bill, the term "light railways" shall apply only to those light railways constructed after the passing of the Bill, and will not include the undertakings of tramway companies.

Wolverhampton.—CHANGE OF SYSTEM.—The work of changing over the tramway system from surface contact to overhead collection is expected to be completed by the end of next month. Of the 12 miles of route more than half is being operated under the new system already.

TELEGRAPH AND TELEPHONE NOTES.

France.—HIGHER FOREIGN TELEGRAM CHARGES.—A decree of August 4th decided that foreign telegram rates, hitherto fixed by the Telegraph Administration in gold francs, should in future be fixed in "French francs," that is to say, at the current value of the franc, which is considerably less than that of the franc at par. An average equivalent of one franc 80 centimes for the French franc as compared with the gold franc has been decided upon, though this figure is susceptible to alterations in accordance with variations of the rate of exchange. Thus a telegram to London (ten words at the ordinary rate), which formerly cost 2 francs 50 centimes, will now have to be multiplied by 1.8, costing 4 francs 50 at the new rate. A ten-word telegram to Switzerland (formerly costing 1 franc 50) will now cost 2 francs 70, and so on. The new rates came into force on August 11th.—*Reuter's Trade Service* (Paris).

New Cables.—Three new submarine cables, from Casablanca to Tangier, Tangier to Oran, and Casablanca to Oran—direct—have just been laid, says *The Times*.

Norway.—NEW WIRELESS STATION.—It is reported from Christiania that a scientific expedition has left Norway for Jan Mayen Island, which lies between Norway and Greenland, where it will establish a wireless telegraph station that is to be used for meteorological service.

Riga.—A BRITISH-BALTIC POSTAL CONFERENCE.—An International Post and Telegraph Conference opened at Riga on Monday, which was to be attended by representatives of Great Britain, Latvia, Estonia, Lithuania, Russia, Finland, Poland, Germany, Denmark, Norway, the free Port of Danzig, and the Great Northern Telegraph Co. Questions relating to tariffs, charges, settlement of accounts, &c., will be dealt with.—*Reuter's Trade Service* (Riga).

South Africa.—DEVELOPMENTS.—Promise is developing into performance so far as the extensions of the Union's telegraph and telephone services are concerned. The Government has allocated £450,000 for expenditure on the system during the current financial year, and we learn from the *British South African Export Gazette* that attention is also to be given once more to the installation of automatic exchanges at Durban, Capetown, Johannesburg, and other large centres. British manufacturers have now completely secured the chief position in the market which was temporarily ceded to Sweden during the war. Indeed, out of the £124,703 spent by the Government last year, the United Kingdom secured £107,505, and should have little difficulty in annexing the bulk of the £450,000 mentioned above.

In Rhodesia, as well as the Union, there are telephone and telegraph extensions in prospect, and it is confidently expected that the total of £7,991 for imports of this character last year will show an appreciable increase at the end of 1921; while, incidentally, it is interesting to note that the South-West African Protectorate is also coming into the market for supplies, though its purchases last year were worth only £1,184, the bulk of this being secured by Germany. Finally, the imports on private account amounted in the Union itself to £31,564, as compared with only £16,727 in 1919, and for the first three months of the current year to as much as £10,215. Rhodesia has not yet made its weight felt in this section of the market, but nevertheless the total of £2,368 for 1920 shows a promising advance on the £1,285 for 1919.

The Telephone Service.—RESULT OF NEW CHARGES.—In reply to a question, the Postmaster-General informed the House of Commons that the total number of telephone subscribers who had given up the service as a result of the increased charges was estimated at 28,500, and the number of extension instruments that had been surrendered, at 21,500. The rental value of those services at the new tariff would have been approximately £265,000. The number of new installations provided at the new rates was about 35,000 new stations and 30,000 extensions.

THE MONEY BILL.—No amendments to the Telegraph (Money) Bill (which was read a second time in the House of Commons on August 7th, as reported in our last issue) were submitted to the Standing Committee of the House of Commons on August 11th, and the Bill was ordered to be reported to the House.

U.S.A.—PHOTOGRAPHY BY WIRELESS.—A photograph has been transmitted by wireless telegraphy across the Atlantic Ocean and reproduced in Paris. The picture was a recognisable likeness, though detail and tone were lacking. The transmission was by the Berlin process from the offices of the *New York Times* through the wireless telegraph stations at Annapolis and the Eiffel Tower to the offices of *La Martin* at Paris.

WIRELESS DEVELOPMENTS.—The Radio Corporation of America announces that its new central stations will be opened early in September. Two of the mammoth wings or spokes of the wheel-like arrangement of the lofty antenna towers, which we described some time ago, are complete. Twelve steel towers, each 400 feet high, compose the two wings or one operating unit. When the entire station is complete there will be twelve of these wings. The total distance between the first and twelfth towers of the completed unit is approximately three miles. In the centre of these twelve towers stands the central power house, which is now fully completed, so that in reality it will be the focus or hub of the entire system when future wings are added. Two of the 200-kW Alexanderson high-frequency alternators have been installed ready for operation.—*Heuter's Trade Service* (New York).

Venezuela.—The MARACAIBO WIRELESS STATION.—According to *Commerce Reports*, the erection of the towers for the new wireless station at Maracaibo has been completed, and the apparatus installed, so that it was expected that the station would be opened for commercial use by the latter part of June, 1921. The station is equipped with a 5-kW set with a rotary synchronous spark system. The towers are 50 metres high and the normal sending radius by day will be about 800 miles and by night about 1,600 miles.

The Venezuelan Government has already definitely arranged for seven additional wireless stations to be situated at Maracay, Caracas, Puerto Caeila, La Guaira, San Cristobal, Ciudad Bolivar, and on Margarita Island. Some of these stations have already been installed by the American who holds the contract covering all the installations. After all of the above-named stations are completed, there are to be 16 additional stations installed to provide service for the capital of every State in Venezuela.

Wireless Telegraphy.—IMPERIAL CHAIN.—The first completed station in the imperial wireless chain was to be formally opened on August 15th by the Postmaster-General (Mr. Kellaway). It is situated at Leafield, near Oxford, and under normal conditions will have a range of 2,000 miles. The next station to be completed will be that at Cairo, in Egypt, which is expected to be ready before the end of the year. Construction of other stations is to be commenced next year, and in two years' time the full chain will be finished.—*Daily Telegraph*.

Wireless Telephony.—TRAIN CONTROL.—Experiments carried out by the Midland and L. & N.W. Railway Co.'s with wireless telephony, including the transmission of messages to drivers and guards, have shown that at the moment the use of wireless on railways is not commercially profitable, says the *Daily Mail*.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Australia.—MELBOURNE.—October 19th. Victorian Government Railways. Three-phase motors, starters, circuit breakers, and switches. Contract No. 34,181. (See this issue.)

P.M.G.'s Department, Queensland. October 12th. Galvanised iron and steel wire. Schedule 537, October 19th. Insulated wire. Schedule 538. (See this issue.)

Belfast.—August 22nd. Electricity Department. One 12,500-kW turbo-alternator, with condensing plant and auxiliaries. Four water-tube boilers, with superheaters and forced-draught fans. Four fuel economisers. Two steel chimneys, with four electrically-driven suction draught fans. One electrically-driven centrifugal pump, capacity 18,000 g.p.m. (July 22nd.)

Belgium.—August 25th. Municipal authorities of Schaerbeek, Brussels. Alterations to the existing static transformer boxes and the "repartition" box, and for the construction of two additional static transformer boxes. Plans and specifications from the Caisse Communale.

September 2nd. Provincial Government of Limbourg. For the establishment of an electricity distribution system between Beerlingen-Bourg, Leopold, Tessenderloo, Beerlingen and Zonhoven. Copies of the plans and specifications may be obtained from 99, Rue des Flamands, Louvain.

Municipal authorities of Ixelles, Brussels. Low-pressure armoured cables for the electricity supply undertaking.

Glasgow.—August 26th. Electricity Department. Works required in connection with the erection of a sub-station at Greenhead, Govan. Electrical engineer.

Horsham.—August 27th. Electricity Department. One circulating water pump, one steam ejector air pump, one water extracting pump, complete with driving units or, alternatively, a centrifugal circulating water pump, one Edwards air extraction pump, complete with driving units; 1,000 yards l.p. feeder cable, 15—075—15 sq. in. area; 1,000 yards 3-core pilot cable, .003 sq. in. area. (August 12th.)

September 3rd. Electricity Department. One 3-crank, triple-expansion engine, coupled to a 300-kW d.c., 460/500-V generator, or alternatively, one 2-crank compound engine, coupled to generator as above. (See this issue.)

Ilford.—September 9th. Electricity Department. Air compressor, motor and starter. (See this issue.)

India.—High Commissioner for India.—August 30th. Telegraph cable. (August 12th.)

London.—L.C.C.—September 5th. H. and l.p. switch-gear for sub-station. (August 5th.)

FULHAM.—September 10th. Electricity Department. A.c. motor-driven centrifugal circulating pump with pipework and valves. (See this issue.)

FADDINGTON.—August 22nd. G.W. Railway. Three months' supply telegraph instruments, electrical apparatus, wires, cables, telegraph ironwork and tools, and drysalteries. (August 12th.)

Metropolitan Asylums Board.—August 31st. Electric lighting installation at the Grove Hospital, Tooting Grove, S.W. (See this issue.)

Malta.—September 15th. Government of Malta. Single-phase a.c. meters. (See this issue.)

New Zealand.—WELLINGTON.—September 27th. Public Works Tender Board. Six sets 3-phase, 50,000-V air-break switches for the Waikato electric power scheme.

Portsmouth.—August 30th. Tramways Committee. Stores, 12 months (including insulating materials, lamps, line materials, &c.). (See this issue.)

South Africa.—PRETORIA.—October 4th. Electric Light and Power Department. Coal-handling plant, 6,600-V cables, induced-draught and ash-handling plant, pumps, piping, &c.—Mr. T. C. Wolley Dod, General Manager, Municipal Electricity Supply, P.O. Box 425, Pretoria.

DURBAN.—August 31st. Corporation. One 3,000-kW, three-phase, 50-period, 6,600-V turbo-alternator with condensing plant, circulating water pump and piping. (See this issue.)

September 25th. Corporation. Two 500-kW rotary converters, switchgear, and automatic controlling devices, also h.p. supply feeders.*

JOHANNESBURG.—November 7th. Tenders for incandescent lamps. South African Railways and Harbours. 85,560, incandescent train lighting lamps (tungsten filament) for 24 volts, 8 to 10 candle power. 8,125, engine headlight lamps, 150-watt, 32-volt (gasfilled type with concentrated filament). 50,472, incandescent lamps (tungsten filament), and 5,545, incandescent lamps (carbon filament).*

Salé.—Urban District Council. Cables, transformers, switchboards, house meters, and a.c. motors. (August 12th.)

Southampton.—August 30th. Electricity Department. E.h.p., 3-phase cable. (August 12th.)

Stockton-on-Tees.—August 31st. District Fund, Gas and Electricity Committees. Articles and stores for six months. (August 5th.)

Uruguay.—September 19th. Board of State Electrical Stations. Generating plant for four electrical groups, consisting of a.c. and d.c. generators, Diesel engines, &c.*

West Ham.—September 8th. Board of Guardians. Three months' supply of electrical fittings. Mr. T. Smith, clerk to the Guardians, Union Road, Leytonstone.

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CLOSED.

Aldershot.—Urban District Council. Accepted:—

Met. Vickers Electrical Co.—H.p. switchgear, £974; l.p. ditto, £780. Bruce Peebles, Ltd.—Converting plant, £6,147. (The next three lowest tenders were: Ateliers de Construction, Belgium, £5,500; Oerlikon, Ltd., Switzerland, £5,390; Crompton & Co., Ltd., £6,056.)

On recommending the Council to accept the quotation of Messrs. Bruce Peebles & Co. (which was £600 higher than the Belgian tender) for converting plant, the engineer stated that the Belgian tender was lower because lower wages were paid in Belgium, and their quotation was for a two-bearing machine, which was cheaper than the three-bearing type made by Bruce Peebles & Co. Both tenders were for machines made under the La Cour patents; the question of obtaining spare parts was an important one. It was for the Council

to decide whether to keep business at home or to patronise foreign manufacturers. Personally, he considered they ought to stick to British manufacturers as much as possible. The Council unanimously agreed to accept the tender recommended.

Bangor.—City Council. Accepted:—

English Electric Co., Ltd. 100 kW Diesel set, £4,260.

Glasgow.—Tramways Committee. Recommended:—

R. W. Birkbeck & Co., Ltd., Glasgow, Birkby & Goodall—Insulated belt Warrs Engineering Co., Ltd.—Motors.
R. I. & H. S. Cables, Ltd.—Cable ties for lighting

Sunderland.—Corporation. Accepted:—

Ferranti Ltd. Holmwood—Eighteen direct-current meters.

NOTES.

Practical Education at Manchester.—A scheme designed to give Manchester engineering students practical experience in the City Engineer's department was considered by the Town Hall Committee on August 10th. It was proposed that two or three suitably qualified men should be taken on for a two years' course during which they would pass through the drawing office and take part in work on roads, bridges, walls, sewers, and surveying. They would not be paid, but would be given a certificate at the end of the course.

The proposal is, of course, applicable to every technical department, and the Town Hall Committee, which approved the scheme, has invited opinions from the other departments of the Corporation. —*Manchester Guardian.*

A 22,000-kVA Water-Wheel Generator.—In a recent issue of the *Electrical World* was described one of the largest horizontal water-wheel-driven generators ever built. This was made for the Great Western Power Company of California. It is a three-phase, 60-cycle machine rated at 22,200 kVA, 0.9 power factor, 11,000 volts, 171 r.p.m. There will be two units of this type in the Great Meadow plant on Feather River.

The fact that it was built to operate on a 165,000-volt transmission line, the highest operating voltage to be reached so far in the U.S.A., caused some interesting features to be incorporated in its construction. Tests made at the factory on the generator show that it has 97.25 per cent. efficiency at full load and unusually high efficiencies at partial loads. These are 95 per cent. at half load and 93 per cent. at quarter load. All efficiencies were at 0.9 power factor.

The rotor consists of four separate wheels made into a single spider with the rim dovetailed to receive the poles. The machine is enclosed for ventilation, having air inlets on each side consisting of ducts coming from underneath. The heated air is expelled into the room. Some of the dimensions are as follows: Total height over all, 21 ft.; distance over the end shields, about 7 ft.; distance from the floor line to the top of the machine, 13 ft. The total net weight is 334,000 lb. The machine was built by the American General Electric Co., and is the largest ever built by that company.

Electricity on New Zealand Farms.—Addressing a meeting of Bradford wool textile manufacturers, last week, Mr. H. W. Massey, Prime Minister of New Zealand, referred to the up-to-date sheep and dairy farms in New Zealand, and spoke of the increasing use of electrical power on such farms. He said he fancied they were rather more up-to-date in New Zealand than in the homeland; they were going to provide electricity for motive power purposes for practically every industry in the country. They were developing their water powers to deal with this, and he believed that within five years every dairy farm in New Zealand having over a dozen cows would have its machinery driven by electricity.

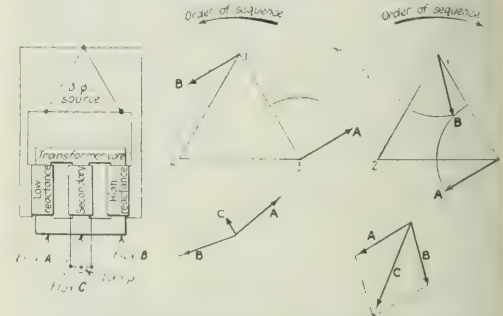
Stage Lighting.—In a new scene shortly to be introduced into "The Peep Show" at the London Hippodrome the scenery, dresses, and furniture will be "changed" by means of coloured lighting. It is claimed by the inventor of the innovation (Mr. Adrian Lamoioli, a young Russian) that it is possible by this means to completely alter the colour, shape, and pattern of, for example, a girl's dress on the stage. —*Daily Mail.*

Indirect Storage of Power.—During the recent Chicago Convention of the National Electric Light Association an interesting plant at Vivarone, Italy, was described. This plant belongs to the Società Idroelettrica Piemonte ed Elettrici Alta Italia, and is a case of artificial storage of power. The company had a certain amount of power available during the night which it wanted to store for use during the day. A place was found where there were two lakes with a difference in elevation of 483 ft. (147 m.). On a level with the lower one, Lake Vivarone, a plant was erected and equipped with a set of motor-driven high-pressure pumps which could be used during the night to pump the water from the lower lake to the higher lake. During the day the water thus stored was discharged into the lower lake through waterwheels driving generators. From the technical point of view it worked well, but the efficiency of the whole system is very low. The calculated efficiency is 53 per cent., but the real efficiency is not more than 40 per cent. —*Electrical World.*

Testing for Phase Sequence.—In an interesting article by Prof. F. A. Kartak on "Testing for Phase Rotation in Three-phase Circuits" which appeared in the *Electrical World* for April 23rd, 1921, four methods of determining phase rotation are classified. A method devised by Mr. H. J. Blakeslee, of Hartford, Conn., which differs materially from the four mentioned in the article will be of interest to those who have to make tests of this nature. This method requires a small polyphase transformer core having two primary windings, one on each of the outside legs, a secondary winding on the common leg, and a lamp in the secondary circuit.

The ratio of resistance to reactance in one of the primary coils is made greater than the corresponding ratio in the other primary coil. The flux in the core of the former coil will, therefore, lag the e.m.f. impressed on that coil by an angle smaller than that by which the flux in the core of the latter coil lags the e.m.f. impressed on that coil. Therefore, the resultant flux in the common leg will have a value which is of different magnitude according to the phase rotation of the source, and it follows that the lamp connected in the secondary circuit will have a different brightness.

The electrical connections of the transformer are shown in the accompanying illustration, as are the approximate phase relations of the polyphase e.m.f.'s and transformer fluxes for



TRANSFORMER FOR DETERMINING PHASE SEQUENCE OF A THREE-PHASE CIRCUIT.

opposite orders of rotation. Vectors 1-2, 2-3, and 3-1 represent the three e.m.f.'s of a polyphase circuit. A represents the approximate phase of the flux in the core surrounded by the highly reactive coil. B represents the approximate phase of the flux in the core surrounded by the coil of lower reactance. A lags the corresponding e.m.f. 3-1 by nearly 90 deg. B lags e.m.f. 1-2 by about 45 deg. C is the resultant flux in the third or common leg.

The effect on the resultant flux caused by different orders of rotation is shown by the two sets of diagrams. The current in the secondary circuit naturally reacts upon the component fluxes so that their lags and magnitudes will not be identical in the two orders. There is no difficulty, however, in so proportioning the windings as to secure the effect desired.

A convenient assembly of the apparatus, including a quick reversing switch, occupies a box 6½ in. by 4½ in. by 2½ in. and weighs 3 lb., thus being readily carried in a meterman's kit.

The Most Popular Lamps.—In the vacuum-tube lamp the 40-watt size is used in the United States to the greatest extent, it representing about a quarter of all lamps of this class. The 25-watt is a good second, followed by the 60-watt and 50-watt. A tendency to standardise the last-named size accounts for a very perceptible increase in its use during the last two years. Meanwhile the gas-filled lamps of 75 watts and 100 watts have risen in popularity, while little change is shown in the larger sizes. It now looks as if the two sizes just mentioned will very rapidly drive out the 100-watt and perhaps the 60-watt vacuum lamps. For street-lighting work the vacuum type has virtually disappeared. The Lamp Committee brought out these facts at the recent N.E.L.A. convention in Chicago. —*Electrical World.*

Spontaneous Combustion of Coal.—Eight years after its appointment, the Departmental Committee on Spontaneous Combustion of Coal in Mines has now issued its final report (Cmd. 1,417, Stationery Office, 1s. 6d. net). It presented an interim report, however, in December, 1913, and afterwards its work was interrupted by the war. The present report, according to *The Times*, states that probably all bituminous coal is liable to spontaneous combustion in some degree, but that there is greater liability to self-heating of the coal in the seams of some British coalfields than in others is due to several causes other than the chemical composition of the coal. The thicker the seam the greater, in general, is the liability to spontaneous combustion; and coal which has been crushed in the mine by reason of superincumbent weight is more liable to self-heating than coal in a solid, compact state.

As regards systems of working, it is declared to be impossible to lay down any hard-and-fast rule for universal application. No regulations are recommended additional to those brought into force in July last, which were based on the committee's interim report.

Electric Dish Washers.—In this country the dish washer appears to be the least-known of electrical appliances, attention being devoted almost entirely to such articles as clothes-washing machines, cooking apparatus, and suction cleaners. Of course, an electrical dish washer is not exactly suitable for the small *ménage*, and this may be the reason for the apparent neglect of the appliance. The United States, however, is still working at this, and the *Electrical Review* of Chicago recently gave some particulars of two new electric dish-washing machines which have been placed on the American market. One of these, the "Autosan," is made in three sizes. The first is suitable for establishments catering for between 100 and 500; the medium size is designed for larger establishments—from 500 to 1,000 persons; the largest size is for establishments dealing with more than 1,000 persons. In this machine a rotary conveyor carries the tableware through washing, rinsing, and sterilising sprays applied from above and below; special fibre cushions are embodied in the tank to prevent chipping or breakage of china and glass. The sterilisation of the washed articles is effected by boiling water and steam. The smallest type is driven by a 1-h.p., 1,750 r.p.m. motor installed in the base of the machine, and connected to the water pumps, and, through a reducing gear, to the conveyor, thus eliminating belts or chains.

The Walker "heavy-service" dish washer is entirely different in design. It contains only one moving part, that is a blade of special design which revolves rapidly in the conical tank of the machine, and thus forces a whirling stream of water through the articles in the upper part of the tank. Four stationary nozzles in the top of the machine introduce water for washing and rinsing. A rubber knob is another accessory. Before being put into the tank, the plates, &c., are tapped against this to remove all loose pieces into a hopper. The plates are then put into trays and slid into the tank. A $\frac{3}{4}$ -h.p. motor has been found sufficient for the operation of this washer.

The Odometer.—The *Quest*, which will carry the Shackleton-Rowett expedition to the Antarctic, will include in her equipment, besides wireless telegraph apparatus, an odometer. The latter device, according to *The Times*, is an electrically-worked recording instrument resembling the barograph, which will be connected to the electric log and gyroscopic compass. Its function is to trace automatically on a chart the route followed by the vessel and to record her speed; it is adjustable to any chart. The odometer is the invention of Rear-Admiral E. C. Villiers, and it is believed that only three such instruments have so far been constructed.

Electric Welding in Wireless Apparatus.—Some very fine work with a small electric welder about the size of an ordinary sewing machine is described in a recent issue of the *Journal of Electricity and Western Industry*. This little machine is used in connection with the manufacture of vacuum tubes, and the work is of such a delicate nature that it has been necessary to confine it to female labour. In one type of detector is a tungsten filament surrounded by a nickel helix, and a nickel cylinder. The helix, which is composed of nickel wire .02 in. in diameter, is electrically welded to a nickel wire support. The weld is so successful that only the single support is required. The cylinder which is $\frac{3}{4}$ in. in diameter, $\frac{1}{2}$ in. long, and made of .007 sheet nickel, is supported by a .03 in. diameter nickel wire which is welded to the cylinder. The amplifying tubes are made in a similar manner. The De Forest tube is a much larger and more powerful type, and the electric welding in it shows a larger field of accomplishment, for a greater number of different metals are used, all electrically welded to each other. Within this tube, tungsten is electrically welded to dumet; nickel to tungsten; copper to nickel; molybdenum to nickel; iron to molybdenum, and molybdenum wire to tungsten, and copper to dumet. All of these metals are of very small sectional area, being under $1/16$ in. in diameter or thickness. The electric welding is all of the resistance type. The delicacy of the work may be judged from the fact that the two electrodes and the wires to be welded are within an area of three-sixteenths of an inch in diameter, and this inside a "pyrex" glass tube.

Conscious after a 33,000-volt Shock.—A correspondent of the *Electrical World* states that recently, while examining some high-line oil switches preliminary to overhauling them, Charles Moore, of the Texas Light & Power Co., came into contact with a circuit and established a "ground" through his body. While he was so badly burned that he lost his right hand, he never lost consciousness, despite the fact that the circuit was operating at 33,000 volts. Mr. Moore and an assistant had been standing before the switch box, the door of which was off. Mr. Moore, it is thought, swung around to leave, and as he did so he caused an arc and was knocked down. Witnesses of the accident rushed to the stricken man expecting to find him dead, but to their amazement he began to talk towards them and intelligently directed the first-aid work himself. The discharge entered his right hand, travelled through his body, and passed through his left leg. The concrete flooring on which Mr. Moore was standing at the time clearly showed the outline of Mr. Moore's left foot, having been turned black where current passed out of his body. It is estimated that the minimum pressure which he could have received was 19,000 volts.

Energy from a City Water Supply.—We recently described an installation in a Canadian town in which the town's surplus water supply was used in the generation of electricity. In Los Angeles, according to the *Electrical World*, there is a hydro-electric installation upon the same principle but on a much grander scale. During the spring of 1919, the power shortage in this district became so acute that the power companies found it necessary to develop a source of power which could be utilised in a short space of time. It was found that by the use of water from the city aqueduct an effective head of 515 ft. could be obtained at a distance of 40 miles from the city. This distance was, however, no disadvantage as the transmission lines from another station passed the site. The water was diverted from the main aqueduct to a surge tank. From this, two riveted steel penstocks, 7 ft. in diameter and 1,430 ft. long, were erected to the bottom of the San Francisco Canyon, wherein was constructed a power house containing two 17,500-kVA vertical turbo-alternators. The present rate of flow to these machines is 600 cu. ft. per second, and the head of 515 ft. gives an effective 30,000 h.p. The generators have a power factor of .8, they are of the "umbrella" type with directly-connected exciters and spring-type thrust bearings. Provision has been made for a third machine of this type. Upon leaving the station the water passes through a tunnel 400 ft. long and re-enters the aqueduct. The whole construction was effected in a remarkably short time. The contracts for the hydraulic part of the work were let in the spring of 1919, and awarded to the Wellman-Seaver-Morgan Co. in July. At the same time the General Electric Co. received an order for the generators. The turbines were delivered in March and April, 1920, and were put into operation on June 30th and August 7th respectively. So accentuated had the power shortage become that seven hours after full load was admitted to the second unit the plant was under full load.

Railway De-control.—The control of the British railway systems, after being in the hands of the Government for the past seven years, ceased at midnight, August 15th-16th, 1921.

Educational.—CITY AND GUILDS OF LONDON INSTITUTE.—Mr. H. P. Philpot, B.Sc., A.M.Inst.C.E., Assistant Professor at University College, has been appointed to the Professorship of Civil and Mechanical Engineering at the Finsbury Technical College; and Mr. A. J. Hale, B.Sc., F.I.C., Chief Assistant in the department of Applied Chemistry, to the Professorship in that department. The entrance examination of the College will be held on Tuesday, September 20th.

Porcelain in Australia.—A deputation representing manufacturers of hard porcelain were interviewed the Australian Minister of Customs recently to ask for increased duties to be imposed on hard porcelain ware for electrical purposes. The manufacturers contended that they were in a position to meet all local requirements, both for high and low-pressure work, and that they were installing plant (which had been made in Australia) to test up to a pressure of 150,000 volts. They desired additional protection, particularly on the general tariff, and the Minister promised to consider the request.

Copper Tempering.—Mr. Walter Bunton, of Laporte, Indiana, has discovered a process of tempering copper, which has been a lost art for many generations. Bunton found some pages of an encyclopedia in an ash heap and read an account of how a Roman metallurgist had discovered the secret of hardening copper, but that the secret had died. He at once began experiments, which have resulted in the new process. His patent has been purchased by the United States Steel Corporation, says the *Chicago Tribune* (Paris edition), for £250,000, and a royalty of 1d. for every pound of material manufactured. The process is being kept secret until foreign patents can be completed.—*Birmingham Post*.

Wireless-Controlled Motor-car.—The first radio-controlled motor-car has appeared in the streets of Dayton, Ohio, according to the *New York Herald* (Paris edition). No one was in the car—to all appearances a conventional one 8 ft. long—yet it made its way through the main streets, obeying the traffic signals, taking the turns, and blowing its own horn at careless pedestrians. The car was driven by its inventor, Captain R. E. Vaughan, from another car following it at a distance of 17 yards or so.—*Daily Mail*.

Colouring Gem Stones.—Experiments in colouring colourless gem stones by exposure to radium emanation are being carried on at the Rare and Precious Metals Station of the United States Bureau of Mines at Reno, Nevada. A colourless Colorado topaz was tinted yellow, but the colouring was not permanent when exposed to light. If it is found that radium possesses the power to colour gem stones, the discovery will increase the commercial value of gem stone material found largely in the West, says the *Engineer*.

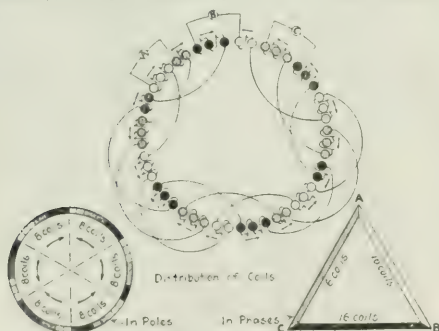
Institution Note.—IRON AND STEEL INSTITUTE.—The Autumn Meeting, as previously announced, is to be held in Paris from September 5th to 10th. The programme includes visits to works in Lorraine, Burgundy and Normandy. Among the papers to be read and discussed are:—"Does the critical point depend on the strength of the magnetising field?" by K. Honda, and "The situation of the French metallurgical industry in the North and in the East of France," by L. Guillet.

Appointments Vacant.—Cable jointer for the Burnley Electric Lighting Department; teachers in electrical engineering, wireless telegraphy, and mechanical engineering, for the Croydon Education Committee. (See this issue.)

Legal.—*Concord v. J. J. Ghegan*. With reference to the report of the case *Electrical Apparatus Co., Ltd., v. J. J. Ghegan*, *The Electrician*, August 12th, p. 251, Mr. Frank W. Ward states that he did not say that he was managing director of Messrs. Burton, Griffiths & Co., Ltd. Counsel referred to him as *late* of that company.

The Ghegan Simplex Main Line Relay.—A radical departure from the time-honoured methods of adjusting the magnetic circuit of main line telegraph instruments has been devised by Mr. J. J. Ghegan, president of J. H. Bunnen and Co., New York, says the *T. & T. Age*. Heretofore this adjustment has been done by varying the distance between the magnet cores and armatures by sliding the magnets back and forth. Mr. Ghegan's method is to leave the armature and magnets in fixed positions in close proximity to each other, and vary the magnetic circuit by moving the yoke or back iron, on which the magnet spools have heretofore been permanently mounted, from contact with the magnet cores to any desired distance away from one or both cores. Mr. Ghegan's relay arrangement has some distinct advantages over the former types, such as the positive protection of the magnets and their connecting wires from mechanical injury by enclosing them in a suitable covering; simplifying the construction by eliminating sliding mechanism for the magnets, and by doing away with the back adjusting post. The instrument is decidedly quicker in action, owing to the additional break in the magnetic circuit, as well as being more responsive to small current variations, perfect work being obtained on a variation of less than 2 milliamperes over a 100-ohm load on a 3,300 ohm circuit. This is made possible by the closeness of the armature to the magnet cores at all times, so that all lines of force go through the armature, whereas in the old arrangement of separating armature and magnet cores, besides the pull being in inverse ratio to the distance, many of the lines of force passed directly from one core to the other, and thus had no effect on the armature. The arrangement for moving the yoke or back iron is simple and ingenious, and is accomplished by turning a nut exactly as in the old style relay, so that operators do not have to learn any new adjusting methods when using the instrument.

Simplified Connections and Diagrams of Three-phase Motors.—A set of simple and clear diagrams for the reconnection of motors by ordinary machinists who were not familiar with the usual style of connections adopted in motor diagrams was devised by the manager of an important manufacturing establishment of Lima, Peru. The work was started having in mind that the diagrams to be prepared must show clearly and faithfully not only the sequence of groups, poles, and phases, but also the formation of groups. Starting at the two terminals of each coil, it was proposed to make a detailed and continuous line representation to converge at the three motor terminals. In some cases it became necessary to alter the usual style of connection so as to make practicable the reconnection in the most simple and regular way. The phases were shown differently, the terminals had to be located symmetrically, the top and bottom splicings were drawn separately,



and even the coil-to-coil stubs were clearly indicated. Among the diagrams prepared there were some for twelve, ten, eight, six, and four poles, using 2,900, 550, 440, and 220 volts both for American and German makes of motors.

The accompanying drawing is a sample of the diagrams made. It belongs to a 5-h.p., 1,150-r.p.m., 220-volt, 48-coil, series-delta, three-phase motor. Each of the small circles represents a coil. The different phases are drawn respectively clear, hatched and black. The lines issuing from the small circles represent the terminals and connection ends of the coils, and there is no other explanation accompanying the diagram than the direction to connect the motor in strict accordance with the lines joining the small circles. As the motor requires odd grouping of coils the distribution of coils in poles and phases is also indicated.—Mr. V. M. Arana, in the *Electrical World*.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

The Sheffield City Council discussed at some length last week the salary of Mr. J. W. BARNES, the commercial assistant in the electricity supply department. From the speeches it appears that in August, 1919, the Council decided to pay him the amount he would have received had he been a member of the E.P.E.A. (then £630 per annum; now £702), but that resolution had never been carried out. Mr. Barnes is now a member of the E.P.E.A., and is receiving £600. One councillor said that the Council ought to redeem its promise, while another denied that the Council ever made any bargain with Mr. Barnes, and wanted to know why he should be paid £700 to-day "when the bottom of Sheffield trade had dropped out." Sir William Clegg, who said that he had always supported Mr. Barnes having £700 a year, now took up an attitude of strong opposition to any advance, and, according to the *Sheffield Independent*, he is reported as saying, "although I believe the man has been badly treated, I will not support him, as I do not approve of the methods." Sir William said that Mr. Barnes said at one time that it was not in the interests of the department that he should join the Association, but when he had failed to persuade the Council to raise his salary he changed his attitude and joined it, his avowed object being to bring himself within the Association's scale. The increase was refused by 36 votes to four.

As mentioned in our last issue, Mr. H. R. FORBES MACKAY has been instructed by the City Council of Sydney, N.S.W., to visit Great Britain and America for the purpose of making himself acquainted with the latest developments in electricity supply systems. Mr. Mackay expects to arrive in London about the middle of October. He will make its headquarters at the offices of Messrs. Preece, Cardew & Rider, 8, Queen Anne's Gate. Mr. Mackay is city electrical engineer and general manager of the electricity department in Sydney. The Sydney undertaking is a big one. The capital expenditure is already near 44 millions sterling, and the annual revenue approximately one million. There are more than 50,000 consumers, with a total connected load of over 150,000 kW. The observed greatest demand is about 40,000 kW. For the twelve months ending May 31st, 1921, there were 19,041 new consumers connected. Mr. Mackay has reported to the Sydney Council that the next main generating unit installed, which it is proposed should be of about 16,000 kW, will fill up the whole of the space available on the site of the existing power house, and that, therefore, by about 1925 a new power house should be in operation. It is largely in connection with the design of this proposed new power house that Mr. Mackay is making his visit to Great Britain and America. He is specially interested in (a) the economy and effectiveness under different conditions of pulverised coal as fuel; (b) the automatic protection of high-pressure cables; (c) modern designs of high-pressure switchgear; (d) the latest developments in different types of automatic stokers; (e) steam turbines, particularly the maximum rating up to which a 3,000 r.p.m. machine can be carried with safety; (f) the use of extra high steam pressures in boilers, &c.; (g) methods of disposing of ash and clinker where coal is burned in large quantities.

On Friday, 12th instant, the staff of the Wallace electricity department, with a number of business friends met together in the afternoon at the offices, 58, View Road, and presented the borough electrical engineer and manager, Mr. J. A. CROWTHER, with a solid silver tea and coffee service as an expression of their esteem and regard, on the occasion of his retirement after 25 years' service. Mr. Starkey, the mains superintendent, by virtue of being the oldest official, made the presentation.

Owing to the resignation of the borough electrical engineer of St. Helens, Mr. B. T. HAWKINS, who has been appointed by the Corporation of Wallasey, the Electricity Committee has resolved that Mr. F. N. BENDALL, BAKER, power-station superintendent at the Corporation electricity works be appointed acting electrical engineer for a period of twelve months at a salary of £650 per annum (inclusive).

Mr. P. J. WATTS, O.B.E., first assistant electrical engineer, who has been at the head of the electrical engineering department at Sheerness yard since July 5th, 1917, as electrical engineer (acting), has been promoted to electrical engineer; and in the same department Mr. A. R. REEVES, inspector of electrical fitters, who has been employed on Admiralty overseeing duties in the Birmingham district for some years past, has been appointed second assistant electrical engineer in the place of Mr. A. E. FRANKLIN. The promotion of Mr. Watts is to the vacancy caused by the death of Mr. A. G. NEWINGTON.

Lieut. Col. A. K. TASKER, T.D., from the Tyne Electrical Engineers, has been posted in the same rank to the Residential List of the Territorial Force Reserve, and Major O. M. SHORT and Capt. C. M. CAMPBELL, A.M.I.E.E., of the same corps in their respective ranks, have been similarly posted to the Reserve of Officers (Territorial Force) from 26th ult. A vacancy for a captain in the Hants (Electric Lights Com-

pany) Fortress Engineers has been filled by the promotion of Lieut. K. N. ARNOLD, who joined the corps in 1915.

Mr. H. J. GREEN has been appointed switchboard attendant at the works of the Scarborough Electric Supply Co., Ltd.

Mr. H. T. W. BOWELL informs us that he has severed his connection with the Silent Electric Clock Co., Ltd.

According to the Sydney Sun, Mr. F. B. SHENSTONE was entertained at dinner in July by the officers of the Chief Electrical Engineer for Railways and Tramways, on the occasion of his retirement from the position of works manager, Randwick workshops, Sydney, to take up the general management of Messrs. Parkinson's (Australia), Ltd., who are starting works for the manufacture of electric motors in Sydney.

Sir ERNEST V. HILEY, formerly Town Clerk of Birmingham, and more recently chairman of the Metropolitan Railway Carriage & Wagon Co., of Salley, has been adopted as prospective Unionist candidate for the Parliamentary Division of Budeston, Birmingham. The present member has intimated his intention to retire at the next General Election.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electrical Distribution of Yorkshire, Ltd.—Mortgage on company's undertakings authorised by various provisional orders and tolls and sums arising therefrom, and all estate, right, title and interest therein, all future undertakings which may be granted to the company during the existence of the mortgage and company's other assets, present and future, including uncalled capital, dated July 26th, 1921, to secure all moneys due or to become due from company to Barclays Bank not exceeding £25,000, including £10,000 previously secured.

Hutchinson Bros., Ltd.—Satisfaction in full on July 19th, 1921, of debentures dated June 11th, 1915, securing £2,500.

Arc & General Equipment, Ltd.—Second debenture dated July 28th, 1921, to secure £100 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. D. Jones, of St. Aubyns, The Vale, Hampshire.

H. E. Ashdown (Birmingham), Ltd.—Mortgage dated July 26th, 1921, to secure all moneys due or to become due from company to London Joint City & Midland Bank, charged on certain land and premises, &c., at Perry Barr, Birmingham.

Staffordshire Electrical Accessories Co., Ltd.—Satisfaction in full on July 29th, 1921, of debenture, dated April 8th, 1920, secured £1,735 notified. Particulars of £1,735 debentures, authorised July 29th, 1921, also filed; whole amount secured; charged on the company's undertaking and property, present and future, including uncalled capital.

Chesham Electric Light & Power Co., Ltd.—Satisfaction in full on July 30th, 1921, of debentures dated July 31st, 1914, securing £25,000.

Sussex Electricity Supply Co., Ltd.—Particulars of £20,000 debentures, authorised £25,000, 1921, and covered by trust deed of even date; present issue £10,000; charged on certain land and buildings at Crawley and company's other assets, present and future, including uncalled capital. Trustee: J. F. Drughora.

Northampton Electric Light & Power Co., Ltd.—Issue on July 22nd, 1921, of £100 second debenture stock, part of a series already registered.

CITY NOTES.

Marconi's Wireless Telegraph Co., Ltd.

In their report for the year ended December 31st, 1920, the directors state that many matters remain unsettled, and consequently the accounts cannot reflect the true strength of the company's position. The credit balance of profit and loss account for the year amounted to £297,682, which added to the balance brought forward, leaves to the credit of profit and loss account £1,242,134. The preference and ordinary dividends paid in January last absorbed £147,959, leaving available for distribution £1,094,175. The directors recommend payment of further dividends for the year ending December 31st, 1920, as follows: On the ordinary shares 10 per cent. (making 15 per cent. for the year), £261,108; on the preference shares 5 per cent. (making 12 per cent. for the year), £12,500, leaving as balance to carry forward £820,567. A large amount of the company's business during the past year has been with foreign countries. In consequence of the unfavourable rates of exchange which obtained during the year, substantial sums of money have been retained abroad on deposit or invested in foreign Government securities. At the end of December, when the company's accounts were closed, foreign currencies showed a very considerable depreciation, materially affecting the profit and loss account for the year. There has been a marked improvement in recent months, but the directors, believing that in the course of time a further appreciation in foreign exchanges will be experienced, regard it to be in the interests of the company that these moneys should, for the present, remain abroad. There has still been no settlement with any of the Government departments in respect of any of the company's claims arising out of the war or the services rendered during the war, therefore no sum in respect of any of these claims figures in the year's accounts. Some progress, however, has

been made. An important and controlling patent used very largely by the Navy, Army, and Air Force was challenged by the Admiralty. The matter was referred for arbitration to the late Lord Moulton, who gave his award on August 2nd, 1920. He found that the patent was valid, and was infringed. The amount payable to the company under this decision has not yet been assessed. Lieut.-Col. Adrian F. H. S. Simpson, C.M.G., has been appointed a director. Annual meeting: August 24th.

Dutch Heemal Co.

The report of the Hengeloche Electric en Mechanische Apparaten Fabriek (Heemaf), of Hengelo, dealing with the year ended on April 30th, 1921, states that the good reasons existed when the directors proposed last September to make a fresh issue of shares for 2,250,000 fl. (£187,500), as the number of orders had increased beyond expectations, and an extension of the warehousing space was necessary, having in view a growth in the export trade. During the first four months of the financial year the monthly orders averaged 1,300,000 fl. (£104,000), as compared with an average of 400,000 fl. (£33,000) in the same months of the preceding year. In November, however, a sudden and large fall in the demand for manufactures took place in conjunction with a big decrease in the prices of raw materials and an unexpected increase in the delivery of the latter under then current contracts. The result was that stocks were now greater than required under existing circumstances, and it was necessary to write them down considerably. During the year the foreign sales organisation was largely extended, and good agencies having wide connections were now established in the principal countries. Having regard to the possibility of the partial electrification of the railways in Holland and the Dutch colonies in the near future, the directors considered that they ought to be active in this direction, and they had concluded an agreement with the Westinghouse Electric Co. under which they would have the right of manufacture of the principal subsidiary parts needed in connection with electric railways. After writing off 1,695,000 fl. for depreciation (of which 1,594,000 applied to stocks), as compared with 223,000 fl. in 1919-20, the accounts show a loss of 361,000 fl. This contrasts with net profits of 782,000 fl. and a dividend at the rate of 10 per cent. in 1919-20.

Chemical and Metallurgical Company, Ltd.

Mr. Herbert Guedalla (chairman) presided at the first ordinary general meeting on August 9th. In moving the adoption of the report and accounts, the chairman said that the estimates of technical experts, that from 18 months to two years would be occupied in bringing the process to a state of commercial utility, were being justified. The commencement of the work was undertaken at a time of general shortage and of labour difficulties, and having regard to these circumstances, the position was very satisfactory, thanks to the unremitting efforts of the technical staff. The excessive cost of coal and labour had compelled the company to devise and install special plant to cut these charges down to a minimum. The recovery process had been developed in a remarkable way; from 90 to 100 per cent. of the lead contents of complex ore could now be gained; the recovery of silver had been improved from about 30 to over 90 per cent.; and zinc recovery from 85 to over 95 per cent. The application of the process had been so improved that the treatment of lead-copper ores and the separation of lead-copper matter was well within their scope. There had been some delay in the purchase of land on the river Tees, but the delay had not proved injurious. The Francois Cementation Co., Ltd., formed by the company, had experienced a check, due to the coal dispute, but the directors considered that this company would eventually prove of valuable assistance.

Fellows Magneto Co., Ltd.

At the annual general meeting, on July 28th, Mr. V. L. Fellows (chairman) said that although the year had been one of unprecedented difficulty, the results were very satisfactory. Until towards the end of the year the demand for the company's magnetos steadily increased, and the existing plant had been taxed to its limits. The new buildings were delayed on account of the low output of labour, but they were now complete and formed a valuable addition to the factory. The shortage of raw material had necessitated a rationing system, and in consequence the company, in some cases, had received only about half of its requirements. Large forward orders had been placed when, suddenly, the demand ceased and orders were cancelled. Only by long negotiations was the company able to secure a modification of the terms upon which raw material was being purchased. Several patents, whose actual value was well in advance of their book figures, had been purchased during the year. The fall in value of raw materials accounted for a large reduction in the year's profit. A gratifying feature of the accounts was the absence of any debenture or mortgage charges, and the directors looked forward to a prosperous future. The report and accounts were adopted unanimously.

Companies struck off the Register.—The following companies have been struck off the register, and are dissolved:—
Electric Tramways of Ribeirão Preto, Brazil, Ltd.
Midhurst & District Electric Supply Co., Ltd.

Rangoon Electric Tramway & Supply Co., Ltd.—The directors announce the issue of the balance of the authorised ordinary capital, amounting to 72,999 shares of £1 each, to be offered at par to existing shareholders. Any shares not subscribed by ordinary proprietors will be available for subscription by the preference shareholders. The new capital will be used to repay bankers' loans and to carry out necessary extensions. *Finance.*

British Columbia Electric Railway Co., Ltd.—Interim dividend of 3½ per cent., free of tax, on the deferred ordinary stock.

Brompton & Kensington Electricity Supply Co., Ltd.—Interim dividend for the half-year ended June 30th on the ordinary shares at the rate of 9 per cent. per annum, less tax.

Fairbairn-Lawson Combe Barbour, Ltd.—Interim dividend on the ordinary shares at the rate of 10 per cent. per annum for the half-year ended June.

Waste Heat & Gas Electrical Generating Stations, Ltd.—Interim dividend of 1½ per cent. in respect of the half year ended July 31st, 1921, less income tax.

South Metropolitan Electric Light & Power Co., Ltd.—Dividends on the 7 per cent. cumulative first preference and 6 per cent. cumulative second preference shares.

Montreal Tramways Co., Ltd.—Dividend of 2½ per cent. for the quarter.

STOCKS AND SHARES.

TUESDAY EVENING.

DE-CONTROL of the Home Railway companies has had little effect upon the stocks and shares of the various undertakings. So far as the steam stocks are concerned, the tendency has been to let prices go back a little, but with Undergrounds—which are, of course, less affected by the release from Government control—the market on the week is irregular. Underground Electric Incomes have recovered sharply, and are 4 points up at 8½. The shares remain about the same as they were, but of the other Underground issues, Districts and Metropolitans are lower. The recent dividend announcements of the tube lines give promise of distinctly satisfactory results being achieved over the full twelve months, whereas the outlook for the stocks of the steam companies is that lower dividends are likely to be declared, on the ordinary issues at all events, until companies get into the full swing of their own working arrangements once more. De-control may be regarded as a good thing from the point of view of the Tube stockholders, but of somewhat doubtful immediate benefit from the standpoint of proprietors of Home Railway steam stocks.

Another feature in the industrial market is the way in which Marconis has given way during the past few days. The price has gone back 5s. to 36s. 3d., which, as a matter of curiosity, is ½ under the quotation ruling for Marconis on the eve of war, though it is necessary to add that the capital has been largely increased during the period. The reason for the present depression is the fear of what the dividend announcement may turn out to be. The declaration was expected on Wednesday in this week. (See "City Notes" in this issue.) Other Marconi shares are dull in sympathy, the preference going back to 1½, while Marines are easier at 23s. 9d. ex dividend. United River Plate Telephones are a good market at 6 3/16, and Orientals maintained their firmness at 2 1/16. The Eastern group is very quiet. Anglo-American Telegraph stocks are both better. Great Northerns have recovered to 24.

Telegraph Constructions at 21 are 5s. up. Other manufacturing shares display a good tendency on balance, English Electric ordinary and preference being, exceptionally, lower at 12s. and 14s. 6d. respectively. General Electrics are once more over par. The newly-issued 7 per cent. debenture stock has risen to 94, which is a premium of 1½ over the price at which it came out. British Insulated hardened to 31s. 3d., Electric Constructions to 16s. 9d., but Edisons are a weak market, falling back to 9s. 6d. Henley's hold their improvement at 28s. 9d. Of the new issues, North Metropolitan 7½ per cent. debenture is 6 premium, while Metropolitan Electric Extension 7½ per cent. debenture is difficult to buy at 8 premium. The Shropshire Electric Power 7½ per cent. ten-year convertible debenture stock hangs fire a little, and can be obtained at ½ premium above the issue price of 97. The stock carries the guarantee, both as regards principal and interest, of the British Electric Traction Company.

This week, on Tuesday, there fell due the payment of eleven half-years' coupons, of 2½ per cent. each, upon Mexican Electric Light bonds, and Mexican Light & Power First Mortgage bonds. Upon Pachuca Fives there were ten coupons due, also of 2½ per cent. each, less tax in all cases. As the coupons were saleable in the Stock Exchange at 37½ and 35, less tax respectively, the amounts deducted from the bonds were 26 points net in respect of the Mexicans and 23 points net for

the Pachuca bonds. With the payment of these arrears of interest, there drops out the necessity for quoting any longer the certificates of deposit, and these are accordingly withdrawn from Stock Exchange lists.

British Columbia Electric Railway stocks are again in request, and the deferred at 59½ has regained the 70s. dividend deducted from the price last week. The preferred, also ex 3½, recovered 2½ points. Brazilian Traction has dropped 1½ to 28½, which is the more singular in the face of the rapid way in which Brazilian Government bonds have been advancing on New York purchases. Some of the Indian electric lighting and traction issues are better. Southland (New Zealand) is about to offer three-quarters of a million pounds 6 per cent. debentures at 96, the money being required for electric power purposes, and the issue bearing the guarantee of the New Zealand Government.

Home Electricity shares are a good market. Rises are to be noticed in the ordinary shares of the Charing Cross, County of London, Westminster and the Metropolitan companies. London Electric preference have advanced to 2½. On the other hand, there is a decline to 15s. 9d. in South Metropolitan preference. Notting Hill Electric 6 per cent. non-cumulative preference, of £10 each, are offered at 7½, at which price the return on the money comes to £7 17s. 6d. Dividends are due in January and July.

Engineering shares keep tolerably hard. Babcock & Wilcox at 2 7/16 are 1/16 better. Vickers have got over their dividend statement, and braced up to 11s. 6d. The rubber share-list is flat, with rubber down to 8½d. per lb. Valorous attempts are being made to take steps that shall prove really effective in rallying the price of the produce. It is hoped that something tangible will result. Meanwhile, however, the American buyers of raw rubber decline to be stampeded into buying stocks of rubber even at the present diminutive figure.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend		Price		Yield.
	1919.	1920.	1921.	Rise or fall.	p. c.
August 16,					
Brompton Ordinary	11	12	5	—	2 1/2
Charing Cross Ordinary .. .	7	8	4 1/2	—	2 1/2
do. do. do. 4 1/2 Pref.	4 1/2	4 1/2	8 1/2	+ 1/2	7 3/4
Chelsea	11	14	8 1/2	—	9 1/4
City of London	12	14	18 1/2	—	10 3/4
do. do. do. 6 per cent. Pref. .	8	8	17 1/2	—	7 1/4
County of London	8	8	8 1/2	—	9 1/4
do. do. do. 6 per cent. Pref. .	8	8	8 1/2	—	7 7/4
Kensington Ordinary	7	9	4 1/2	—	10 1/4
London Electric	9 1/2	9 1/2	1	—	7 10 0
do. do. do. 6 per cent. Pref. .	8	8	2 1/2	+ 1/2	10 9 0
Metropolitan	6	7	2 1/2	—	9 6 8
do. do. 4 1/2 per cent. Pref. .	8	8	2 1/2	—	7 16 0
St. James' and Pall Mall .. .	13	13	6 1/2	—	7 14 0
South London	6	7	2 1/2	—	10 13 2
South Metropolitan Pref. . .	7	7	15 1/2	-6d.	8 17 10
Westminster Ordinary	10	10	6 1/2	—	8 13 10
TELEGRAPHS AND TELEPHONS.					
Anglo-Am. Tel. Pref.	6	6	5 1/2	+1	7 0 4
do. do. Def.	1 1/2	1 1/2	1 1/2	+ 1/2	8 15 2
Chile Telephone	6	6	6 1/2	—	6 14 8
Cuba Sub. Ord.	7	7	7 1/2	—	9 6 8
Eastern Extension	10	10	10 1/2	—	8 2 0
Eastern Tel. Ord.	10	10	10 1/2	—	8 2 0
Globe Tel. and T. Ord.	10	10	10 1/2	—	5 10 6
do. do. Pref.	6	6	9 1/2	—	8 10 0
Great Northern Tel.	25	24	24	+ 1/2	10 0 0
Indo-European	10	10	80	—	8 8 8
Marconi	25	—	11 1/2	—	—
Oriental Telephone Ord.	12	12	2 1/2	—	* 16 8
United R. Plate Tel.	8	8	6 1/2	+ 1/2	* 16 4
West India and Panama .. .	Nil	Nil	6 1/2	—	—
Western Telegraph	10	10	10 1/2	—	* 16 1 2
HOME RAILS.					
Central London Ord. Assented ..	4	4	4 1/2	—	8 1 8
Metropolitan	14	14	25	+ 1 1/2	6 0 0
do. District	Nil	Nil	18	—	Nil
Underground Electric Ordinary ..	Nil	Nil	2 1/2	—	Nil
do. do. do. "A"	Nil	Nil	6 1/2	+ 1/2	Nil
do. do. Income	4	4	8 1/2	+ 1/2	9 13 8
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams, First Pref.	6 1/2	12 1/2	9 1/2	—	10 8 0
do. do. 2nd Pref.	Nil	Nil	5 1/2	—	10 0 0
do. do. 5 1/2 Deb.	6	6	6 1/2	—	7 16 0
Brazil Traction	Nil	Nil	28 1/2	1 1/2	8 10 2
British Columbia Elec. R. P. Pref. .	5	5	5 1/2	+ 1/2	8 9 2
do. do. Preferred	5	4 1/2	5 1/2	+ 1/2	8 8 2
do. do. Deferred	5	6	5 1/2	+ 1/2	* 10 10 2
do. do. Deb.	4 1/2	4 1/2	6 1/2	—	7 10 2
Mexico Trams 5 per cent. Bonds ..	Nil	Nil	5 1/2	+ 1	Nil
do. do. 6 per cent. Bonds ..	Nil	Nil	25	+ 1 1/2	Nil
Mexican Light Common	Nil	Nil	9	—	Nil
do. do. Pref.	Nil	Nil	17 1/2	—	Nil
do. 1st Bonds	Nil	Nil	5 1/2	+ 1/2	9 14 2
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	2 1/2	+ 1 1/2	8 3 0
British Aluminium Ord.	10	10	10 1/2	—	11 8 6
British Insulated Ord.	15	15	1 1/2	+ 1/2	9 12 0
Callenders	15	15	1 1/2	—	10 8 8
do. 4 1/2 Pref.	15	15	1 1/2	—	7 8 7
Crompton Ord.	10	10	10 1/2	—	13 8 8
Edison-Swan	10	—	9 1/2	-1/2	—
do. do. 5 per cent. Deb.	6	6	6 1/2	—	7 7 1
Electric Construction	10	10	10 1/2	+ 1/2	11 18 10
English Electric	8	8	12 1/2	-6d.	13 8 8
do. Pref.	6	6	14 1/2	-6d.	8 5 6
Gen. Elec. Pref.	6 1/2	6 1/2	17 1/2	—	* 10 0
do. Ord.	10	10	20 1/2	+ 1/2	* 12 10
Henley	15	15	1	—	10 5 0
do. 4 1/2 Pref.	4 1/2	4 1/2	8 1/2	—	6 18 6
India-Rubber	10	—	1 1/2	—	—
Inds. Rubber	8	8	1 1/2	—	8 16 10
Siemens Pref.	10	10	10 1/2	—	* 18 9
Telegraph Con.	30	30	31	+ 1 1/2	* 16 14 1

* Dividends paid free of Income Tax.

THE RIGHT TO USE WATER FOR CONDENSING.

[By a Legal Contributor.]

In considering the question: Where shall a generating station be erected? there is one very important problem which often confronts the engineer called upon to select the site. It is: Can water for condensing purposes be procured? Even if there is water near the chosen site, whether in a stream, tidal river, or canal, it does not follow that it can be used.

Although water which is to be employed for condensing purposes need not be pure, it must be ample in amount, and, generally speaking, the manufacturer who uses it must be allowed to return it to the place from whence it came. Bearing these considerations in mind, it will be seen that there may be serious objections in the way. If the source is a tidal river, a question can scarcely arise. In the case of a canal, it is possible that the canal proprietors if allowed to do so by statute would charge but a small rent for the use of some of their water; unless, indeed, that water was used (lower down) for drinking purposes, and in that case the chance presence of a certain amount of grease in the water might make it impossible to allow it to be used for condensing.

In the case of a running river, the problem becomes much more difficult. The generating station may be erected on the banks of a stream in such a position that the company becomes a riparian owner. The question then arises whether the use of water for condensing is reasonable conduct on the part of a riparian owner, who is under certain obligations to similar owners lower down the stream.

In so far as it relates to the rights of electrical undertakers the law has recently been modified in certain particulars; but before considering these modifications let us see how matters stand at common law, and under older statutes.

In *Sandwich v. Great Northern Railway* (10 Ch. D., 707) it appeared that the railway company, whose line crossed a stream in the immediate neighbourhood of one of their stations, took water for supplying their engines and for the general purposes of the station. A mill-owner lower down the stream stated that the abstraction of water did no damage in wet weather, and never shortened the working of the mill for more than a few minutes a day. It was held, therefore, that the company, as a riparian owner, was entitled to take a reasonable quantity of water for its purposes, and that in this case the quantity taken was reasonable.

The question whether the use of water for condensing is a reasonable use of his property by a riparian owner appears never to have been decided. It is conceived, however, that if it interfered with the fish, or fouled the water, it could be restrained by injunction.

One case shows that when a plot of land on the banks of a stream is let with intent that the water shall be used, among other purposes, for condensing, the landlord must not himself heat the water by using it higher up for condensing.

In *Tipping v. Eckersley* (2 K. and J., 264) it appeared that the defendants demised to the plaintiff a plot of land, one-half of an adjoining brook, a cotton mill, reservoir, and a steam engine of 100 h.p., and the use of a weir below the mill for the purpose of holding up the water from the level of the bed of the brook at a bridge above the mill, "and the free use and enjoyment of so much of the stream of water which usually flowed down the brook adjoining the plot of land as should be necessary for effectually supplying with water and working the steam engine, or any other steam engine of like power and capacity," and covenanted not to construct any other weir or dam between the weir and bridge. Shortly afterwards the defendants erected, a little below the bridge, but above the plaintiff's mill, a new cotton mill and steam engine, with a reservoir, which drew off water from the brook between the plain-

tiff's reservoir and the bridge, and they discharged the heated water which they had used for their new mill into the brook, whereby on one occasion they raised the temperature of the water which the plaintiff had to use for condensing purposes from 57 deg. to 68 deg. It was also deposed that in consequence of the increased temperature the plaintiff's engine worked nearly half a stroke a minute less than the usual rate of 28 strokes a minute. Upon a motion for a decree the Court granted a perpetual injunction restraining the defendants from discharging heated water, so as to increase the temperature of the water which the plaintiff used for condensing purposes, being of opinion that the evidence, exclusive of that as to the actual diminution in the working of the engine, showed a material interference with the quality of the water to which the plaintiff was entitled under the demise.

The use of canal water for the purpose of condensing has often been expressly recognised and sanctioned by Act of Parliament, on the ground that such use must of necessity encourage the erection of mills near the canal. Where such use is authorised the statute will be liberally construed in favour of those who have the right to condense. Thus in *Rochdale Canal Co. v. Radcliffe* (18 Q.B.D., 287) a company was established by statute for making and maintaining a navigable canal, and by a section reciting that the erection of steam engines near the navigation might promote its interests it was made lawful for the owners of lands within 20 yards of the canal to draw off sufficient water to supply such engines for the sole purpose of condensing, such water to be returned into the canal (allowing for inevitable waste) so that no obstruction should be caused to navigation. The company sued the defendant on the ground that, being possessed of land within 20 yards of the canal, and of a mill and steam engine on such land, he drew water from the canal more than sufficient for the sole purpose of condensing, and used it for purposes other than that of condensing. The defendant, in his defence, alleged that he was a tenant of the land, and was the occupier of a mill abutting on the canal and of a steam engine, and that he and all occupiers of the land, mill, and engine, had for 20 years used as a right the easement of drawing from time to time from the canal such quantities of water as were necessary for other purposes than that of condensing—such as supplying the boilers of the engine, generating steam to heat the mill, cleaning the boilers, and supplying water to a cistern on the roof of an engine-house on the land. A mill of the defendant called the Old Mill, with a steam engine, abutting on the canal, had existed for more than 20 years; but within 20 years a new mill with another engine had been erected adjoining and communicating with the old mill, water passing from one to the other. The machinery of one mill was worked by power from the other, and the water of the canal had been used in both mills for most of the purposes mentioned in the plea. The jury found that the buildings constituted one mill, and a verdict was taken for the company. It was held that the use of the mill was justified, and that in so far as there had been excessive use there should be nominal damages for the canal company.

Where a mill-owner is entitled to use water for condensing purposes, he may well be tempted to use it for steam raising. If he does so, and the canal company acquiesces, it seems that he may acquire a right. In another case, by a Canal Act, the owners of steam engines on the banks were empowered to lay pipes and take water from the canal for the purpose of condensing steam. In 1830 K. built a steam engine and laid pipes to the canal with the cognisance of the canal company, and, until the year 1847, when disputes arose, used the water for the purpose of raising as well as condens-

ing steam. An action was brought by the company which recovered 1s. damages. The defendant continued to take the water, and the company filed its bill, praying that he might be restrained. The defendant, by his answer, produced and alleged evidence that the company was aware, when the mill was built, that the water would be used for raising steam. Although the company's right had been established at law, the Court at the hearing held that the company was bound by its acquiescence, and refused a perpetual injunction to restrain the defendant from taking water for the purpose of "generating steam." An injunction, however, was granted with regard to another mill, acquiescence and encouragement on the part of the company not having been established.

With regard to tidal waters, it is conceived that there could be no objection to a riparian owner making use of the water unless restrained by the port authority acting under the provisions of some statute.

We now come to the point at which the legislature has intervened.

The Electricity (Supply) Act, 1919, confers very important rights on those who are responsible for the supply of electricity. By Sec. 15 of this Act the Ministry of Transport on the representation of the Electricity Commissioners may by order authorise any Joint Electricity Authority or any authorised undertakers to abstract water from any river, stream, canal, inland navigation or other source, and to do all such acts as may be necessary for the purpose of enabling the Joint Electricity Authority or authorised undertakers to utilise and return the water so abstracted, subject to such conditions as may be specified in the order. The Board, however, cannot in any case make such an order until notice of its intention to make the order has been given by advertisement or otherwise as the Board may direct and an opportunity has been given to any person, who appears to the Board to be affected, to state any objections he may have thereto, and such order may provide for the recovery in a summary manner of penalties for infringement of the order.

The reference to a "special order" in this section involves that an inquiry must be held before the rights of riparian owners are interfered with by an order made in pursuance of the Act. At such an inquiry a riparian owner might put forward such objections that the Ministry of Transport could reject the scheme and refuse the order.

Where the source from which the water is to be abstracted is a canal, inland navigation, or harbour, or where any existing rights of riparian owners will be affected, the order authorising the abstraction shall be a special order, and shall provide that the water not consumed shall, subject to any agreement to the contrary, be returned at a level not lower than that at which it was abstracted.

The order must also require that all water not consumed (and in no case less than 95 per cent. of the water abstracted) shall be returned in a condition not less pure than when it was abstracted, and at a temperature not higher than such as may be specified. The temperature is to be fixed at such a degree as appears necessary to avoid injury to public health or to fisheries, if any, or in the case of a canal or inland navigation to the works thereof, or to vessels using the same, or to the trade or business carried on by any person using the water for the purposes of or in connection with his trade or business. Finally, no order can be made authorising the abstraction of water from any dock regulated by Act of Parliament except with the consent of the owners.

We are not aware that any order has yet been made in accordance with these provisions. Some nice questions are sure to arise when the words "not less pure" have to be considered. Does this mean that no water which shall be used for condensing must be contaminated with the least trace of oil? Again, the question of temperature may create difficulties where the water abstracted from the stream or river forms a considerable part of the whole. Expert evidence will have to be adduced to show how far, if at all, fish life is affected by raising the temperature of water to any material extent.

CARPETS AND THE ELECTRIC SUCTION CLEANER.

By F. FRENCH KEMP.

[In the course of a recent article on electric suction cleaners, the author commented adversely on the use of a brush driven by the motor, in conjunction with the exhaust fan. The following article, which has been written by a dealer in oriental and antique carpets, presents arguments in favour of the brush, from his point of view.—EDS. ELEC. REV.]

THE great increase in the sale of electric cleaning machines during the past few years has led to the production of so many and various types, that the retailer who handles these appliances must, in his own and his customers' interest, deliberate very carefully before deciding to adopt a particular make. Inasmuch as the primary function of these machines is to clean carpets, and it is by their efficiency in this operation that they should be mainly judged, the opinion of one who has for years been engaged in the sale of antique and oriental rugs and carpets, may be of some help.

To a dealer in antique carpets the problem of thorough cleaning without damage to the fabric and the delicate pile is one of primary importance. These carpets, when received by us, are generally in a very dirty state, and the first step to be taken by the dealer is to have them cleaned. Oriental carpets also, when first imported, are full of sand, which likewise needs removal. Now the old method of carpet cleaning was to send the carpet away to be beaten by steam or shampooed, but in the case of antique carpets, which frequently come to us after 100 years or more of use, such a process was quickly found to be unsatisfactory. The carpets certainly returned clean, but the injury caused to their delicate fabric was irretrievable. In some cases hardly anything but the bare foundation was left.

We were, therefore, forced to seek some method of cleaning which would be equally thorough, but not destructive, and we decided to test the capabilities of electric suction cleaners. Superficially the results were very encouraging. The surface of the carpet was rendered beautifully clean, the dust-dimmed colours regained their beauty, and no injury was done to the carpet.

But close study of the carpet cleaning problem had taught us that there are three kinds of dirt in carpets. First, there is the surface dust; secondly, surface litter, such as crumbs, hairs, threads, &c.; and thirdly, most destructive of all, dirt deeply trodden into the material of the carpet. This last kind of dirt, apart from the insanitary condition which it produces, is ruinous to carpets. It is the cause of those ugly, bare patches which necessitate many an otherwise beautiful carpet being prematurely relegated to the lumber room. For amongst this dirt are particles of sharp-edged grit. Ground in by constant foot pressure, these sharp pieces of grit soon sever the threads, and the pile thus detached leaves behind the bare foundation of the carpet.

Now, though the surface dust was quickly removed by suction, a close inspection of the carpet revealed the fact that the other two kinds of dirt were still left behind. Hairs and threads still adhered obstinately to the surface, while, more important still, the destructive grit was left behind embedded in the fabric. After

repeated tests, we were driven to the conclusion that suction alone could not clean with the thoroughness which was essential; but its advantages were so obvious that we decided to make further investigations on these lines.

It was at this juncture that our attention was called to a type of machine which, besides making use of suction, embodied a motor-driven brush, and an inspection of this machine at work decided us to give it a thorough trial. Its method of operation seemed extremely simple. The revolving brush, driven by the electric motor, possesses two rows of spiral bristles. As the carpet is lifted off the floor by suction, the first row of bristles strikes and depresses it. Again the suction lifts it, and the second row of bristles depresses it. It will be seen, therefore, that the constant repetition of this process is equivalent to a gentle beating of the carpet while suspended on a cushion of air. At the same time, of course, the brush sweeps the carpet, so that here was a machine combining three processes—beating, sweeping, and suction cleaning.

Exhaustive tests of this machine proved to us conclusively that in this simple addition of a motor-driven brush to a powerful suction cleaner lay the solution of our carpet-cleaning difficulties. The closest scrutiny of the texture of a carpet after it had been cleaned by one of these machines failed to reveal dirt of any kind. All the clinging threads and hairs, all the deeply-embedded dirt, had vanished and the carpet was ready to pass inspection by the most critical buyer. It seems to us impossible to over-estimate the importance of the motor-driven brush in securing this result. The suction cleaner pure and simple keeps the carpet suspended all the time it is being cleaned; whereas we found that it was the alternative raising and depression due to the impact of the brush, which shook loose the embedded dirt, and so gave the suction a chance to operate. Surface matter also, which had adhered too firmly to the surface to be removed by suction unaided, had been swept up by the rapidly revolving soft hair bristles. In short, this type of machine seems to us to be the logical result of experience; it combines effectively the new process of

suction cleaning with the old methods of beating and sweeping.

It must be borne in mind that the fabrics we were dealing with were oftentimes of an extremely delicate nature. We had to satisfy ourselves, therefore, that repeated cleaning by this machine would in no way injure the carpet. In this connection perhaps it will be sufficient for us to say that for years now we have used nothing else but this machine on every kind of carpet, some of them over 200 years old, and that the experience thus gained enables us to state definitely that this process is absolutely harmless to even the most delicate material and, in our opinion, a regular grooming by such a process, which removes the destructive embedded grit, must tend to lengthen the life of carpets very considerably.

It has been stated that a motor-driven brush is inclined to injure the pile of carpets—a misunderstanding which has arisen probably from the fact that some makes of carpets, when new, contain a certain amount of loose pile. This is due to the fact that when the final process of clipping the pile takes place, some of these clippings are left behind. By wetting the thumb and drawing it across the surface of the carpet, it will be found that some of this loose pile adheres to the wet skin. In other cases also, the sharp pieces of grit cut the pile, which then lies about loose. Needless to say, the motor-driven brush machines will remove this, but its removal is essential in order to obtain the longest possible life from this species of carpet. To leave these soft clippings in means that they become matted with dirt and grit, the ruinous consequences of which we have seen.

To summarise the results of our experience, we would unhesitatingly advise dealers in these appliances to recommend to their customers a machine which embodies the principle of a motor-driven brush. Many carpet owners are ignorant of the very existence of beneath-the-surface dirt embedded in the material, and still more so, of its destructive effect. It can only be extracted by beating, and for this purpose the inclusion of a motor-driven brush combined with powerful suction is effective and essential.

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(Concluded from page 229.)

The Relation of Run-off to Rainfall.

By H. LAPWORTH, D.Sc., M.INST.C.E. (Abstract.)

The relation of run-off to rainfall is extremely complex, and though many data have been published of late years with regard to the flow of British streams, the accuracy of some of the figures is open to question.

A study of 29 different streams in Britain yields the result that the mean annual loss (evaporation) may range from minus 2 in. (or gain) to 28 in., the average being a little over 14 in., while 18 out of the 29 observations show average losses between 11 and 17 in.

The evaporation from land surfaces increases with increase of rainfall, both regionally and in the same watershed. While our British records are too uncertain and variable to enable one to trace this regional law, it certainly appears to hold good in individual British streams. The mean annual evaporation increases by about 7/10 in. for each degree (°F.) increase in the mean annual temperature. The influence of vegetation (especially with regard to forests) on rainfall, evaporation, and stream flow regimen is still a vexed question.

No investigation of stream flow regimen can be satisfactory unless the factor of ground water storage be taken into account, and assumptions that the distribution of flow in dry years will be similar, or that the monthly losses will be identical with those in normal years, may be seriously misleading. Owing to the dual nature of stream-flow, that is, a surface or flood flow superimposed upon a discharge of ground water, it would seem that casual stream-gauging, unless covering a fairly dry year, is apt to be of less real value than is usually supposed, except in so far as the average annual loss and the average dry-weather flow is concerned. The dry weather or spring flow is derived almost solely from ground-water storage, and is a factor of the greatest importance.

The extreme dry-weather flows in this country appear to range from zero in very small gathering grounds and areas of low rainfall to 1 or more cusecs per 1,000 acres in areas of

previous rocks or of high rainfall. In relatively impervious gathering grounds with average annual rainfalls of between 40 and 50 in., the extreme dry-weather flow is generally found to lie between 1/10 and 1 cusec per 100 acres. The dry-weather discharge is higher in areas of pervious than of impervious strata, and that the dry-weather flow increases with the rainfall is certainly the case in individual gathering grounds, though when we study the minimum summer flows from many different watersheds in relation to the average rainfall, no obvious connection is apparent.

The maximum rates of flood-discharge appear universally to have no relation to the mean rainfall, and in Britain our heaviest storms and floods appear to take place in areas of least rainfall.

For British upland impervious gathering grounds the late Mr. P. A. Morley Parker recently proposed the formula $Q = 500 M^{5/6}$, where Q = rate of maximum flood discharge in cusecs and M = area of gathering ground in square miles.

Mechanical Appliances and Labour in Loading and Unloading Ships' Cargoes.

By A. MUSKER, M.INST.C.E. (Abstract.)

This note indicates how much more mechanical appliances could be used, and shows how many docks lack up-to-date methods in this respect.

For example, in the London docks over 3,000,000 tons of coal per annum are raised from barges by means of crude steam winches and boilers; the coal being shovelled by hand into wickerwork baskets. Some large appliances are used for this purpose, but being unwieldy and difficult to move from dock to dock, they only do a small portion of the work required.

A visit to any ordinary dock shows a fearful lack of mechanical appliances which could take the place of manual labour, and the loss of time one sees owing to the men having to wait on one another is appalling. To keep up-to-date and handle warehouse goods economically, warehouses, if not suitable, should, like old machinery, be scrapped.

A striking instance of what could be done is shown by the appliances used in handling goods at the Port of Manchester warehouses, where they have overhead cranes, electric trucks, conveyors, stacking machines, and numerous others. Why should not electrical trucks be used in place of hand trucks? and why should not careful attention be paid to the floors over which they have to run? On the other hand, why should not ordinary wheel trucks, to carry about 10 or 15 cwt., be fitted with ball bearings so that each load lowered by the crane could be moved to its destination by one man, instead of its being split up into hand-truck loads of, say, 2 cwt., one man to each? With a reasonably smooth floor and a well designed truck, 20 cwt. can be easily moved by one man. Even in the slings used for lifting the goods there is a want of attention to detail; one sees almost every lift sling used about 8 or 10 ft. too long, which means that the crane, as a rule, lifts 8 or 10 ft. higher than is necessary, probably wasting 25 per cent. of the power used.

The discharge of frozen meat is an important item, and although in some cases conveyors are used, it is to a very limited extent; the continuous conveyor, as against the intermittent crane system, might be extended with considerable advantage as regards economy in time and labour.

DISCUSSION.

Opening the discussion on Mr. Musker's paper, Sir ARTHUR TREVOR DAWSON, Bart., who presided, considered that they were far from being up to date as a country in their loading and unloading appliances.

Sir JOHN ASPINALL, who followed, thought it nothing less than astonishing to see the apathy displayed in this country regarding the handling of cargo, and instanced Liverpool, where even now there was no crane capable of lifting a ton from a ship and placing it in the warehouse. With rapidly working electric cranes one could do the work so quickly, Sir John said, that the position of the goods did not matter.

In his remarks, Mr. SCRUTTON said that the old-fashioned methods of handling cargoes had completely broken down. New ships of great capacity had put the hydraulic crane and the hand truck out of court, and more up-to-date appliances must take their place.

Mr. DAVIS referred to the method of handling cargo at Liverpool as being of the most elementary kind.

Exhaust Steam: Its Employment for Power, Heating, &c.

By E. R. DOLBY, M.INST.C.E.E. (Abstract.)

Steam which has passed through a prime mover may vary in pressure from that of the atmosphere to 60 lb. per sq. in. or even higher. In non-condensing engines about 90 per cent. of the heat which is contained in the steam entering the engine is discharged with the exhaust; also in the condensing engine or turbine, about 60 per cent. of the total heat in the fuel burned passes to waste with the cooling-water effluent from the condenser. The total heat units from water at 32 deg. F. in a lb. of dry saturated steam at 150 lb. gauge pressure is about 1,194, while in exhaust steam at 1 lb. gauge pressure it is about 1,147.

The most efficient utilisation of the thermal value in coal cannot be obtained until there are sets of public mains provided by the community for public utility. One set of the mains might receive electric energy in the form of alternating current at a standard pressure and frequency; another set might receive steam at a pressure of from 5 to 10 lb. per sq. in.; while a third set would deliver water at a temperature of from 180 deg. to 200 deg. F. The electric energy, steam, and hot water, would be by-products from scattered installations comprising prime movers driven by steam.

The subsidiary electric mains would be coupled to the existing public supply mains, as is now the case on the north-east coast of England, the consumer being paid for what he delivers and charged for what he consumes. The steam mains would furnish direct heating in radiators, drying-chambers, and calorifiers for the supply of domestic hot water, and wherever practicable the condensate would be drawn back by an air-pump to the starting point. Such mains are common in the United States, although rare in Great Britain, where, however, several large blocks of buildings in Manchester are supplied with exhaust steam from an electric generating station. The hot-water mains would convey water heated in exhaust steam calorifiers and circulated by pumps. In some instances steam mains would be preferable, while in other cases hot-water mains would be better.

The subject may be divided under the following headings:—
Class 1.—Power only Required.—1. If steam be employed solely for power purposes with a fairly steady load and condensing engines are used, then the saving of the thermal loss in the condensing water may be obviated by eliminating the condenser, providing steam at a somewhat higher pressure, and discharging the exhaust at, say, 5 lb. back pressure into a public steam main. Electric power from the public mains might in some cases be substituted with advantage.

2. If the load is intermittent, such as that of colliery winding, hauling, &c., the exhaust may be passed into an accumulator and thence into an exhaust steam turbine. If extra power is not required, this turbine can be used to drive an alternator and the energy delivered to the public electricity mains. The heat loss in the condensing water could be ob-

viated by omitting the turbine and discharging from the accumulator to the public steam mains.

Class 11.—Power and Other Uses.—1. If the other uses require steam at about atmospheric pressure only, then steam engines or steam turbines may be used for power only, or for electric energy also; they would be non-condensing, and the exhaust at a back pressure not exceeding 1 lb. would be taken into the private heating mains, and an air pump used on the return. Steam at this temperature would not boil water, but it could be used for drying, air heating, water heating, and in radiators.

2. If rapid boiling or high-temperature heating be necessary, the stop-valve pressure would be selected so that the necessary power could be obtained from the prime mover within the assumed fall of pressure. With steam turbines several different "pass-out" pressures may be selected, say, 60 lb. for cooking the raw product, and from 15 to 30 lb. for heating the drying cylinders. If reciprocating engines were used they would be of the simple type exhausting at the highest back pressure desired.

The methods of allocating charges to the various purposes for which the heat is employed are often fallacious. The author is of opinion that the thermal units employed for each service should be charged to that service, and that all costs of labour, fuel, stores, taxation, interest, and sinking fund should be charged *pro rata* on the thermal units consumed by each service.

Enormous savings can be effected by using back-pressure on reciprocating engines, employing "pass-out" steam turbines, and utilising apparatus to employ the heat in the exhaust steam. The cost of electric energy can in many cases be reduced well below the rates charged by public authorities. It must, however, be borne in mind that much private electrical generating plant in works, and also in public institutions, has been removed, even although the whole of the exhaust steam was usefully employed. This has occurred particularly in London, but in most of these cases the high cost of labour, the necessity for three shifts of stokers, and the high costs of secondary battery maintenance have been the deciding factors in the removal.

MAGNETIC STORMS:

Their Effects upon Railway Signal and Telegraph Apparatus.*

THE effects of magnetic storms on railway telegraph apparatus, such as single needle, Morse, duplex, quadruplex, and telephone single-wire circuits, have been noticed on very many occasions, rendering signalling almost impossible.

Records of the value and direction of these currents have been taken by some railway companies, notably the Midland Railway Telegraph Administration. But the difficulties in obtaining actual measurements in the cases of tablet or block circuits are very great, owing to the fact that the circuits are mostly isolated, and in the majority of cases practically impossible to get at, to take measurements while the storm is on. Further, it is not desirable to interfere with these circuits at such times any more than is necessary.

Fortunately, local circuits have not been so frequently interrupted by these currents as through or long circuits have. This, however, depends upon the intensity of the magnetic storm. The severe magnetic storms during 1919-1920 were strong enough to generate currents sufficient to affect many local or comparatively short circuits, such as signal arm repeater circuits, which are considerably under one mile in length. In all cases inconvenience and delay have been caused, but if tablet, staff, block, or lock and block instruments are interfered with, the consequences may be serious.

Through the kindness of the engineer-in-chief of the Post Office and various railway companies' telegraph engineers, in supplying measurements and particulars, the author has prepared tables, which show the extent and importance of the subject.

The currents actually measured on railway signal and telegraph circuits vary from 8 to 33 milliamps, and voltage from 13 to 53 volts. The interference is not due altogether to the earth's magnetic field acting magnetically on the armatures or needles of telegraph apparatus, as in the case of s.n. telegraph instruments. If the circuit is disconnected the needles tend to return to normal. There may be some influence magnetically due to the variations in the earth's field, but the major part of the interference is due to currents in the circuits.

The currents passing over the wires during magnetic storms may be due to one of many causes, for instance:—

1. The effect of the energy discharges from the sun may be to raise the potential of the earth itself electrostatically at one point (or area) above the surrounding areas, and in the endeavour to establish equipotential, currents flow through the earth and every other conductor that offers a convenient path.

* Abstract of paper read at the Institution of Railway Signal Engineers (Inc.) by Mr. W. J. Thorowgood, signal and telegraph superintendent, London & South-Western Railway.

The author has calculated that the total currents passing through the earth between observing stations (the distance between which varies from 3 to 350 miles) may be anything from 5 to 225 amperes.

2. The effect may be due to the changes in the earth's magnetic flux (in or surrounding the conductor) acting inductively on the wire. This view necessitates a continual alteration in the magnetic lines of force, or flux, across the conductor to maintain the potential difference, and the author gives the absolute value of the earth's magnetic field and rate of change per second to generate the currents observed. He also gives the strength of the earth's magnetic field per sq. cm. in the area enclosed between the surface of the earth and the wire above the surface of the ground.

3. It may be that the ions driven off from the sun bombard, as it were, the earth at certain parts, the conducting wires become electrically charged at that place, and the electricity passes to earth over the conductor. It may be that the electricity flows from the charged spot towards both ends of the wire to earth at the same time, thus there may be two currents in the circuit passing in opposite directions from the charged part.

The currents due to magnetic storms on August 11th, 1919, and March 22nd, 1920, caused a release or false clear indication to be received on practically every form of block, lock and block, tablet, staff and block bells in use on English railways, but there is no case recorded where a signalman actually acted upon the false signal, although it is obvious that he was free to do so had he disregarded the block instructions.

A summary of the Post Office records of currents due to magnetic storms between August 1st, 1919, and April 1st, 1920, a period of eight months, during which 18 magnetic storms, or an average of 2.25 per month, were recorded, is given in the original paper.

On ten days the observed currents were 25 m-A, or over, to 56 and 150 m-A on March 23rd, 1920, which may be called dangerous magnetic storms, or 1.25 per month on an average.

The areas over which the magnetic storms are experienced are very great. On August 11th, 1919, magnetic storm effects were felt all over Great Britain and Ireland, and the maximum current values observed varied from +150 to -60.

The merit of the author's tables is that the records of the currents and e.m.f. recorded, have actually been measured during magnetic storms, and the resistances measured.

The special feature concerning the magnetic storm on August 11th, 1919, was its sudden appearance and its effects upon comparatively short circuits (such as signal arm repeater circuits) which had not been noticed previously; a current of 50 m-A was recorded on a circuit 13 miles long between Ambergate and Mansfield. A summary of the record of the number of days the earth's magnetic field was disturbed and the comparative extent of the daily disturbances during the years 1918 and 1919, shows that the number of magnetic disturbances vary from year to year. In 1918 disturbances were observed on 211 days; on 13 days the disturbances were great, and on 8 very great. In 1919 on 253 days magnetic disturbances were recorded; on 21 days the disturbance was great, and on 18 days very great; thus in 1919 there were 2.25 as many days when the magnetic disturbances were "very great" than in 1918. During the magnetic storm in August, 1919, the declination of the earth's magnetic field varied from $13^{\circ} 44' W.$ to $15^{\circ} 49' E.$ The vertical force varied 935v. The north force varied 840v. During the storm in March, 1920, the declination varied from $13^{\circ} 35'$ to $14^{\circ} 54'$. The vertical force varied 820v. The north force varied 810v.

Circuits having no connection with earth (that is, having metallic returns) are practically immune from the effects of currents due to magnetic storms. Mr. Stevenson, of the Caledonian Railway, states:—

"None of our block, train tablet, or train signalling telegraphs were interrupted in any way, as they are practically all now on return wire circuits," although some of the a.n. telegraph circuits on that railway were disturbed to a certain extent. The records show that some metallic circuits have been affected, but very slightly, compared with the effects observed on earth-connected circuits.

The complete and safe remedy therefore appears to be to provide metallic returns for all circuits. This does not of necessity mean that a return wire will have to be provided for each circuit, as a common return wire can be used for all circuits over certain lengths, but the distance between the conductor and return should be as little as possible. It is best to sectionalise common return wires, owing to the difficulty of tracing faults, also to the lowering of the insulation resistance of the whole of the circuits, when only one common return is used over a large area. If a common return wire is provided the resistance of the instruments should be as high as possible.

The currents due to magnetic storms or stray earth currents may be reduced by increasing the resistance of the circuit and keeping the sensitiveness of the electric signalling instruments the same as at present. The question arises what value of resistance should be added to the circuit to ensure that any magnetic storm current would not affect the apparatus? Probably 200 per cent. increased resistance would give a sufficient factor of safety to render the circuit safe from dangerous interference. It would, of course, be necessary to increase the battery power at each station to correspond with the increased resistance to give the working current for the instruments on the circuit.

It may be put forward that owing to the infrequency of magnetic storms the expense of providing return wires would not be justified, but there is a danger that, owing to their infrequency, a false signal given by a magnetic storm may not be recognised immediately.

A third method of lessening the effects of magnetic storm currents would be to issue special regulations to signalmen, and rely upon the men to notice any irregular working of the apparatus.

TELEGRAPHY AND TELEPHONY IN THE UNITED STATES.

THE annual report of the Telegraphy and Telephony Committee of the American Institute of Electrical Engineers reviews telegraphy, telephony, and radio-communication during the Institute year 1920-21, and according to the *T. & T. Age*, points out that the technical developments of the past year have placed the telegraph and telephone departments of railroads in the United States and Canada in a more serviceable condition than they have heretofore been.

The employment of recent types of telephone repeaters has been arranged for on a number of the large railroads for the purpose of improving long-distance telephone service, and the subject of stronger pole lines has been given serious attention on many railroads. On some lines the factor-of-safety plan of construction has been extended. During the year the increase in telephone lines has not been great, due mainly to retrenchment following temporary business depression, but tests have been made with wired radio, under the direction of Major-General Squier, and the practice of welding joints in exposed lines has been extended.

The application of automatic printing telegraph systems to commercial requirements is being extended, both in the United States and Canada. For trunk circuits carrying heavy traffic, the multiplex system is being widely applied, by which it is possible to handle eight hundred or more messages per hour over a single conductor, correct incidental errors instantly, and have every message ready for delivery to the addressee as soon as it has passed over the wire.

A new field being entered by printing telegraphs is that including private branch offices, and way-office circuits. A promising use for this system is its employment by commercial concerns and industrial establishments for intercommunication purposes and for communication between business offices and telegraph offices. Start-stop systems are satisfactory, their use is being extended, and they are operated duplex over distances of 300 miles without intermediate repeaters. The employment of repeaters permits operation over greater distances. Simplex printers are operated at a speed of about fifty words per minute.

Considerable progress has been made in applying printing telegraph systems to submarine cables. Further improvements now being made will result in much simplified equipment with promise of an increased output in unit time.

No radical changes have recently been made in the character of devices installed on communication lines for protection against lightning disturbances, but promising progress has been made during the year toward the solution of the problem of inductive interference control and reduction. Prominent among the efforts towards more systematic treatment of the problem are facilities inaugurated by the National Electric Light Association for centralised study by a committee and engineering staff specialising in this subject. The trend is clearly toward co-operative study and treatment. There has been no outstanding development during the year in the form of specific devices or methods applicable, but the American Telephone and Telegraph Co. has developed and given some preliminary field use to a new type of "noise meter," designed to measure the degree of disturbance indicated in a telephone receiver without bringing in the personal factor of the observer in judging equivalent noise as is the case with the older "noise" standard employed by the telephone companies.

During the year there was in general a continuation of refinement in the design of automatic telephone apparatus. So far as radically new developments are concerned no epoch-making inventions have been disclosed, but progress has been made in standardisation and the standardisation of nomenclature resulted in the publication of about one hundred definitions of current terms.

There have been placed in service three devices which may have an important relation to the further development of the art:—

1. The call indicator, used in calling from an automatic office to a manual office during the period of mixed working, which displays the call number before the operator and permits automatic exchange subscribers to dial all numbers.

2. A calling device number plate with office names in addition to numbers, to permit retention of office names in small multi-office exchanges converted to automatic operation.

3. A calling device number plate with the alphabet in addition to the numerals to enable the first few letters of the office name to be used as numerals in a large multi-office exchange.

At the Midwinter Convention of the Institute a paper by Messrs. C. Spitts and Blackwell described the carried systems which have been developed and put into commercial use in the Bell telephone system.

The commercial telephone installations described give four added circuits over each pair of line wires in addition to the usual telephone and telegraph facilities provided by the wires. Commercial telegraph systems provide as many as ten added duplex telegraph circuits, also in addition to the usual facilities. The apparatus involved in such systems is necessarily complex, and therefore expensive, so that systems of this type are in general economical only for comparatively long circuits.

Radio-communication during the past year has undergone a reorganisation of ownership of the important patent rights which should relieve a very complicated situation and result in placing in use equipment superior to that heretofore employed. The radio companies are now in a position to proceed without imminent fear of infringement of essential patent rights.

The superior serviceability of continuous waves, with beats reception, has been recognised, and spark transmitter systems, for all but ship emergency uses, are no longer planned for commercial operations. There is a strong legislative sentiment in favour of more liberal regulations. The sentiment that favours greater freedom in wave-band selection also favours the enforcement of more rigid requirements of purity of radiation and the securing of minimum damping at transmitting stations.

A broadening of the field is noticeable in adapting radio to new uses, and several such applications are looked for in the immediate future. The remote control of switches by means of radio is now being considered.

The superheterodyne method of reception, due to E. H. Armstrong, stands out as an important contribution of the past year.

The progress of radio-telephony during the past year in all its phases is illustrated in a radio-telephone toll circuit now in commercial operation in the territory of the Pacific Telephone & Telegraph Co., furnishing telephone service between the Island of Santa Catalina and the wire network of the mainland centring in California. The circuit is operated according to wire line methods. The radio section is between coastal stations 32 miles apart. The circuit is provided with through line ringing of a type which is free from interference, and a superposed telegraph circuit capable of forming a link in a duplex wire telegraph circuit. The transmission and quality over the circuit are of such high standards that it is regularly connected, when required, into the long-distance telephone circuits. The extensive application of electric wave filters in transmitting and receiving circuits has made it possible to obtain a good quality of speech and at the same time to secure greater selectivity than was possible with the prior art. The use of loops for receiving and of shorter wave lengths for short distances has to some extent reduced interference.

A sub-committee of the Standards Committee of the Institute has been engaged in the work of formulating standard definitions of terms most commonly used in telegraphy, telephony, and radio signalling.

Consideration has been given to bringing about agreement so far as is practicable between English-speaking countries, and the sub-committee is co-operating with the British Engineering Standards Association, with the above-mentioned object in view.

Considerably greater attention is now given in American universities and technological schools to instruction and research work in communication engineering.

REVIEWS.

Coil Ignition for Motor Cars. By C. SYLVESTER, A.M.I.E.E., A.M.I.Mech.E. Pp. xii+228; figs. 106. London: Sir I. Pitman & Sons, Ltd. Price 10s. 6d. net.

The subject of ignition in motor-car engines is particularly interesting from the fact that exactly opposite practice is found as the standard system on either side of the Atlantic, coil ignition in America and magneto ignition in England and on the Continent. Opinions differ widely as to which system will prevail and as to the merits of each; consequently a book with the above title appearing at this juncture has great scope for a wide appeal, and should be full of interest. One naturally expects to find a full discussion of the case, all the arguments set out clearly for and against each system, a well balanced opinion of the problem stated and the reasons for it given. After that one might expect to see the various steps in the evolution of coil ignition traced, and all the important inventions noticed, especially as regards this country. All the differences in the use of coil and magneto ignition might be brought to notice, together with the latest refinements in coil ignition practice from America.

Unfortunately, in this case one is largely doomed to disappointment. A third of the book is taken up in the first two chapters, called "Introduction" and "Equipment Testing," with instructions to the "chauffeur-mechanic" on elementary electrical principles, the care of dynamos and motors,

&c. Full details are given and illustrated of such operations as undercutting the mica on commutators, sanding-in brushes, &c., and much space is devoted to testing armatures with a millivoltmeter. It is recommended that £30 be spent by every car owner on electrical testing instruments for his garage. In the preface we are told by the author: "Every owner of a motor car should obtain a copy of this work. He should give it to his chauffeur, who is sure to appreciate it." Also the remark is made that when a fault occurs in the electrical system the chauffeur generally scratches his head instead of laying his hand on the fault. He is supposed to start reading the book with his electrical knowledge at zero, and arriving at page 15 is confronted with the following: "To commence a simple description of induction one cannot do better than quote Faraday's Law. This is to the effect that 'An electromotive force is induced in any circuit when the magnetic flux linked with the circuit changes in value, the magnitude of the induced electromotive force being proportional to the rate at which the magnetic flux linked with the circuit changes.' One can imagine the 'chauffeur-mechanic' indulging in a considerable amount of head scratching at this point.

Chapter III is taken up with detailed instructions about making a trembler type induction coil. A new trembler is described which gives a spark described as being "more juicy" than others. By this time the "chauffeur-mechanic" has presumably become a "chauffeur-electrician-mechanic." And Chapter IV deals with the ignition system, a point where the book might well have begun. The usual hydraulic analogy appears, and then some examples of Delco interrupters, wrongly called distributors, are given. A good modern form of interrupter is shown on p. 106, and a clear circuit diagram on the next page, the remainder of the chapter dealing with faults in the ignition system interspersed with a description of an automatic cut-out on the lighting system.

Chapter V is called "Coil Ignition Systems in Use," the first 42 pages being devoted to descriptions of Delco apparatus as produced in the years 1912-1920. The Delco system is stated to be almost the standard system in America—a fairly large claim. Are such names as Remy, Atwater-Kent, Connecticut, Westinghouse, and Wagner entirely negligible? The C.A.V. and the Mira systems are described, the latter being a peculiar kind, in which the coils and contact-breaker rotate, thereby losing one at least of the advantages of coil ignition.

The remainder of the book consists of wiring diagrams of Delco lighting, starting, and ignition installations as used on ten American cars, very few of which are well known in this country, with comments on these diagrams.

It is curious as the author is such a strong believer in the future of coil ignition, that he does not gather together all the claims for this system, and put forward a strong case, for there is no doubt that an attractive appeal can be made out by a skilful counsel. Instead he merely mentions a few points in favour of coil ignition incidentally, while describing the apparatus, and assumes that magneto ignition is dead and almost buried. Now, considering the fact that 96 per cent. of this year's British cars rely on magneto ignition, and approximately the same proportion of Continental cars, this is a pretty large assumption. The author several times gives his opinion that coil ignition will very soon become the standard system here as in America. Does he realise that in some well-informed quarters the opinion is held that the only reason why coil ignition is used so much in America is because that country has never yet been able to produce a really good magneto? Coil ignition undoubtedly has points in its favour, and one would have expected to see all of them brought out, and the whole subject thoroughly ventilated in a book with this title. Perhaps the most remarkable fact concerning coil ignition in this country is that the Wolseley Co. has adopted it on some if not all its new cars. That so well-known a firm, rather conservative in its habits, should have taken this step is a very noteworthy incident, but is not mentioned in the book under review. Neither is there any notice of two very interesting pieces of apparatus connected with the history of coil ignition. One of these is the ingenious Atwater-Kent open-circuit type contact-breaker used on enormous numbers of cars in recent years; the other is the unique and very scientific form of coil ignition invented by Sir Oliver Lodge which might well have become general if the high-pressure magneto had not been commercially developed just about the same time. Two other notable omissions are the Conner coil system, which has some specially interesting features, and the Rotax, as installed on the Cubitt cars.

The book is well printed on good paper, and there is a pleasing absence of misprints. F. H. H.

Armature Winding and Motor Repair. By DANIEL H. BRAYMER. Pp. vii+515; figs. 288. New York and London: McGraw-Hill Book Co. Price 18s. net.

This book is intended by its author to be a practical treatise for the benefit of those engaged in the manufacture, operation and repair of electrical machinery. In the preface, the author disclaims any intention of dealing with the theoretical side of his subject, but, as a matter of fact, he does give a considerable amount of information on the theory of winding, as becomes inevitable in describing the various types and arrangements of armature coils.

Perhaps it is impossible for a book of this kind to be quite complete, but some of the omissions are of such importance,

that attention should be drawn to them. The squirrel-cage winding of induction motor rotors, and the closely allied damping windings of alternating-current machines have caused manufacturers and users probably more anxiety than any other single detail of design. The problem, of course, is to make a stronger joint than is possible by soldering, and although riveting, brazing, and welding have good points, in this particular application they also have their bad points, and finally has certainly not yet been reached. The author had ample scope for telling the practical men how to approach this thorny question, but he dismisses the whole subject of squirrel-cage rotors in ten lines, with a single illustration of a cast construction, now discredited for all except the smallest sizes. Another example of inadequate treatment is to be found in the reference to turbo-alternators. A big percentage of the generating plant in this country and America is now of the direct-coupled steam turbine type, and before long the percentage will be still higher. The winding of the stator calls for the greatest skill and care, and the author quite rightly devotes a special section to this work. Difficult, however, as the stator may be, the rotor of the modern turbo-alternator is still more difficult, and only specially trained and experienced men can deal with it satisfactorily. It is, therefore, an important and curious omission on the part of the author to make no reference whatever to the rotor. The section dealing with varnishes is very incomplete, and the question of insulation generally receives inadequate treatment. The author indicates the use of mica for the insulation of large machines, but for machines of small and medium output, he recommends such unsatisfactory materials as duckcloth, pressboard, fish paper, and Empire cloth for parts for which mica would now be used in this country. We have to remember, however, that this is an American book, and the use of mica on the other side of the Atlantic is not so general as here. From the writer's point of view, winding pigs play a big part in the universe, and it is disappointing that the author has made only very casual reference to such an important item. The author makes clear reference to the importance of symmetry in the windings of armatures for direct-current machines, but he ignores the subject altogether when dealing with alternating-current machines. The omission is important for the reason that it is possible to have a winding symmetrical without a commutator that would be unsymmetrical if a commutator were connected. It is to be regretted that the author confines himself to giving rules for determining symmetry, instead of giving the fundamental definition that the voltage in parallel circuits must be identical at any instant.

The author does not always make his meaning clear. For instance, what will be the state of mind of the student who refers to the book to find the correct section to employ for equalising connections and reads the following?

"Equalising rings should have an extremely low resistance. Such practice requires not only an excessive amount of copper, but leads to considerable loss and heating in the winding. All that is really necessary is to provide an alternative path of negligible resistance compared with that of the brushes, and for this purpose it is usually sufficient to make the section of the rings about half that of the conductors."

The least satisfactory part of the book lies in the extensive quotations from articles, and from manufacturers' catalogues and instruction pamphlets. The illustrations are plentiful and good; the printing also is good, and there are few misprints. The book can be recommended to practical men, students, and junior designers, for, although each of these three classes of readers will find the subject treated inadequately from their point of view, nevertheless the book does contain a great deal of information and is free from incorrect and misleading statements.

Electric Power Transmission. By ALFRED STILL. Pp. xviii+407, 136 figs. London: Hill Publishing Co., Ltd. 1919. Price 17s. 6d. net.

Prof. Still's work, published in 1913, on "Overhead Electric Power Transmission" is now expanded by the addition of an important chapter treating of underground conductors. The author's object, in issuing a second edition of his useful work, is stated to be that of making it more suitable for use as a college text-book; but the constructional engineer in charge of erection work, for whose use the first edition was intended, will find the value of the book in no way diminished by its increased field of utility. Since the new chapter has been written with the assistance of Mr. C. J. Beaver, the matter contained in it is sure to be reliable, and thoroughly representative of modern practice.

The book opens with a list of the symbols employed, a practice we should be glad to see all authors adopt. Some of them are used for several different purposes, such as R, which has four meanings when used without a suffix, and four more when used with one. Some are not quite up-to-date, as k.v.a., instead of kVA, but as it has only recently been realised that there are standard symbols, we refrain from doing more than drawing Prof. Still's attention to the matter.

There is little to add to our review of the first edition, but we think it is worth mentioning to an author of Prof. Still's knowledge and experience, both as an engineer and as a writer, that the production of books for use as college

texts, while very necessary, and to that extent desirable, is not the highest aim a clever engineer, even if he is engaged in teaching, can set before himself. The present volume, as we have already said, is excellent, but we could point to others, one at least by Prof. Still, which bear every sign of having been written between lectures. The student at college needs feeding with theory and up-to-date accounts of the practice obtaining, but the man in the field, on the job, feels the need more frequently than seems to be generally appreciated, of looking up the theory of the subject with which he is dealing, and so carrying out his work more intelligently. The field to be covered in the electrical industry is so enormous, and the really good books are so few, that, in the language of the day, it is "up to" those who can write, and who have the knowledge, to do what they can to supply the deficiency.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR JULY, 1921.

AN improvement occurred in the export total during July, the figure being 29 per cent. above the June total, although it must be remembered that the latter was low on account of the coal dispute. There was a substantial increase in electrical machinery, but by far the largest advance was in submarine telegraph and telephone cable. Imports fell by about 30 per cent., the principal decreases being in the items "Glow lamps" (75 per cent.), "Batteries," "Meters," "Carbons," and "Telegraph instruments and apparatus." The total of re-exports was increased by the re-appearance in the third column of "Telegraph and telephone wire and cable," other items, with the exception of "Electrical machinery," showing decreases. Further information showing the increases and decreases for the month, and for the seven months, is given in our "Business Notices" to-day.

VALUES OF ELECTRICAL EXPORTS AND IMPORTS FOR JULY, 1921.

	Exports.	Imports.	Re-exports.
Electrical goods and apparatus (unenumerated)	£148,081	£40,176	£3,250
Insulated wire	180,853	10,816	210
Glow lamps	34,711	9,712	312
Switchboards (not telegraph or telephone)	24,645	213	
Arc lamps and parts	101	4,343	
Batteries	51,531	4,470	
Meters	51,891	3,699	762
Carbons	3,285	3,094	1,314
<i>Electrical machinery:—</i>			
Railway and tramway motors	25,117		
Other motors and generators	252,654		
Electrical machinery (unenumerated)	129,883	55,921	1,267
<i>Telegraph and telephone cable and material:—</i>			
Telegraph and telephone wire and cable (not submarine)	135,327	7,768	3,416
Submarine telegraph and telephone cable	338,208		
Telegraph and telephone instruments and apparatus	188,655	30,101	3,511
Totals... ..	£1,565,545	£170,673	£17,042

The total weight of electrical machinery exported during last month was 1,196 tons, as compared with 863 tons in 1920 and 2,035 tons in 1913; for the seven months ended July, 1921, 1920, and 1913 the total weights of electrical machinery exports were 11,231 tons, 5,641 tons, and 15,820 tons respectively.

Estimated Cost of Hydro-Electric Transmission.—An estimate of the cost of building a new hydro-electric plant of 6,000-h.p. rating, and 66,000-volt lines from the station to other points on its system, has been prepared by the New England Power Co., and is published in the *Electrical World*.

The estimate is for doing this work during 1921 and 1922. It is based upon the company's extensive experience in hydro-electric plant and line construction in central New England, and assumes wooden-pole lines and a generating station operating under a head of about 245 ft. and producing about 25,000,000 kWh per year. The proposed dam is to be from 30 ft. to 40 ft. high. The figures are summarised below:

Preliminary and general expenses, \$36,000; dam, \$70,000; spillway, \$73,000; outlet, \$8,000; conduit, \$598,500; surge tank, \$13,000; penstock, \$26,200; power-station building, \$36,000; power-station equipment, \$222,000; engineering and supervision (5 per cent.), \$54,300; total, \$1,137,000. Transmission lines: Length 6 miles, \$35,521; length 0.5 miles, \$69,900; length 21 miles, \$163,920; total, \$269,341.

PUBLISHED SPECIFICATIONS.

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The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

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13,476. "Ignition device for internal combustion engines." A. Press.
June 11th, 1917. (166,503.)

1,392. "Electro-magnetic wave signalling arrangements." F. Lowenstein.
January 19th, 1918. (122,640).
2,1067. "Operating mechanism for electrical generators and magnetos,"
Splidtorf. Electrical Co. January 16th, 1915. (131,890).
2,1503. "Telemotor apparatus." W. J. Paulin, T. C. Fortune, and T.
McLeod. September 2nd, 1919. (166,591).
2,1714. "Electrical switches." E. Dobson and Foster Engineering Co.
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23,801. "Wireless telegraphy and wireless telephony and the like." S.
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2,521. "Electrical heater or warming device." D. Lyon. (October 23rd 1930.) (166,603.)

3,390. "Electric audio apparatus more especially for use by deaf persons." S. Brown. (October 25th, 1930.) (166,610.)

4,714. "Electric transformers." Hickbridge Cable Co. Ltd., and W. C. Kennett. November 4th, 1930. (166,613.)

4,916. "Junction box for electric wiring systems." J. C. White. February 18th, 1930. (Cognate application, 7,106, 1930.) (166,615.)

6,988. "Telephone transmitters." Minsner Inventions Corporation. March 12th, 1931. (160,070.)

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9,899. "Combined electric switch and meter for use on motor cycles and the like." F. E. Wilson, W. A. Shepherd, and Powell & Hammer, Ltd. April 8th, 1920. (166,642.)
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10,963. "Electric step-by-step motors of the unwound armature type." Bar
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THE CHINESE MARKET.

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A REMARKABLE communication from a Chinaman residing at Frankfurt on Main, dealing with the industrial training of Chinese students, was published recently in the *Frankfurter Zeitung*. The article brings to mind the fact that as a rule young Chinese and Japanese who come to Europe or proceed to the United States in order to study the industrial and other conditions in those countries, and also to work in them for a certain time, usually return home with a predilection for the manufactures and machinery of the particular countries where they have received most of their industrial education. As these students are frequently those who rise to official and other positions of importance, it generally follows that when they have reached the stage of being able to control business in the departments or branches which they manage, they place the orders which have to be executed abroad, in the countries where they were trained, because they retain the impression through the acquisition of the language and the perusal of the technical literature of the countries concerned that the manufacturers in the latter turn out the best goods in the world, apart from the efforts made by the manufacturers themselves to convey this idea to their pupils.

The author of the communication is Wang Kwang chi, who acts as the correspondent of a Chinese newspaper at Shanghai. After referring to the recent conclusion of a treaty of peace between China and Germany, the author states that all educated people in China are weary of political activity and now devote themselves to the social sphere, and as a consequence the centre of gravity of political influence has gradually passed from the government to the social sphere.

In this respect China is divided into two classes. The one represents the idea of capitalism, and is endeavouring through it to develop Chinese economy. The leader is Tschang Tchien, he is a big capitalist, was formerly Minister for Trade and Agriculture, and is at present superintendent of the commercial port of Wusung. The modern Chinese industrialists and merchants of Shanghai belong to this class. The second class would like to make use of socialism in order to bring about the development of Chinese economy. This class, whose leader is Ysai Yuan pei, Rector of Peking University, is of opinion that China should not enter upon the path said to have been erroneously trodden by Europe. The leader was formerly Minister for Education, and at one time studied in Germany.

Mr. Wang Kwang chi proceeds to state that the Government of the United States has always paid great attention to social questions in China in order to carry out what is termed educational (civilisation) policy. Among these matters is mentioned the return of the Boxer indemnity, so as to permit of the defraying of the costs of maintaining Chinese students in the United States, and for these reasons the relations between America and China are declared to be growing more intimate day by day. The number of young Chinese who are studying in the United States already exceeds 2,000, and the modern Chinese industrialists and merchants are mostly students who have returned from the United States.

We are also told that the French Government has likewise devoted much attention to the social question in China during the past two years. The Rector of Peking University, in conjunction with French interests, has organised the Chinese French Educational Community, whose object, among others, is to promote the dispatch of an increasing number of Chinese students to France.

to study, and the number there also surpasses 2,000. It is noted in this connection that most of those who have been sent to France are young Chinese who represent the idea of socialism. After arrival in France they take an active part as they learn by practical experience in the works on the one hand, and on the other they in this way earn wages and thus raise the expenses for their education. The French Government only collects from these students the sum of 100 dollars each to cover the travelling expenses, and the Government also exerts itself to secure the introduction of the students into works and educational establishments.

The author says that the situation of Germany is now different from that of France, as Chinese students who wish to proceed to the former country do not find the same facilities as those who go to the latter, and there are consequently only about 200 Chinese pupils in Germany at the present time. In his opinion, however, nothing now stands in the way of the Germans forming with the social leaders a Chinese-German Educational Community so that the industrialists in China could then send more students for training in the German works. The industrialists would be able to furnish financial support, although it would be better for the German works to pay wages to the Chinese volunteers, while the duty would devolve upon the Germans to instruct and supervise the pupils. If this procedure were adopted, the author states that on their return to China the students would be able to spread the idea of German education, which would have the practical result that German goods would be purchased to a larger extent.

The pages of the ELECTRICAL REVIEW contain a record of the solicitude of German electrical authorities toward fathers of Chinese lads whom, taking the long view, they were anxious to have under their educational influence in Berlin electrical factories in pre-war days. The writer of the article now under consideration states that about 40 or 50 students have been sent to Europe and the United States with the assistance of private capital furnished by large industrialists. As to the difficulty of language, it is considered that this could be remedied in a short time by study; and it is mentioned as an instance that from 60 to 70 per cent. of the students who go to France have no previous knowledge of the language. In conclusion, Mr. Wang Kwang chi expresses the belief that after the lapse of 20 years from now the position of all the Powers in China will change in a great measure, quite irrespective as to whether this will be brought about through the idea of capitalism or that of socialism.

It appears, however, that the engineering training of young Chinese has now been overdone. On this point the Norwegian Legation, in a communication which reached the Government of Norway at the end of July, states that the bulk production of Chinese engineers, both in China and abroad during the past two years, without any corresponding expansion in the industrial life on the country, has placed these engineers in a critical situation. Complaints are being increasingly made to the Government that young Chinese students, who have been abroad at the instance of the Government to obtain engineering training, on their return have to wait a considerable time before they can find any employment, and as a consequence many of them have to enter upon a commercial occupation.

At a Convention of Chinese students held at Swanwick, Derby, on Saturday last, Dr. V. K. Wellington Koo, the Chinese Minister, laid emphasis upon the need of encouraging more Chinese students to come to these islands. He said that the number here was 250 against ten times the number in the United States. Through the students who come here the Chinese people learn about us, our country, our industries, and our business organisation, as well as engineering skill and applied science. The speaker said that the Chinese students' movement must lead to a rapid extension of commercial and trade relations between China and Great Britain: each student and his social circle became channels for the consumption of British goods. The rapid growth of trade between the U.S.A. and China was largely due to

the fact that her relationship with the Chinese students was on so large a scale.

A "Correspondent recently in China," writing in the last number of *The Times Trade Supplement*, says there is very little doubt of the desirability of our establishing a closer contact with the Chinese—especially those in the remoter districts. Closer contact implies among other things ability to speak fluent Chinese. When the writer enters into details he states that the British organisation for the sale of machinery and electrical goods is at the present time most open to criticism in this respect. This weakness, however, appears to be recognised, and efforts are being made to improve matters in some measure.

Though Mr. Wang Kwang chi suggests that the foreign training of Chinese engineering students has been overdone, there is reason to believe that the electrical and engineering developments, of which the country is on the verge, should sooner or later absorb all their special knowledge and ability. Yet it is quite true, as *The Times* writer says, and as we have often stated here, that "the immediate consideration in the machinery market is not the present demand, which is admittedly small, but the safeguarding of the future, which has enormous possibilities."

Boiler House Control.

A GREAT deal has already been written on the subject of boiler inefficiency, and there is no excuse at the present day for either engineers or managers to profess ignorance of the subject. It is at last becoming recognised that the boiler house is the place where large sums of money may be either wasted or saved in a power plant, and the up-to-date engineer realises the effects of improved efficiency upon his weekly cost sheets.

It is interesting to analyse the psychology of some of the engineers and managers responsible for the policy adopted in connection with the management of boiler plant in this country.

We have first of all the chief who decides that the installation of certain ornate and expensive instruments will bring about the much desired higher efficiency in his boiler house, and after the expenditure of quite an appreciable sum in this direction, he is somewhat disappointed to find that his ambitions are never realised.

Then there is the engineer who delights in the efficiency of his new turbines, the consumption of which per kWh is jealously worked out to two places of decimals each day, but his boiler house is regarded as being quite efficient because it contains the latest type of steam-raising plant.

Or again, we may have the engineer who, although he probably realises the effects of boiler inefficiencies on the cost sheets, adopts the policy of leaving the operation of the steam-raising plant to the already overburdened charge shift engineers, who may or may not have the necessary training and time to exercise adequate control in the boiler house.

In view of these facts it was quite refreshing to hear Mr. David Wilson discoursing on boiler house management at the recent Summer Conference of the Institution of Mechanical Engineers. In the course of his brief paper, Mr. Wilson dealt with the importance of expert supervision and the necessity of having an engineer-specialist in control of a modern boiler house staff. The raising of status and the payment of adequate salaries to secure competent men were emphasised, and the author laid stress on the fact that immediate action was necessary if results were to be obtained. Undoubtedly, the savings in fuel alone by the adoption of such a policy are sufficient to pay the salaries incurred several times over in even comparatively small plant, in view of the present cost of fuel in this country.

In the case of a plant using, say, 1,000 tons of coal per week, the difference between ordinary supervision and specialised control may quite well result in a 10 per cent. saving of fuel, and this alone capitalised means £200 per week, assuming a coal cost of, say, £2 per ton. There are, of course, other incidental advantages

such as a steady supply of steam, increased capacity of plant, and reduced costs of coal and ash handling, &c., which can only be obtained by the adoption of scientific boiler control.

In some of the large American plant the importance of the boiler house has led to a system of staff organisation which ensures that the best engineers are appointed to boiler room duties, whilst we in this country are still inclined to view the turbine room as being of the greatest importance.

THE memorandum (Form 329, June, 1921) on the subject of electric arc welding which was recently issued by the Factory Department of the Home Office, is presumably intended to invite discussion from those interested in electric arc welding, in preparation for the issue of definite safety regulations by the Department. It is, therefore, highly desirable that it should be in the hands of all users and makers of arc welding machinery, to prepare them to meet the official views indicated in the memorandum, and to seek to alter those views if they see any danger to their own interests—without corresponding advantages of safety to the workers—in their crystallisation into definite regulations.

As regards danger from shock, very little exception can be taken to what is said about direct-current welding. Whatever the pressure at the arc, it is the open-circuit pressure when the arc is broken which constitutes the chief source of danger from shock. This, of course, is true for both direct current and alternating current. The memorandum states, as a matter of fact, that up to 100 volts the danger of shock from direct current is practically negligible, whereas the danger from shock from alternating current where the open-circuit pressure is generally from 100 to 120 volts is a real one, and the use of direct current is consequently to be preferred wherever it is, or can reasonably be made, available.

This statement is profoundly modified by a footnote stating that since the memorandum was drafted the Department has been made aware of systems of welding by a.c. in which the open-circuit pressure is reduced to as little as 25 volts. This is in accordance with the most recent developments, and it may be expected that in any regulations the preference for d.c. welding will be deleted, subject to the use of such a.c. apparatus as indicated. As a matter of practice, if direct current is taken from a public supply (3-wire with middle wire earthed) there will usually be 200 volts or more open-circuit pressure, which is decidedly dangerous. It is clearly easier to get the lower pressure by a proper transformer from public supply a.c. mains than by a motor-generator from d.c. mains.

The suggestion that, to avoid shock and short-circuit dangers, there should be a switch in the electrode lead within easy reach of the welder when at work is generally quite impracticable, and it may be hoped will not be found in any regulations. At least it should be limited to fixed working places. Other precautions for avoiding dangers from accidental "shorts" and contacts are reasonable, and such as no careful supervisor or operator can object to.

The protection from the injurious effects of radiations is treated rather tentatively. The trouble is that most effective protection is somewhat cumbersome and awkward to the welder, and he gets careless about using it. Reference is made to the matter elsewhere in this issue in the report of the Chief Inspector of Factories. A very great step in this protection will be achieved when someone finds a screen combination which will stop the injurious rays and yet let sufficient light through to permit the welder to see his tools, &c., as well as his work. This is by no means unattainable. The direction in which to seek it is already known.

Protection from hot metal and slag is suggested in some quite practicable ways. The beginner who lets a few shots drop into the front of his boots and similar

crannies of his attire is not likely to neglect them afterwards.

The memorandum does not suggest that the Factory Department proposes to do anything unreasonable or unduly restrictive in the way of safety regulations for arc welding, provided that one can read the footnote on a.c. welding as cancelling the preference for d.c. welding expressed in the body of the text.

Economy and the Minimum Charge.

A CONTRIBUTOR to the *Daily News* has a grievance which he may, or may not, share with a number of other consumers of electricity. He complains that although, in response to a request from the company which supplies him with electricity, he reduced his consumption drastically during the coal dispute, and thereby fell far short of the minimum for which the company charges, the minimum price remains the same. He considers that he is, therefore, in effect, paying for his assistance to the community in a time of stress.

Now we know the company's defence already; it will point out that coal prices rose and neutralised the effect of reduced consumption so far as running costs were concerned; moreover, the standing charges continued unaltered. All this is true, but the question is: Will the average consumer view it in that light, even after explanation? There is already a considerable amount of doubt in his mind about the justice of the minimum charge itself, and surely this development will not tend to allay the suspicion that he is being "done."

Thus, although the charge can be fully justified, electricity (or the supplier) secures a bad character.

The course taken by the Bexhill Corporation of suspending the minimum charge for the quarter may, superficially, appear to be "bad business," but the effect of this action may show itself in a certain measure of confidence on the part of the consumer, who will be gratified to see that his contribution towards the general good is not to be penalised. What do the other supply authorities think about it?

Chartered Electrical Engineers.

THE grant of a Royal Charter of Incorporation to the Institution of Electrical Engineers, recorded elsewhere in this issue, will be welcomed by all the members and well-wishers of this, the largest engineering Institution in this country, as an important further step in its development; we extend our hearty congratulations to the President and Council on the success of their petition. Thus it has fallen to Mr. L. B. Atkinson to celebrate most fittingly the jubilee year of the Institution during his period of office; but he, we are certain, would be the first to associate with this new distinction Mr. C. H. Wordingham, C.B.E., who included in his famous catalogue of projects for the improvement of the Institution and the raising of its status, as one of the most important factors, the obtaining of a Royal Charter. He was unfortunately unable to carry that project to fruition during his occupancy of the chair, but he will share with the sitting President in the satisfaction arising from its accomplishment.

Under the provisions of a Royal Charter, the Institution ceases to be bound by the restrictions imposed upon the conduct of a limited liability company, which at times have been felt to be extremely irksome; far greater scope will be conferred upon its operations, and the prestige associated with its membership will be greatly enhanced.

We think the Council was well-advised in petitioning for a Royal Charter on the basis of the existing constitution of the Institution; thus all questions regarding the effect of proposed changes have been avoided, and the desired end has been attained in less than three months. Necessary changes can be effected as and when they are required—the main thing was to get the Charter, and let the rest follow.

A NOTE ON THE INTERCONNECTED-STAR METHOD OF CONNECTING THREE-PHASE TRANSFORMER WINDINGS.

By S. AUSTEN STIGANT, A.M.I.E.E., M.Am.I.E.E.

THE interconnected star or zigzag connection of three-phase transformer windings is now fairly well established, but so far as the writer is aware, the various reasons for its use have not been given quite the amount of publicity which is desirable. It is with a view to remedying the omission that this article has been written.

In actual practice the connection finds its greatest application when adopted as the method for connecting the secondary windings of three-phase transformers or transformer groups in conjunction with a star connected primary, and the combined connection is frequently used in place of the delta/star connection. It would be as well, therefore, to compare the star/interconnected-star connection with the delta/star, particularly as the latter connection is perhaps the one most widely used, and certainly so in this country. The chief features involved are as follows:—

1. The effect of the connection chosen on the economical limits of voltage and output.
2. Parallel operation of star/interconnected-star with delta/star connected transformers.
3. Unbalanced loading.
4. Harmonics.
5. Availability of neutral point.

1. *Effect of the connection chosen on the economical limits of voltage and output.*—As a high-pressure distribution system extends into less dense areas it is often found that more or less scattered loads of a few hundred kW require supplying, the only voltage immediately available being that of primary distribution which may be, say, 11,000 or 20,000 volts. Now it is at once apparent that there must be some economic relation between the output and voltage of a transformer, other things being equal; in other words, for a given kVA output there is a limiting voltage per phase beyond which a transformer to be supplied could not economically be designed, particularly having in mind the exigencies of standardisation. Conversely, for a given phase voltage there is a minimum kVA output below which it would not be economical to go. The economical upper and lower limits of voltage and output are dictated by considerations of mechanical strength and rigidity of the windings, and not by electrical or magnetic features of the design, so that outside these limits, while the proposed coil conductors might be amply large from the standpoint of current-carrying capacity, losses and voltage drop, they would not be mechanically strong enough to withstand the short-circuit conditions occurring on a large system, nor would they lend themselves to the best methods of modern winding and insulating processes. Such coils would be "mushy" of necessity, due to the inherently low copper factor.

Fig. 1 shows an average relationship between the economical voltage and the three-phase output.

Broadly speaking, we are not so much concerned with the voltage *per phase* for which the transformer is designed, as with the line voltage of distribution, so that if the same, or closely similar operation conditions can be attained with two different types of connections, obviously the one to select is that giving the greatest mechanical strength to the transformer windings.

Consider first the delta/star connection for a step-down transformer of given line voltage ratio.

On the h.p. side the number of turns per phase is a maximum as the phase voltage is equal to the line voltage. The space taken up by the insulation is also a maximum due to maximum number of turns. The cross section of the winding conductor need only be large enough to carry as per cent. of the line current, so that in the region of voltage and output limits we have all the characteristics of a "mushy" winding, viz. 100 per cent. turns, 100 per cent. insulation and as per cent. copper section.

If, however, a star connection is used on the primary side the number of turns per phase is 58 per cent. of the foregoing, the space taken up by insulation is 58 per cent. of that taken up by the delta winding (as the best modern practice is *not* to reduce the insulation between turns and layers on account of the star voltage), and the conductor cross section is a maximum as the phase and line currents are equal. Hence a much more robust winding is produced which is inherently better able to withstand the arduous conditions imposed by service on a large system. The total space taken up by the copper and insulation of the high-pressure winding

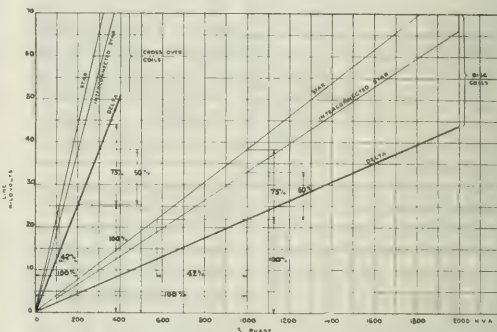


FIG. 1.—AVERAGE RELATIONSHIP BETWEEN ECONOMIC VOLTAGE AND 3-PHASE OUTPUT OF TRANSFORMERS.

is, therefore, less with the star connection than with the delta as the total copper section in the coil is the same, but the star connection only requires the same thickness of insulation for 58 per cent. of the maximum number of turns. So far as the high-pressure winding alone is concerned, therefore, a smaller magnetic frame can theoretically be used by adopting the star winding though due to standardisation of parts it may not be found convenient.

Now clearly it is not desirable to retain the star connection on the secondary side with a star connected primary, particularly if loads are to be connected between line terminals and neutral. The reason for this is discussed later. Neither is a delta connection suitable for somewhat similar reasons. If, however, the secondary windings be designed for and connected up interconnected-star the objectionable operating features of the star or delta secondary with star primary for three-phase four-wire service are immediately overcome.

With such a winding, due to the phase difference of the two halves of the windings on different limbs which are connected in series and comprise each phase, the number of turns per phase is 67 per cent. of the maximum, i.e., of those obtaining with a delta connection. The space taken up by the insulation is also 67 per cent. of the maximum, while the cross section of the individual conductors is a maximum as the phase and line currents are equal. Consequently a winding is produced which mechanically is almost as good as a star winding and which, in conjunction with a star connected primary, is electrically as good as the delta/star combination.

So far as the l.p. winding alone is concerned, a slightly larger magnetic frame is theoretically required to accommodate the interconnected star winding as compared with the straight star, as there is 15½ per cent. more copper and insulation per phase in the former than in the latter. This may be offset to some extent by the gain obtained in using a star connected primary, and often the delta/star standard magnetic frame will ac-

commodate the interconnected star secondary, in which case there may be only a slight increase in cost due to the 15½ per cent. additional copper in the secondary winding, though this depends on the relative cost of labour to materials. It may happen, of course, that the nearest standard frame size suitable for the particular output and voltages will not take the star/interconnected-star winding, so that the net result is a somewhat larger magnetic frame, and consequently increased cost of the transformer.

With, at the most, a small increase in frame size we have, therefore, obtained a design and connection of windings electrically equivalent to the delta/star, and mechanically much stronger, and in addition, one in which the high-pressure voltage per phase is only 58 per cent. of the maximum, *i.e.*, of the line voltage of distribution.

In effect, therefore, the upper limit of line voltage for a given kVA output has been increased by 73 per cent., or the lower limit of kVA output has been reduced by 42 per cent. for a given line voltage by changing from the delta-star to the star/interconnected-star combination.

Due to the higher copper factor the secondary l.p. winding takes much less room in proportion to the h.p., and for the purpose of this argument can be ignored.

Given, therefore, equal possible technical performance of the two combinations, this is the main reason for using the star/interconnected-star connection for an ordinary step-down transformer supplying a consumer direct.

2. *Parallel operation of star/interconnected-star with delta/star connected transformers.*—With regard to the question of parallel operation of star/interconnected-star transformers with delta/star transformers, it is

vector diagram and fig. 2a shows a comparison between the two kinds of combined connections. From this it will be seen that there is the same angular displacement in both cases between primary and secondary terminals, *viz.*, 30 degrees, and therefore both primary and both secondary line currents and voltages are in phase.

Of course, cases may also occur in practice where the interconnected star winding is required on the primary side to be used in conjunction with a star-connected secondary, and in this case the connection would be electrically equivalent to the star/delta. Fig. 2b shows a comparison between these two combined connections from which it will be seen that there is again the same angular displacement in both cases between primary and secondary terminals.

3. *Unbalanced Loading.*—One great advantage of the delta/star connection for step-down distribution transformers is that a three-phase, four-wire, supply may be given without appreciably distorting the position of the neutral. The four-wire supply need not necessarily be balanced, in which case the resulting distortion of the neutral is simply due to the out-of-balance current flowing through the impedance of the phase concerned. There is no choking effect as the primary current corresponding to the secondary out-of-balance current has a perfectly free path through the primary winding of the phase concerned and the two line wires; the other two phases are not affected by the out-of-balance current.

(To be concluded.)

AN AUSTRALIAN POWER SCHEME.

By H. M. S.

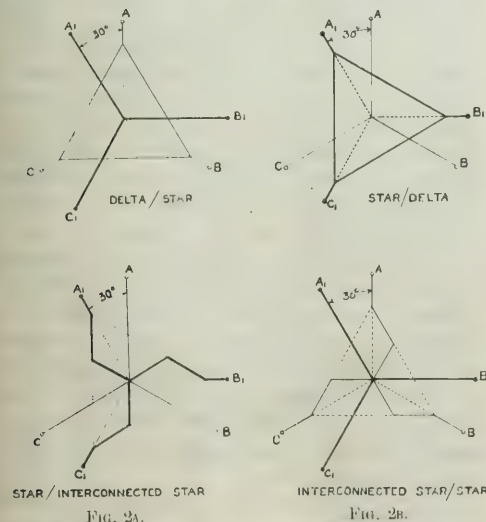
A SPECIAL supplement to the *Industrial Australian and Mining Standard*, entitled "Power for Victorian Industries," has been sent to the writer for review, but a review in the ordinary sense of that word is hardly appropriate to a publication evidently designed to inform the Victorian public of the plan for the provision of electrical energy for Melbourne and other towns, and to raise some interest which may later display itself in a practical form.

The scheme is that known as the Morwell brown coal scheme, which has been mentioned in various ways in Australian contemporaries and in these pages for some time past. The plan was drawn up by Mr. C. H. Merz, specially engaged by the Victorian Government. It has the particular interest of combining coal production with the supply of electrical energy, and shows what can be done where one is so fortunate as to have a clean slate, with no vested interests to conciliate or acquire.

Melbourne finds itself near the limit of its present power houses. The Government wishes to develop home industries, and has appointed a body of Electricity Commissioners first to advise on, and later to carry out, the necessary power supplies, as well as to control electricity undertakings generally in the State.

At present the State depends for its fuel on coal imported from Newcastle, N.S.W., the price of which has risen greatly of late years, and the supply of which has been irregular lately as the result of labour troubles.

So the Electricity Commissioners studied the possible sources of power supply. There are some water powers in the State, but they require heavy expenditure to develop, and the works will take a long time to execute. Recognising that these resources may be of future value, they have determined that the readiest plan which will give early results is to utilise the very large beds of brown coal at Morwell, in the valley of the Latrobe river, about 90 miles south-east of Melbourne, not far from the Gippsland main railway, and with a branch line off that already built to the coalfield. The coal lies in thick beds with an overburden of from 30 to 80 feet of alluvial, so that it can be worked by open quarrying. Both the overburden and the brown coal can be excavated by steam navvies or other mechanical diggers.



FIGS. 2A AND 2B.—VECTOR DIAGRAMS, COMPARING THE TWO KINDS OF COMBINED CONNECTIONS.

not necessary to go into this here in great detail, and it is sufficient to state that delta/star connected transformers or transformer groups will operate satisfactorily in parallel with any star/interconnected-star transformer or transformer group. This holds good whatever the meshing of the phases may be or whatever may be the direction in which the primary and secondary coils are wound, and it is only a question of selecting a proper set of external connections from the transformer terminals to the busbars in each case.

It has already been stated that electrically a star/interconnected-star transformer is equivalent to a delta-star connected one, though no proof has been given for this. The fact can best be illustrated by means of a

The conditions are not unlike those of the German brown coalfields at Fortuna and elsewhere, and the scheme proposes to utilise similar methods to those there employed. The coal is State property, and has been proved by borings to exist over a wide area. There are other thick beds below the top one above described, but it appears that the upper one will provide for a good many years' working. The cost of quarrying this coal by such means is reckoned at only 2s. 3d. per ton. Its calorific value is low; indeed, as mined, it contains nearly 50 per cent. of water, but as Newcastle coal costs 32s. 9d. per ton at the Melbourne wharves, the low cost will make up for low heating value. From a number of calorimeter and boiler tests, it is estimated that it will take $2\frac{1}{2}$ tons of this coal (air dried down to about 20 per cent. moisture) to equal one ton of Newcastle coal, when burned in properly-designed boilers. It is not clear from the description whether the method of firing has been settled; briquetting and powdering are both mentioned. Powdering should be a fairly cheap process; briquetting will probably be used, as it is in Germany, to make some of the output suitable for transport, for ordinary use. It appears, indeed, that the idea is to make Victoria independent of its neighbour State for coal supplies.

The power house at Morwell has been designed by Messrs. Merz & McLellan for an output capacity of 50,000 kW at its first stage, with turbo-alternators generating at 11,000 volts, to be stepped up to 132,000 volts to the duplicate overhead transmission lines to Melbourne.

It is estimated that the energy can be delivered to the 20,000-volt distributors in Melbourne at about three-fourths of the present cost from the existing stations there using Newcastle coal.

The whole scheme involves much more than has been described. It will be necessary to build a new town at Morwell to accommodate the miners and other employes, and plans for this modern industrial town are in course of preparation. The country appears from the descriptions given to lend itself to real garden city conditions. It is undulating, with a considerable river, and sparsely inhabited. It was, when first explored, well wooded, but the not very successful attempts at settlement for sheep raising brought about the destruction of the forests.

Besides supplying the power house and briquetted coal for general use, it is hoped to distil some of the output for the production of oil, tar, sulphate of ammonia, &c., and gradually to develop a chemical industry based on these by-products.

The future development of the water power elsewhere is evidently linked up with irrigation and the fostering of agriculture.

It will be noted that the scheme means a considerable amount of nationalisation, but under all the circumstances, this may possibly be the only method by which such a far-reaching combination of objects of public interest can be made effective. The fact that there are no private interests to be compensated or conciliated is favourable to State enterprise. Development of a country with great potential resources, and a very small population, is something like afforestation; it takes a long time to become actively remunerative, longer than the private investor can afford to wait for returns. A Government can take longer views and plan for future benefits.

The publication gives a good deal of interesting history of the early exploration of this part of the State, and is written in a style to arouse enthusiasm and hope. It will be very pleasant to hear that the scheme is working out according to plan in all its phases.

When it is remembered that the population of the whole of Australia is about that of the Administrative County of London, and its area over 1,400,000 square miles, say, twelve times that of the United Kingdom, it will be realised that the success of large schemes of industrial and agricultural development may have a very important and beneficial result on the future of the British race.

HOUSEHOLD MACHINERY AND THE HOUSEWIFE.

By MARY GWYNNE HOWELL.

THE average English housewife is too new to the wonders of electricity for general household purposes to make a whole-hearted bid for the all-electric house unless she can be quite convinced that the equipment is going to prove an all-round blessing. She "trembles on the brink," having been pushed that far by the overwhelming burden of housework performed by human labour, old-fashioned methods, and the lack of domestic help.

Yet she is fearful to avail herself of the wonder-working appliances she sees on every side, for several reasons.

1. The apparent high cost scares her.

2. She knows nothing of mechanism and fears to experiment.

3. Shop demonstrations are given under conditions totally different to her home surroundings.

These difficulties can best be dealt with by understanding the woman's point of view, and meeting her on her own ground.

In all explanations it must be remembered that if the housewife is ignorant of the workings of machinery, on the other hand, she knows methods of housework from A to Z, and it is worse than useless to try and convince her that a washing machine, for example, plus a pail of hot water and an indiscriminate sprinkling of soap powder, is going to accomplish all her washing while she gets on with her other work! Such "lore" is fatal to the general adoption of machinery, since one disappointed housewife who spreads the news of failure has more influence on her friends and acquaintances than all the spectacular window demonstrations. The sellers of household appliances need the principles of housewifery behind their teaching.

As regards the cost difficulty, the average woman purchaser can be won over, if it is pointed out to her that if the original outlay is somewhat costly, this is practically the only cost, and the long-lasting results show it to be an investment which will repay the cost over and over again in the saving of time, energy, labour, and wear and tear, as well as money. This puts the matter in a fresh light, and gives the housewife a true idea of labour-saving appliances as an economy, not an extravagance.

It is not altogether easy for one versed in mechanical lore to understand the total ignorance of the ordinary housewife on all matters pertaining to machinery, and therefore it does not occur to the salesman to give the necessary instructions to a would-be purchaser. A woman who buys a vacuum cleaner expects it to act by magic, and if the magic fails she discards the machine as a poor thing, and goes back with fortified adherence to her brush and broom. Every time this occurs it is a serious set-back to the electrical appliance trade.

A summary of the teaching necessary for housewives, apart from detailed explanations of individual appliances, is as follows:—

1. *The directions supplied with a machine must be followed minutely.*

Good results cannot be expected if wrong use and handling take place. Every detail of the instructions is important and should be faithfully carried out by the operator of the appliance.

2. *The machinery must be kept in a condition of absolute cleanliness.*

Satisfactory service is impossible if the appliance is clogged with dust or allowed to become rusty.

3. *The use of every appliance must be strictly confined to its own particular work.*

Unlawful use is a frequent cause of deterioration. A vacuum cleaner is not intended as a polisher of floors, nor is an electric iron designed for a door stop!

4. *Frequent oiling is necessary with all machinery.*

Unless some lubricant is applied to all the moving parts, the constant friction will result in scoring and grooving, but a film of oil between metal faces in the

hinges, and around bolts and screws, will lessen the wear and tear to a marked degree, and consequently lengthen the life of the appliance.

5. Great care must be taken of the connecting cord.

It contains the wires that transmit the power necessary to operate the machine, and knotting or twisting this cord or any excessive wear on any portion of it will shorten its life and affect the usefulness of the machine.

The faithful observance of these simple rules will in many cases guard against failure, and the housewife, thus fortified with knowledge, will be much more confident in her attitude towards labour-saving appliances.

A word as to "telling" arguments for selling purposes.

In the case of a vacuum cleaner, for example, it is possible to impress a woman favourably by explaining that the life of her carpets and rugs depends upon keeping them free from gritty dirt, which is ground into the pile by every pair of shoes treading on them. *Grit, plus the tread of heels, is the most destructive combination possible.* From this the obvious deduction can be made and used as a text, *i.e., a clean carpet has the longest life.*

Having got the housewife to see the importance, from an economical point of view, of thorough cleanliness, it should not be a difficult matter to convince her of the superiority of the suction method over the brush and broom.

1. It is more thorough.
2. It is more sanitary.
3. It is more economical.

The possibilities of a washing machine properly used have already been dealt with, but since the use of such a machine makes it possible to wash sheets and table linen at home, it follows that the "aftermath" of laundry work (the ironing operations) call for equally efficient labour-saving appliances. For this purpose the merits of the roller ironer may well be extolled, since the speed and efficiency with which the ironing can be accomplished with such a machine save hours of time and an immense amount of human energy. A seeming drawback to such a machine is sometimes pointed out in the fact that it cannot iron "gathered" garments, but as a matter of fact, it is quite possible to iron all but the actual gathers themselves in the machine, releasing the shoe just before these are reached. The amount of hand ironing is thus reduced to a minimum.

The investment idea will here again overcome the cost difficulty, especially since large articles as sheets, counterpanes, tablecloths, &c., are priced so highly at the commercial laundry.

The position in which the average housewoman finds herself to-day, obliged to play the double rôle of mistress-maid, is in itself quite the most telling argument in favour of a general adoption of labour-saving equipment, and it should not be a difficult matter to overcome the prejudices and ignorance which are the chief stumbling blocks in the way.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Electric Conduit and Pipe Cleaning Device.

So far no effective method has been employed to blow down obstructions thoroughly in pipes, particularly electrical conduit that is placed in the walls or other positions during the construction of a building, and which is liable to become clogged during the time that cementing or plastering is being accomplished.

A device has been patented in the United States, however, by Mr. E. G. CHEUVREUX, Junr., of 710, Leonard Street, Brooklyn, N.Y., and will probably be placed on the market in the near future, that will, it is said, blow down any foreign matter in conduit, such as wooden plugs, waste, cement, plaster, and

even ice, and on a test it blew through 200 ft. of conduit, around elbows, carrying before it all material in the tube.

The principle of the device is concussion, and the tool itself is simple in construction, easily handled, and, it is claimed, safe. Conduit is usually provided with screw threads on the exposed ends to which fittings are screwed, and it is to these exposed threaded ends that the device is attached.

Fig. 1 shows a sectional view and details of the device. Through a longitudinal passage the firing pin passes and

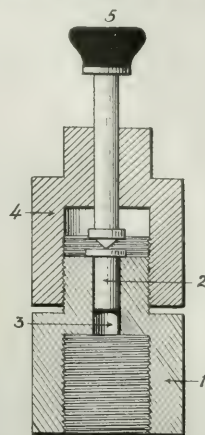


FIG. 1.—A PIPE-CLEANING DEVICE.

operates freely, so that there is no effective pressure until the time desired. There is also a spring used on the firing pin, so that it rebounds after discharging the cartridge, but this is not shown in the sketch.

The device is operated as follows: Member (1) is screwed to the pipe, and this member can be made any size to suit the diameter of the pipe, and can be used on two sizes of pipes by means of reducers, and also on elbows or any fitting attached to the pipe. A blank cartridge (2) of .32 calibre is then placed in the passage (3) with its flanged end resting on the face of the passage. Member (4) is then firmly screwed to the latter, and a blow of a hammer on the knob (5) will explode the cartridge. The explosion in the pipe will cause sufficient pressure to blow out all foreign matter; if a single cartridge does not accomplish the work effectually, a second or even a third cartridge may be used, but as a rule it will be found that one will do the work.

A New Brush Holder.

THE CORLETT ELECTRICAL ENGINEERING CO., LTD., Wilcock Street, Wigan, has recently placed a new brush holder on the market. The special feature of this holder (fig. 2) is that no

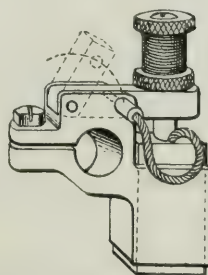


FIG. 2.—THE "PARKIR" BRUSH HOLDER.

pressure is put on to the brush until the top portion is held in position by the retaining pin on the end of the flex. In this way complete contact is ensured. No tools are required when changing the brushes, and the spring is totally enclosed. The holder is known as the "ParKir."

A New Belting.

MESSRS. ESSENHUGH BROS., 27a, Green Street, Warrington, have sent us particulars of a new type of belting which they are manufacturing. This belting, the "S.N.I. Patent Link V Belt," is intended for high-speed drives of all kinds. The belt is made up of leather links connected by small metal links. A brass bush runs right through each connecting point, and thus the strain is taken off the leather. These brasses are retained by small screws sunk into the substance, there being no projections at all. The links have an air space in the centre, which, it is claimed, effectively cools the brasses when the belt is in use.

The "Agraf" Switch.

We have received a sample of a new type of switch introduced to this country from Germany by Mr. T. M. SEMMERS, 8, The Mall, W. 8. This is a three-position switch of very compact design. The base, which is of porcelain, has a raised centre with four steps—three contacts and an "off" position. The operating knob and contacts are contained in a domed porcelain cover, and are assembled as a part of the cover. The spring beneath this contacts serves also as the cover's retaining spring, and the cover instead of being screwed on to the base, as is usual, is held by two small brass projections which slide into slots in the cover. Correct alignment is obtained by means of a steel pin which enters the centre of the base. The switch is very neat in appearance, and, so far as can be judged, likely to prove efficient, and it is unfortunate that it is not a British invention. The sample is rated at 6 A, 125-250 V, but larger sizes are being made.

The "Dictograph" Telephone Junction Box.

We reproduce an illustration (fig. 3) of the new "Dictograph" telephone junction box, which has now been placed on the market for the first time by DICTOGRAPH TELEPHONES, LTD., Aurelia Road, Mitcham Road, Croydon.

For many years this box has been successfully used in the "Dictograph" telephone installations, by some of the biggest engineering concerns in the country, but it can also be used for other apparatus which employs multi-core cable, such as annunciators, and large systems of bell indicators for hotels.

The chief feature of the box is that all connections are

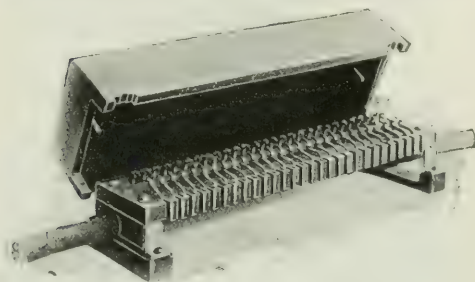


FIG. 3.—THE DICTOGRAPH JUNCTION BOX.

soldered. Each lug, made of heavy tinned wire, will take three conductors, and each junction box three or four main cables. There is ample room behind the base of the box to lace and form the cable, and when fixed to the wall, the cables are entirely hidden, only the soldered ends and colour code being visible from end to end. The box is completely enclosed in a hard wood cover which can be obtained in a variety of finishes to match the furniture of the room in which it is placed.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Self-synchronising Rotary Converters.

In answer to "1,500 kW's" letter, I have attempted the following elementary explanation of the self-synchronising of a rotary converter.

The problem is this: We must get a synchronous motor (for a r.e. viewed as an a.c. machine is really a synchronous motor) up to synchronous speed, while we have at our disposal a 3-phase supply of constant frequency and voltage.

We cannot, of course, apply the working voltage directly across the slip-rings of the machine while at rest. This would be equivalent to shorting the supply through the rotary armature. But we could easily apply the same voltage to the machine if we put in series with the armature a suitable choking coil, and the supply current being taken by the choke and none, or practically none, by the armature itself. If, now, this choking coil I am at present considering one only of the three phases of the machine, be in the shape of the stator winding of an induction motor, which will start our rotary, so much the better.

Again, the starting induction motor has a lesser number of poles than the rotary, i.e., its synchronous speed is higher than that of the rotary, so that the machine is bound to pass through its synchronous speed while accelerating.

How well it does at that particular speed? Thus: Consider for a moment the rotary as a hunt d.c. generator. When speeding up it tends to excite a quite appreciable field being

maintained. We have, therefore, again our synchronous motor coming up to speed and having a strong field as well.

At the particular instant when it is exactly in synchronism with the supply, the well-known strong torque of the synchronous motor comes into play and keeps it there.

The induction motor being now rid of almost all its load, the supply current falls down to that value which will suit the synchronous motor (i.e., the rotary), and the voltage across the former diminishes and is simultaneously transferred to the rotary armature. A further reduction can be made by adjusting the rheostat in the rotary field-circuit, when the induction motor can safely be shorted out of circuit.

Our rotary is now straight across the supply and running at synchronous speed.

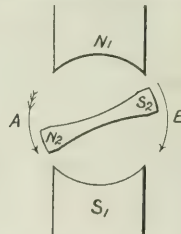
The above explanation is, I repeat, very elementary, but, I hope, clear enough to suit its purpose.

M. L. C.

August 18th, 1921.

In reply to "1,500 kW" re the "self" synchronising rotary converter, may I, without the aid of elaborate vector diagrams and calculations, submit to him the following theory, which is true for all numbers of poles and phases.

Consider N_1S_1 in the figure, to represent a two-pole revolving field produced by the stator supplied with 3-phase current. N_1S_1 will not, of course, actually be salient poles as indicated, but will be "polar regions." N_2S_2 will represent the two actual salient poles of the rotor. At the time of starting the speed of the rotor is much below that of the stator field N_1S_1 , and consequently much below that of synchronism. At the speed of synchronism, the speeds of N_1S_1 and N_2S_2 will both be equal, and one is at rest with respect to the other. Imagine the whole to be given a backward rotation equal to the speed of synchronism so that N_2S_2 will be brought to rest; however, at starting, N_2S_2 will move in the direction of the double arrow A with synchronous speed when it first starts from rest, and as the rotor body gains speed in the direction of the single arrow B, so the imaginary backward motion of N_2S_2 with respect to N_1S_1 decreases. As the poles N_2S_2 sweep by the polar regions of the stator, N_1S_1 , the former experience an alternately retarding and accelerating torque by the laws of simple magnetism—"unlike poles attract, like poles repel." Hence, superposed on the driving torque—due to the prime mover or induction motor action, according to the type of machine and method of starting—we have an alternating torque caused by the fact that the



A.—Relative direction of rotor field before synchronism is reached.

B.—Actual direction of rotor body given by prime mover.

N_1S_1 is always at the speed of synchronism, but is at rest in the diagram, assuming the whole is rotated backwards at synchronous speed.

rotor has well-defined poles. So long as the speed falls well below that of synchronism, the effect of this alternating torque is slight, as each half-wave of torque is of short duration and the corresponding impulse (mean torque \times time) is not enough to affect the speed materially. But as synchronism is approached, the impulses of these alternating torques have longer, i.e., slower periods, and therefore increase in value, and oscillations are imposed on the uniform rotation of the rotor. Finally, at a certain speed just a little below synchronism, the impulses become powerful enough to jerk the rotor field into step (synchronism) with the stator, and after that synchronous rotation is maintained.

The residual magnetism of the rotor field is sufficient to cause a machine to pull into synchronism, but, unless Dr. Rosenberg's series motor method is used, it is easy to see that N_2S_2 may be reversed by induction from a strong N_1S_1 , and the rotary will come up with the wrong polarity, necessitating the well-known "pole slipping."

W. T. P., Wh. Ex., Student I.E.E.

August 10th, 1921

I.C.C. Tramway Car Design Competition.

It will be remembered that about a year ago the I.C.C. tramway authorities organised a £1,000 car design competition. The fact is kept fresh in one's memory by the articles recurring in the lay papers, ridiculing those unwitting enough to have paid the necessary two guineas.

* NOTE.—For Dr. Rosenberg's method of starting self-synchronising rotaries, see I.E.E. Journal, Vol. II, p. 77 (1913).

"Sardine Tin" framers, &c., are doubtless entertaining to the ignorant; that the misused entrants are either humorists or lunatics is comforting also to the reader—an "official" of the L.C.C. said so (lucky for him he was debarred from competing)—and note that these scurvy diatribes are the *only* "official" statements that have been published; no rational report to a technical journal, upon those designs which show that the designer to have understood the technicalities and shortcomings of his subject, and made an engineering attempt to improve it.

Here it should be stated that to comply with the conditions of competition required a knowledge of mechanics, also drawings costing anything from £20 to £30.

Then why this Judas attitude of the L.C.C.? The fact is, officialdom's sold its soul (and the competitors) for that £1,000.

Finding, what their technical advisers should previously have known, that mere mortal could not by magic improve that which is the product of a dozen, at least, independent specialists, they reported of the £1,000 offer. But certain gentlemen, influential in the tramway world, having reason to know, cast certain doubts upon the honesty and even the legal tenability of their position.

So why not smother criticism by appealing to the readers of *Puck* with "Sardine Tin" framers, complete with tin opener; picture them an orange box on four scullery boiler covers, motored from a cat's interior scratched backwards on a revolving broom. Never mind immolating the few innocents on the pyre of contumely.

The L.C.C. says "many" entrants were either humorists or lunatics; the insult applies to all. I say "some" tramway undertakings (or is it overtakings?) are unscrupulous and heartless. Let the L.C.C. if the cap fits.

B. Lloyd Price.

Newport (Mon.).

August 17th, 1921.

Country House Lighting Plant.

Having read Mr. H. R. Tamton's interesting article on "Automatic Lighting Sets," I am surprised to see no mention of a type made by the Kohler Co., of America. So far as I remember the main details are as follows: The petrol fuel is vacuum fed from a tank sufficient to last over a month. There is no lighting battery, but a 12-volt battery is used to automatically start the engine as soon as the first lamp is switched on, and when the last lamp is switched off the engine automatically stops; hence no power is wasted.

P. F. Roberts.

Hertford.

August 16th, 1921.

Trade Cards and Trade Discounts.

The letter from Messrs. Allen & Son, of Gravesend, in your issue of July 29th, to my mind opens up a very big subject. It is not possible to stop a dishonest person from using, say, a traveller's visiting card in order to obtain a trade discount. This, however, might be minimised if the trade as a whole would resolve what firms or persons should be entitled to trade discounts, say, not without an official order or its equivalent. There are trades where no discount is allowed even to the larger firms outside their circles, an agreement having been arrived at in the particular trade and rigidly adhered to. The engineering trade as a whole, however, as far as my experience goes, makes no inquiries from the purchaser if he seems to have a knowledge of the discounts when purchasing.

I came up against this matter only a few days ago. An inquiry was received from two electrical firms; a quotation was sent to each, identical in price; the order was received from one and a letter from the other grumbling because we had stolen his customer. This makes things very awkward. Offence was not meant, and I considered myself a victim of circumstances, as I have little doubt that my competitors quoted on the same lines.

Interested.

August 16th, 1921.

A Synthesis of Production.

I do not know to what extent the various manufacturing companies have developed the system of recording the progress through the factories of the various orders which they receive for their standard productions.

I believe that a carefully organised progress department could serve two very valuable purposes. First, to prevent material, upon which considerable sums of money have been spent, lying about the shops which are waiting for some, possibly small, piece of mechanism from another department. Here, I would say, that shop managers, shop foremen, and shop clerks are all very human, and it is to expect more from ordinary human nature than is just, to expect the man in charge of one department to chase round into another department and collect the small parts of a machine necessary for completion. The head of a department might say that he had enough to do to keep up his output without worrying any-

body else in the factory. Very often the head of a department is so concerned for his rating by the progress department that he is unable to complete the order.

The other point which I think a progress department could bring out is the distribution of any particular order to the various departments in the factory. It is extremely difficult for a head office which is directing the affairs of a company to keep track of the progress of delivery of a particular order. That, in my day, was a source of difficulty, but the progress department of a factory of considerable size, and of a very valued customer might find that his requirements had suddenly developed an aspect, that he had applied to the head office, and he would naturally get in touch with the head office of a company to know whether his order could not be pushed forward, and this is one of the occasions on which a good progress department could supply the head office with all the data. For every order or part of an order should be booked out from one department into another by the shop clerks, and it would be possible for the progress department of the factory to give the head office the exact history of that order, as to where it stands and the possible date of its completion and, at the same time, give the head office the necessary information as to what orders stand in front of that particular one, and will occupy the machines in advance of it, so that the head office could then give instructions to the factory as to which order should take precedence.

It should be borne in mind that the progress department would have a necessarily more comprehensive view of the company's interest rather than that of the factory which is mainly concerned with production pure and simple.

I think it is possible to organise, at comparatively small cost, a progress department dealing with all orders received by any factory. In such a way the actual position of any order could be ascertained in a few minutes and definite instructions could be received in a factory, conditioned by the knowledge of any of the company's interests as a whole, which is more likely to be held in the head office than in the factory.

In every complex form of manufacture, even with the most carefully thought out scheme of mass production, either stock orders on factory orders must come through from one department to another and so on to another, and with a carefully organised progress department all this information could be given on the telephone from the factory to the head office. These two points which I am advocating, the ordered sequence through a factory of materials for production (eliminating the cost of half-finished materials waiting), and the power conferred on the head office to give a reasoned date of delivery, would be safeguarded.

Human nature being what it is, I venture to think that customers are likely to be pleased rather than otherwise at receiving a date of delivery based on the whole effects of manufacture rather than the cheery optimism that is sometimes evinced in dates of delivery given by those who hope for the best.

D. P.

August 18th, 1921.

Carpets and the Electric Suction Cleaner.

I have read with interest the article on vacuum cleaners, and as an engineer who has spent many years in this particular line, I would like to point out to your correspondent (who appears to favour a foreign machine) that a machine that is properly designed will, without the assistance of a brush, take practically every morsel of dirt out of a carpet.

Now, he is an expert on carpets, and in his position wishes to safeguard his antique carpets. I am an engineer with wide experience of vacuum cleaners. Will your correspondent be interested enough in his property to allow me to give him the benefit of my experience, and, if required, take actual tests in his carpet store? I will then prove to him that: (1) The best vacuum cleaner on the market is British; (2) has no brush; (3) runs at a lower speed than any other machine (and has in consequence a longer life); (4) is more robustly made than any other machine, and is, therefore, a sounder proposition than competitive machines; (5) that all parts are standardised and interchangeable; (6) that soft-hair bristles are not powerful enough to depress a carpet that is lifted by powerful suction; and hard bristles do take the pile off a carpet.

Trusting that I may have the pleasure of meeting Mr. Kemp in the near future.

G. M. Oates.

London, S.W.

August 22nd, 1921.

We have read with interest the article appearing in your journal under the heading of "Carpets and the Electric Suction Cleaner." To any person connected with the electric suction cleaner business it is obvious to what particular machine the writer refers. So why not state the name "Hoover." The scolded tests which the writer claimed to have submitted his delicate oriental carpets to, appear altogether too vague to be convincing. He mentions "this simple addition of a motor-driven brush to a powerful suction cleaner" (the italics are mine). The machine in question, like all the American-produced cleaners, has not a powerful suction, and unless it were fitted with a brush, to incorporate the old-fashioned

area of beating and sweeping, the suction would not be sufficiently powerful to take up even the surface dust or dirt.

There is no doubt as to the fact that motor-driven brush machines extract the pile of the carpets cleaned. Most people are well aware that there is always a certain amount of loose pile on a new carpet which has to be taken off by a motor-driven machine that is employed, but the users of these machines are not inclined to appreciate the fact that they are destroying their carpets when they find that they have extracted pile of nap, even after constant use of a motor-driven brush machine. This is readily proved by an examination of the contents of the dust bag.

Embedded grit or dust extraction from any fabric is purely a question of suction, but that suction must be sufficiently high to loosen and pull the dirt out of the fabric.

It is possible to obtain electric suction cleaners, which are solely suction cleaners, and not a combination of a vacuum cleaner and a brush machine, which have ample suction to extract all the embedded grit and dirt out of any fabric without brushing out the pile or nap.

A recent test, carried out in one of the most efficiently equipped research laboratories in the world, proved that the "Magic" suction cleaner—no brush—extracted within five minutes 97 per cent. of the dirt from a saturated carpet, against 61 per cent. extracted by an American machine.

Yet intending purchasers of cleaners should well consider the different merits of the various machines available prior to purchasing, bearing in mind that carpet cleaning comprises only one of the duties of a suction cleaner. Hanging tapestries, chairs, beds, book-cases, pianos, and stairways, &c., have to be cleaned, and there are various machines that have to rely upon suction alone, and this is where the American vacuum cleaners fail, because they have insufficient suction to operate efficiently.

Magic Appliances, Ltd.

London, S.E. 1.

August 22nd, 1921.

Flickering Light.

I have read with some interest the report on Factory Lighting, with its suggestions as to the production of flickering and uneven light.

Also I noticed at the British Industries Fair, Birmingham, our principals' stand was supplied with a very flickering light. On inquiring the reason of this, I was informed it was due to the supply being at 25 periods in that part of the Fair buildings (other parts were supplied with d.c.).

Now I see that 25-period supply is to be standardised in the Birmingham and Shropshire and Worcestershire power area, and this makes me wonder if lighting is to be on the 25-period system, and whether this will be suitable for factory lighting. Speaking personally, I found it highly fatiguing and discomforting at the Fair, and would rather have oil lamps in my home than this.

You will understand that I am not an electrical engineer, and this is my first acquaintance with a 25-period lighting supply. I am a constant visitor at a colliery where it is used for power, but they have a separate d.c. lighting circuit, and say their a.c. supply is unsuitable for the purpose.

L. R. I.

August 19th, 1921.

Accumulator Froth.

I have noticed that when a celluloid accumulator has been placed on charge for two or three hours a froth oozes through the vent plug.

This never happens with accumulators other than of the celluloid type. The accumulators are always charged at the rate specified by the makers. Could you please tell me the reason?

August 17th, 1921.

Curious.

Testing and Repairing Magnetos.

On the subject of magneto repairs in your issue of August 19th, I quite agree with Mr. Perry that there were Service men who did not have the slightest idea of testing or repairing a magneto. But I saw quite good repairs carried out by Service electricians. The repairs consisted of testing, re-winding, re-magnetising, drawing off and fitting new slip-rings and ball-races, &c. After the repair, the parts were tested, and the whole assembled and run at various speeds, and the timing was checked before being passed out of the shop. An electrician when out with a repair lorry was only provided with a pair of pliers, a roll of adhesive tape, a screw-driver, and a few tools borrowed from the fitter's kit, so he could not do much away from the shop in any case.

J. H. Owen.

Ruabon.

August 21st, 1921.

I quite agree with all the remarks of Mr. J. Perry on this subject, particularly those about ex-Service electricians. My

experience is that the only magneto repair ever done by a Service "electrician" was to take off the magneto, scrap it, and replace it with a new one. I am quite satisfied that there are one or two firms which have a good system of dealing with repairs, but they guard it as a "trade secret," and think it is to their advantage to do so—an idea which has been exploded long since in other branches of electrical work. Surely this lack of knowledge (or apparent lack) on one of the most every-day matters in the electrical industry is a disgrace to this industry, which prides itself on having applied scientific methods and theoretical principles to its practical work more closely than any other industry.

The only way in which this can be cleared up is by everybody placing on record the best methods, tests, machines, and materials he has used or seen used; it should then be fairly simple to pick out the best of these good methods, and as a result everybody would benefit.

Would Mr. J. Perry let us have a sketch of the infallible "race puller" he mentions?

Mag.

August 20th, 1921.

Oil Consumption and Prices.

The writer has been specially interested in the letters contained in your issues of July 25th, August 12th and 19th, referring to "Oil Consumption and Prices."

As no mention has yet been made of the consumption of oil in high-speed steam engines, perhaps the following information will be interesting to readers of the ELECTRICAL REVIEW.

At a neighbouring colliery a 400-kW high-speed steam engine has been running practically continuously for eighteen months, always up to load and very often 25 per cent. overloaded, and during this time has used 50 gallons of oil. The temperature of the oil has never exceeded 110 deg. F., and the engine has required no maintenance attention whatsoever. With the capacity of the engine in kW as 400 and the kWh generated per week as 67,200, we find the oil consumption to be .0000097 gal. per kWh generated.

On comparing this consumption with those mentioned in your issue of the 12th inst., it is at once seen to be exceptionally low—almost incredibly so. The result, however, is obtained by the introduction of a recently patented oil-cooler working in conjunction with the engine. This cooler is also adaptable to steam turbines and internal-combustion engines fitted with forced lubrication.

Robert Scott,

The Economy Oil Cooler Co.

Swansea.

August 22nd, 1921.

The E.P.E.A. Schedule and Economy Stunts

The insistent craze for economy, which is so prominent a feature in public life at the present time, is doubtless the inevitable aftermath of the orgy of expenditure during the war. The necessity for retrenchment in every direction in which such can reasonably be accomplished is obvious, and most people are awake to the fact that the spendthrift habits acquired in recent years must necessarily be replaced by those of greater prudence.

Unfortunately, to many minds economy is synonymous with low wages. The more or less drastic cuts in the remuneration of employes, which have been, and are being effected, is evidence of this point of view. "Wages must come down" is preached to us from the pulpit of the Press; shrieks at us from every boarding.

As with wages, so with salaries, and it would be too much to hope that the "emoluments" of the technical staffs in the electricity supply industry should escape the prevalent epidemic of economy.

In point of fact, there have been two recent determined attempts to effect a radical reduction in staff salaries and to throw overboard the E.P.E.A. Schedule, viz., at Dover and Perth. In both cases, thanks to the resolute front shown by the members of this Association, the move was successfully countered.

It is well known, of course, that the Schedule includes a sliding scale for the periodical adjustment of salaries according to the Government figures for the cost of living, but this provision evidently was not sufficient to satisfy the voracious appetite of the Hotspurs of economy, whose zeal for retrenchment rendered them oblivious of the fact that they had but recently accepted and approved of the Schedule as a fair and satisfactory scheme.

Although victory has favoured the cause of the intended victims of a *coup de main* in these two instances, there is little doubt that, despite the object lessons of Dover and Perth, other attempts will be made to upset the Schedule, either openly or in ways that are less obvious though none the less dangerous. In every case, it is the firm intention of the E.P.E.A. to resist by every means in its power. It is determined to maintain unimpaired the "Bill of Rights" which has received the approval of both sides of the National Joint Board, and which, with very few exceptions, has been accepted by every under taking in the Kingdom to which it is applicable.

A significant feature of the attacks made on the Schedule has been the complete disregard shown by the aggressors for the machinery erected for dealing with all matters pertaining to the salaries and working conditions of technical engineers, that is, the District Joint Boards. It is no secret that the E.P.E.A. pins its faith to Whitleyism as the best existing means for the preserving of peace and the securing of justice in industry. Whether Whitleyism will be the ultimate solution of the problem is a matter for the future, but until a better system is devised, the Association will refuse to countenance any attempt to short-circuit or to ignore the established tribunals for the consideration and settlement of grievances and disputes. It consistently adheres to constitutional procedure itself, and it expects others who are parties to and are represented on the Joint Boards to do likewise.

In the event of an undertaking desiring a variation in the interpretation of the Schedule owing to particular circumstances, its proper course is to lay its views before the D.J.B., when due weight will be given to any arguments brought forward and a fair decision arrived at after careful consideration of the case. The Board exists for that purpose. To resort to arbitrary methods and without reference to the body constituted for the deciding of precisely such cases is to revert to the chaotic conditions prevalent in the bad old days before the idea of Whitleyism had taken coherent form.

It is to be hoped—though one must be careful not to be over-sanguine—that the exemplary lessons of Dover and Perth have been duly noted and taken to heart by all other undertakings, and that there will be no further attempts at similar high-handed and unconstitutional action.

Should such unfortunately occur, the E.P.E.A. will be found no more disposed to take it lying down than it has been shown itself, for it is after all very much like the cat, which is "un animal méchant, quand on l'attaque, il se défend."

W. Arthur Jones,
General Secretary.

Electrical Power Engineers' Association.

London, S.W.1.

August 19th, 1921.

The Electrical Trades Union and Non-Union Labour.

It is amusing to read in your current issue of the latest edict uttered by the London Executive of the Electrical Trades Union, placing a ban upon the connecting up of installations in buildings wherein the employés are not trade unionists.

Do they really think the whole community is going to bow down to them and obey their laws? In these days of slack trade and widespread unemployment, it is no time to clog the wheels of industry and hamper trade as these "dog in the manger" followers are attempting to do.

The obvious solution to the present dilemma would be for Stepney Corporation's engineer to order his men to make the necessary connections, and should the "chosen few" refuse to obey orders, there are plenty of non-union men out of work who will be only too glad to take their places.

Non-Union.

August 15th, 1921.

POWER FACTOR.—I.

By E. W. DOREY, A.M.I.E.E.

INCREASING attention is being given by the engineers of supply undertakings to the improvement of power factor, but until such time as the supply undertakings in general adopt a tariff which incorporates some form of charge on a kVA demand basis the installation of apparatus for the improvement of power factor will not be given the attention which it merits.

It is a generally accepted fact that the power factor of the load is the concern of the consumer, and is controlled by the consumer, therefore logically the consumer should improve the power factor, but in turn should get some benefit by way of reduction of the bill for improving the power factor, and thereby reducing the kVA demand. Again, it is obviously the correct thing to effect the improvement at the source of the trouble, viz., the consumer's load.

The supply of cheap electrical energy is vital to the interests of this country, and to obtain this we must have the maximum of economy in working. The linking-up of power stations and the construction of super-stations are all working to this end, but it is doubtful whether sufficient consideration is being given to the question of low power factor. The maximum economy of working cannot be obtained unless the general power factor of the system is high.

The power factor of the station may be high—even as high as unity—but it does not follow that, so far as power factor is concerned, the maximum economy is being obtained, and to illustrate this point a simple example will be taken as follows:—

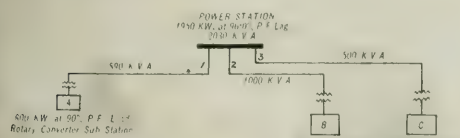


Fig. 1.

It will be seen that the load of the power station in both cases is identical, but with conditions as in fig. 1, although the power factor of the station is 96 per cent. lagging, maximum economy, so far as distribution is concerned, is by no means being obtained.

By the installation of, say, static condensers at sub-

stations "B" and "C" to improve the power factor at these points to 89.6 per cent. lagging, and by running the rotary converter sub-station "A" at unity power factor instead of 90 per cent. leading (with reduced excitation losses), we get precisely the same result at the power station, but with obviously improved results on the distribution network as follows:—

	As fig. 1. kVA.	As fig. 2. kVA.	Saving. kVA.
Load on power-station	2,030	2,030	—
Load on feeder (1)	890	800	90
Load on feeder (2)	1,000	896	104
Load on feeder (3)	500	394	106
Totals: 1, 2 and 3	2,390	2,084	306

If it be assumed that the system as figs. 1 and 2 is to be laid out to meet the respective conditions, then fig. 2 would show the following saving against fig. 1:—

	Reduction.
Power-station switchgear capacity	...
Distribution feeder capacity	...
Sub-station transformer capacity	...
	306 kVA.

To effect the improvement of power factor stated, assuming a frequency of 50 cycles and a normal medium pressure of supply would cost about £1,800, or in other words, the condensers would cost the equivalent of approximately £6 per kVA of reduction in load. Again, there would be a very considerable saving in the running costs due to reduction in excitation losses of the rotary converter sub-station. (It is assumed that the losses in

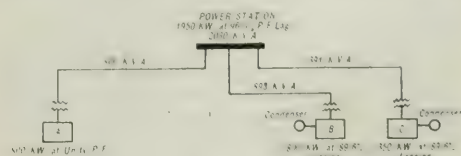


Fig. 2.

the mains would remain the same, as the section would be reduced in fig. 2.)

An expenditure of £6 per kVA for power-station switchgear, feeder mains, sub-station transformers, and sub-station switchgear will not carry very far, and although an apparently unpromising example has been

chosen, it will be seen that the improvement of power factor would undoubtedly result in improved overall economy both as to capital costs and running costs.

It is obviously impossible to disassociate capital costs and running costs, and power factor has an important bearing on both. The power factor meter at the power station gives no indication whatever as to the conditions on the distribution network, as will be seen from the example given above. It is essential, therefore, that to ensure a supply of electrical energy at a low figure the problem of power factor be dealt with on a sound basis by keeping the power factor of the consumer's load at as high a figure as is reasonably possible.

A HIGH-RESISTANCE BREAK TEST OF SUBMARINE CABLE.

By J. RYMER-JONES.

In *re* "high-resistance break test," based on both the measured resistance up to, and through, the break in the cable conductor, in combination with the observed capacity, the Rymer-Jones means of easily perfecting the balance adds considerably to the value of a dead-beat marine galvanometer for localising, at sea, the position of a high-resistance break, by the Rymer-Jones test; because it will be recognised that the better the coil is *balanced*, the more steady and comparable will be the capacity *throws* observed while the ship is pitching and rolling.*

In saying this, the writer wishes it to be understood that observations made from the shore (where everything is quite steady) with a loose-wire suspension; and where the galvanometer can be made much more sensitive; and where, moreover, the consideration of *balancing* does not come in, will always be much more exact because the swing is comparatively slow, and therefore more easily read. On the other hand, on board ship the suspension must necessarily be very taut, and the throws comparatively quick and abrupt; so unless they are tolerably *regular* and the limit of each throw is, therefore, approximately known (*i.e.*, supposing that the fault under test does not vary much) the true value of the throw cannot be read with absolute certainty; and the number of reliable throws obtainable in a given time is considerably lessened.

Moreover, an ordinary "Kelvin" *astatic* galvanometer, whose coils can be connected differentially, is very suitable for use *on shore*; for, although not *dead-beat* when measuring the conductor part of the circuit, it is very suitable for observing *capacity* throws. Indeed, it was with such an *astatic* galvanometer that the writer first made his tests when localising the positions of breaks, of very high and differing resistances, which gave the remarkably exact results as published in the *ELECTRICAL REVIEW* of June 24th, 31st, and August 7th and 14th, 1908, and reprinted in pamphlet form.

At the end of the same pamphlet will also be found the effect of *retardation* in reducing the *capacity* throws below their true value, when observed through long lengths of cable extending from the testing station to the broken end, which retardation has to be taken into account (according to the kind of galvanometer employed) when evaluating, from the observed readings, the distance of the *high resistance break*.

As the two "balancing" wires are at right angles to each other, and both pass exactly through the mechanical centre-line of suspension, altering the position

of the *threaded wire*, to equalise the weights, say, at the back and front of the coil, should not make any change in the degree of balance brought about by previously adjusting the position of the wire intended to equilibrate the weights of the two *sides* of the coil. Consequently, one adjustment can be made immediately after the other. In other words, the two adjustments are quite independent of one another in their effect on the existing degree of balance. It is on this fact that the extreme simplicity and success of the balancing process depends; time is saved, and risk of damaging the coils, by unnecessarily frequent handlings, is obviated.

HYDRO-ELECTRIC POWER IN FRANCE.

PROSPECTIVE WATER-POWER DEVELOPMENTS.

All the water power resources in France which are available for use in connection with the production of electricity are to be mapped and harnessed, and rendered serviceable, where lacking and where it has hitherto been, and still is, furnished by steam power, or in certain cases even imported. This is the broad scheme of the Administration, the present situation being set forth in the accompanying map, fig. 1, on which the areas in which hydro-electric energy is generated are shown in circles (the sizes of which are proportional to those of the installations), and the areas in which electricity is generated by steam power are indicated by squares, similarly dimensioned.

Arranged according to size, the existing water-power plant is as follows: In the south-east, a group of 2,500,000 h.p.; in the south-west, one of 800,000 h.p.; in the middle, a group of 700,000 h.p.; and in the east, a group of 500,000 h.p.

The steam-driven plant is distributed throughout the whole of the north-west, with 600,000 h.p. at Paris, 300,000 h.p. in the coal districts of Arras, 200,000 h.p. at Rouen,

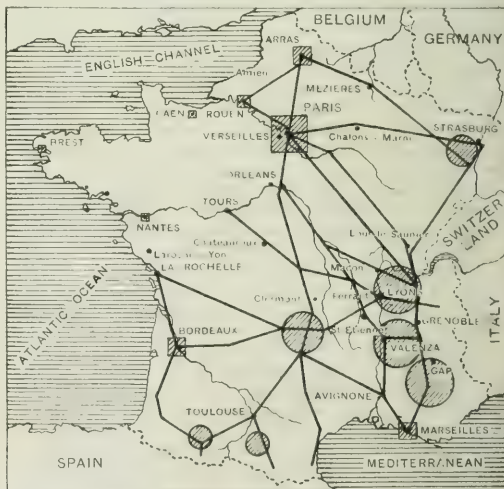


FIG. 1.—CENTRES OF PRODUCTION OF ELECTRICITY IN FRANCE AND THEIR INTERLINKING NETWORK.

100,000 h.p. at Caen, 100,000 h.p. at Brest, 100,000 h.p. at Nantes, and, by way of exception, 300,000 h.p. at Marseilles. The network of lines in the Government's programme will link up all these generating stations, in order to obtain the systematic utilisation of the whole of the water and steam-power resources in the centres of consumption, taking account at the same time of developments under way and the idea of securing the utmost continuity in working. The programme also shows how it is possible, in the ordinary way, to convert the steam stations into reserves and standbys, as well as some of the water stations.

As a principal result, the consummation of the network will tend to bring to zones wholly unprovided with energy—and Paris is the biggest centre of consumption of the whole country—the energy available in the Alps and along the course of the Rhône, besides utilising, within the bounds of practical economy, energy generated by steam-driven plant in coalfields or by local waterfalls. Thus Paris, which is 165 km. from Arras, and about 500 km. from the principal south-eastern centre of water-power production, may be served

* See Rymer-Jones' galvanometer and particulars of suspending, and balancing, the coil as explained in Patent Specifications Nos. 108,949, 19, 17, and No. 117,028, 7/1/18.

The galvanometer coils can be connected in *series* or *differentially*.

from two quarters, according to the economic conditions of production of the energy. The scheme does not contemplate setting up an entirely new distribution network, but the provision of suitable section posts for the reinforcing of existing networks serving consuming areas, with bold offshoots to the right or left. French technical experts thus intend, on one hand, to facilitate the progressive extension of the networks already in existence in all districts contemporaneously; and, on the other hand, avoid the difficulty of the parallel operation of power stations at great distances apart, and also general dislocation in cases of overload at any point in the network. There will thus be many high-pressure networks and many at lower pressures, but the dangers from the crossing of mains will be suitably guarded against. The scheme for the utilisation of the power recoverable from the Rhône, which is typical of the rest, is arranged in six groups, each with its respective generating stations, as portions (fig. 2).

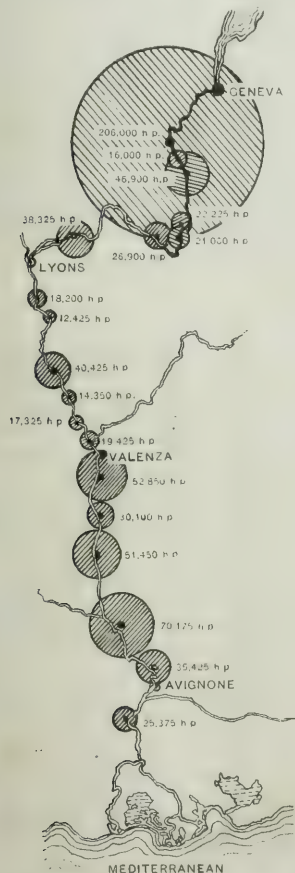


FIG. 2.—HYDRO-ELECTRIC POWER RECOVERED FROM THE RHÔNE.

In the French portion of this river some 770,000 h.p. is obtained, of which more than 260,000 h.p. is got in the higher part; and over 100,000 h.p. in the Lyons and neighbouring districts. The first group, from the Swiss border to the Canale Savière, has three generating stations—Genissiat, 206,000 h.p. capacity; Seysel, 16,000 h.p.; Bourein, 46,900 h.p., or a total of 268,900 h.p. The second group, from the Canale Savière to Saône, Bellevue No. 1, 22,225 h.p.; Bellevue No. 2, 21,000 h.p., and Bellevue No. 3, 26,900 h.p., or a total of 70,125 h.p. The third group consists of one generating station, Villette, of 38,325 h.p. capacity, and embraces the district of Lyons. The fourth group, from Saône to the Isère, has five generating stations—Ternay, 18,200 h.p.; Vienne, 12,425 h.p.; St. Rambert, 40,425 h.p.; St. Vallier, 14,350 h.p., and Tournon, 17,325 h.p., or a total of 102,732 h.p. The fifth group, from the Isère to Gardon, has six generating stations—La Roche du Gluc, 19,425 h.p.; Valence, 58,850 h.p.; Logis Neuf, 30,100; Montelimar, 51,450; Mondragon, 70,175; Sorgues, 35,325, a total of 265,335 h.p. The sixth group, from Gardon to the sea, has one station, Aramon, 25,375 h.p. The grand total of the Rhône is thus 770,775 h.p.

The technical method of division and crossing of the general network will help the carrying out of the political idea of leaving the production of electricity to private initiative, stimu-

lated solely by actual local requirements for industrial purposes, and controlled by the principles of strict economy. With neither industrial nor private initiative forthcoming to undertake the erection of generating plants, then the State will step in, as it has done in the war-devastated areas. The amount of coal that the scheme will save will be very large.—*L'ingénieur Italien*

STATUTORY COMPANIES AND THE LAW OF NUISANCE.

FROM A LEGAL CONTRIBUTOR.

A RECENT case in the King's Bench Division will serve to remind those who carry on manufacturing processes in large cities that they are exposed to actions for nuisance. In the case in question, it was alleged that the defendants, a gas company, who had a coal conveyor at Wapping, had caused a nuisance in the neighbourhood by allowing coal dust to escape from their conveyor. They pleaded, in extenuation, that they did their best to cope with the nuisance and to keep the coal dust within its proper limits; that the air of Wapping could not be expected to be like that of a breezy moor. It was also urged that they had carried on business on the site where their works now stand continuously ever since the year 1823. One other defence was also put forward. It was suggested that the defendants were protected by the Public Authorities Protection Act, 1893. But it was in vain! Mr. Justice Shearman held that a nuisance had been caused and that the defendants were liable to pay damages.

This case appears to point a moral for electric lighting supply authorities who necessarily carry on the production of electricity in crowded areas. If, in the course of their operations they create a nuisance, are they liable, and, if so, to what extent? They are not excused, by statute, if they cause a nuisance. Their liability is the same as that of an ordinary manufacturer.

There is one plea advanced on behalf of the defendants in the case just mentioned which is often put forward in these cases—namely, that the defendants had been in the same place and done the same thing for a number of years. But this is no answer to an action for nuisance. If Brown builds a house next door to Jones's factory, from which nasty odours, or disagreeable noises are emitted, it is no answer to an action for nuisance for Jones to say that Brown knew what he was in for when he came to the district. Similarly those who complained of the coal dust from this Wapping gas works. But there are certain peculiar forms of action for nuisance to which electricity authorities are exposed, and "product" which is generated at the station may do damage to premises and property far away. For example, side by side along many of the principal streets in the City of London there are laid electric mains, gas pipes, water pipes, and mains for the conveyance of water under hydraulic pressure. When subsidences take place forces are let loose which begin to react one upon the other. Who is liable? Damage is sometimes done by the bursting of a gas main; the effusion of gas into an inspection chamber, and the inevitable explosion. Is the gas company liable?

We may refer to the case of the Charing Cross, West End and City Electric Supply Co. v. London Hydraulic Power Co., which was decided in 1913. The Charing Cross Co. supply electricity in the City of London under a provisional order which authorises them to place their cables under the surface of the streets. They brought an action against the London Hydraulic Power Co., who have by statute the right to place in the streets of the City of London mains containing water at high pressure used to supply hydraulic power, and alleging that water escaping from these mains damaged their cables, and that it either escaped through the defendants' negligence, or, having escaped, was a nuisance doing them damage, and they claimed damages. The defendants replied that they were not negligent, and that in the absence of negligence they were not liable, especially as they contended that the fractures of their mains were caused by subsidences due to the laying of the plaintiffs' pipes. This case came before Mr. Justice Scrutton (as he then was). In giving judgment, on July 5th, 1913, he said that the hydraulic company had been guilty of no negligence either in their system or its working. This finding must, no doubt, have been gratifying to the hydraulic company; but it must have been a little disconcerting to find that this favourable opinion notwithstanding, his Lordship felt bound to decide against them!

Upon what principle did he so decide? It was long ago declared that any man who brings anything on to his land which may escape and do damage to his neighbours' property, must keep it there at his peril, and the very fact of its escaping is, *prima facie*, evidence of negligence. This principle was settled in relation to water in the case of Fletcher v. Rylands (1868, 1 L.R. 3 H.L.C. 330). There the defendant had made an artificial lake on his estate. The water broke through and flooded certain shafts in a mine belonging to

the plaintiff. The defendant was held liable. Mr. Justice Blackburn stated the principle to be that anyone who brings on to his property something which is not naturally there, harmless to others so long as it is confined to his own property, but which he knows to be mischievous, if it gets on his neighbour's land, must keep it at his peril, "and ought to be obliged to make good the damage which ensues if he does not succeed in confining it to his own property." It was the very essence of this decision that the plaintiff was injured through no fault of his own. Quoting Mr. Justice Blackburn, Lord Curzon, in giving judgment in the highest legal tribunal in England—the House of Lords—said, at page 340 of the report: "The person whose grass or corn is beaten down by the escaping cattle of his neighbour, or whose mine is flooded by the water from his neighbour's reservoir, or whose cellar is invaded by the filth from his neighbour's privy, or whose habitation is made unhealthy by the fumes and noxious vapours of his neighbour's alkali works, is damaged without any fault of his own."

The learned judge might have had some difficulty in applying the doctrine of *Rylands v. Fletcher* to water under hydraulic pressure had it not been for the fact that the principle had already been followed in relation to electricity.

In the case of *Midwood & Co. v. Manchester Corporation* (1905), 2 K.B. 597, the defendant Corporation were empowered to supply electric energy for lighting purposes in the City of Manchester, and were accordingly empowered to lay down mains under the streets, and were bound to give a supply to persons requiring it. Clause 70 of the statute under which they worked provided that nothing in the order should exonerate the undertakers from any indictment, action, or other proceeding for nuisance in the event of any nuisance being caused by them. A leakage of electricity occurred in one of the

mains which fused the wire, and the fusing of the wire caused the compound in which the mains were laid to be volatilised. Large quantities of gas were thus generated which caused an explosion and set fire to the plaintiffs' house. It was held that apart from any question of negligence, the Corporation were liable for a nuisance by virtue of clause 70 *supra*. The judge came to this conclusion with evident reluctance, and gave a distinct hint that the day may come when the use of the highway underground for pipes, cables, and the like will be looked upon as ordinary normal use. Thus he said towards the end of his judgment: "But for *Midwood's* case, I should have some doubt whether the defendant was not protected as a person using the road, in the ordinary way, and therefore not liable to persons damaged by the user unless his negligence was proved on the lines of such cases as *Blake v. Wolf* (1898) 2 Q.B. 426 and the authorities cited therein. For I think it is now an ordinary use of a road to carry mains for water, ordinary or hydraulic, gas, and electricity underneath it, and that there is something to be said for the view that all these co-licensees take the road subject to the risks arising from the ordinary use of the mains of their co-users, so long as the latter are not negligent. But this defence was open in *Midwood's* case, and was not sanctioned, and Section 17 of the Act and similar clauses may be meant to exclude it."

In the result, therefore, the hydraulic company have brought a dangerous thing into the road, and the dangerous thing has escaped through the subsidence of the soil. This is just how the water escaped in *Rylands v. Fletcher* (*supra*) where the defendant was held liable. It would seem that in this case also the defendants are liable for the amount claimed with costs. The same measure of justice will apply to the plaintiffs if their electricity escapes and does damage.

BUSINESS NOTES.

Bankruptcy Proceedings.—T. HYDE, electrician, 180, London Road, Croydon.—Receiving order made August 16th on debtor's own petition. First meeting August 26th at 132, York Road, S.E. Public examination October 20th at the County Court, Croydon.

A. LORD, electrical contractor, Burnley.—Last day for proofs for dividend August 31st. Trustee, Mr. C. H. Plant, O.R., 13, Winkley Street, Preston.

A. E. DICKINSON (Crown Electrical Co.), electrical engineer and contractor, Leeds.—August 31st is the last day for proofs for dividend. Trustee, Mr. H. C. Bowling, O.R., 24, Bond Street, Leeds.

A. KERSHAW and C. H. WOOD (Kershaw & Wood), electrical engineers and merchants, Dewsbury.—First and final dividend of 4s. in the £, payable at 155, Norfolk Street, Sheffield.

W. HEDGECOX, electrical engineer, 121, Salop Street, Wolverhampton.—First and final dividend of 1½d. in the £, payable August 29th at the Official Receiver's Office, 30, Lichfield Street, Wolverhampton.

Dissolution of Partnership.—MAURICE & COWARD, 139, Oxford Street, London, W.1.—Messrs. C. B. Maurice and H. W. Coward have dissolved partnership from 6th inst. The business will be carried on under the title of Coward & Co. Debts will be attended to by Mr. Coward.

Company Liquidation.—F. HUSBAND, LTD.—Meeting called for September 19th at 119, Finsbury Pavement, E.C., to hear an account of the winding up from the liquidator, Mr. W. A. J. Osborne.

Receiver Appointed.—F. J. Shenton & Co., Ltd.—Receiver and manager, Mr. H. A. Allison, Kennans House, Crown Court, Cheapside, E.C., appointed August 10th by order of the Court.

Deed of Assignment.—A. Gray (Gray's Electrical Co.), 9, Denmark Street, Charing Cross Road, W.C.2. Particulars of claims must be sent to the trustee (Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement) by September 12th.

Trade Announcement.—With reference to a recent announcement, the appointment of the British Central Electrical Co., Ltd., as agents for Messrs. Richardsons, Westgarth & Co., Ltd., relates only to London, Midlands, and South Coast.

Catalogues and Lists.—THE BRUSH ELECTRICAL ENGINEERING CO., LTD., Loughborough Works, Loughborough, Leicestershire.—A well-produced brochure dealing with the construction and capabilities of Brush-Ljungström turbines and alternators. Many illustrations of details are given, as well as detail drawings.

THE D.P. BATTERY CO., LTD., 11, Victoria Street, S.W.1.—A folder illustrating and describing a specific gravity tester for all types of car and truck accumulators.

DIELECTRIC TELEPHONE CO., LTD., Altrich Road, Mitcham Road, Croydon.—A descriptive pamphlet of a new calling system for factories and offices.

MESSRS. RAYNER & HEALD, LTD., Duke Street, Derby.—Stock list of 2 and 3 phase induction motors of from 1 to 45 h.p.—slipping and squirrel-cage types.

MESSRS. GREY & CO., 7, Market Place, Oxford Circus, W.1.—A pamphlet advertising "Platac"—a metal for electrical contacts.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—An illustrated pamphlet dealing with the "Terra-Grip" continuity system for conduit installations.

MESSRS. BELLING & CO., Derby Road, Edmonton, N.18.—A number of illustrated pamphlets dealing with "Belling" cooking and heating appliances.

MESSRS. J. & W. B. SMITH, LTD., 15-23, Farringdon Road, E.C.1.—Catalogue No. 151, a price list of switches, fuses, adaptors, ceiling roses, flexible wires, cables and other electrical accessories.

MESSRS. F. A. WILKINSON & PARTNERS, LTD., Hatfield, Herts.—A small brochure describing automatic high-speed wind dynamos (*vide* ELEC. REV., April 29th, 1921, p. 545).

MESSRS. ANDERSON, BOYES & CO., LTD., Flemington Electrical Works, Motherwell.—A profusely-illustrated catalogue of mining type ironclad switchgear, lighting fittings, &c., of compact and robust design.

THE NEW ROTAPLUNGE PUMP CO., LTD., 24, Broadway, S.W.1.—A number of illustrated and priced lists dealing with "Rotaplunge" pumps and pumping sets for hand-operation and various types of drive.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., 20, Brazennose Street, Manchester.—Circular No. 1790/1, an illustrated description of motor equipments for main rolling mill drives.

For Sale.—By direction of the Disposal Board, Messrs. King & Chasemore will sell by auction on September 22nd, at Southwick, Sussex, electrical plant and machinery, including motors, rotary converters, electric winches, cranes, &c.

Aldershot Urban District Council Electricity Department invites offers for one 4-cylinder, 135-kW Carel-Peebles Diesel set.

By direction of the Disposal Board, Messrs. Geering and Colyer will sell by auction, at Hartley Ferry Factory, Faversham, on September 14th and 15th, electrical equipment consisting of electric generators, motors, dynamos, lifts, pumps, &c., and on September 15th and following days, at the Royal Dockyard, Woolwich, Messrs. L. Farmer & Sons will offer by auction plant, machinery, electrical equipment, telegraph, telephone, and wireless stores. Full particulars are given in our advertisement columns in this issue.

By order of the Disposal and Liquidation Commission, Messrs. Fuller, Horsey, Sons & Cassell will offer by auction on September 20th, at Greenwich, chemical plant and machinery, &c.

Fusion of Swedish Telephone Manufacturing Concerns.—According to *Svensk Handelstidningen*, the Cedergeren Co. will hold an extraordinary meeting on August 30th regarding the fusion with the L.M. Ericsson Co. at which it will be proposed that the agreement be accepted. Although the agreement was rejected on June 17th, it is stated that many of the opposing shareholders have changed their opinions regarding the real position of the L.M. Ericsson Co. If the agreement is approved one share of the Cedergeren Co. will probably be exchanged for each ten shares in the Ericsson concern.—*Reuter's Trade Service* (Stockholm).

Miners' Conference and F.B.I.—We have received the following communication from the Federation of British Industries:—

"At the Miners' Conference at Llandudno on Friday last, Mr. Gavan Duffy was reported generally in the Press as having said that the Federation of British Industries had 375 of its members in the House of Commons—this group, in his opinion, possessing complete control over the Government. Statements of this kind have been made by responsible labour leaders in every part of the country, though without the slightest foundation. It seems necessary, therefore, to correct an error which such a large number of Labour publicists are making. The facts can be clearly stated as follows:—

"The Federation of British Industries takes no part in politics whatever, and has never at any time supported or worked for Parliamentary candidates.

"It happens in the ordinary course of events that there are between 70 and 80 Members of Parliament who are connected with firms which are members of the Federation, but in no single instance can it be said that the Federation had any part in these being elected."

International Exhibition in Brazil Next Year.—The Centenary of the Independence of Brazil will be celebrated at Rio de Janeiro in the autumn of next year. In connection with the celebrations there will be an extensive Brazilian National Exhibition, and also an International Exhibition. A number of nations have been invited to participate, and many of them, it is understood, have already accepted the invitation. The celebrations will be on a magnificent scale, and will include an international naval display. It is quite certain that it will be largely attended by the peoples of all the South American States, and should afford an unusual opportunity for those interested in trade with Brazil to develop their business. The social atmosphere in Brazil is said to be most favourable towards the British Empire. The friendship is the result of long association and the vast British interests which have been developed in Brazil over a long period of years, notably in connection with their railways. It is calculated at the present time that there is nearly 300 millions of British capital invested in the country which at the same time is being subjected to intensive propaganda by rival nations. It is probable that official participation by the Empire will be decided upon at an early date. Owing to the limitations of space available for the erection of national pavilions such participation fortunately need not entail very much expenditure, but while it affords opportunities for collective exhibits on behalf of the various nations of the Empire, and of those manufacturers and commercial bodies most intimately interested, it is insufficient to provide space within the national pavilion for individual exhibits of British firms. It is understood, however, that space for these is available to the extent of some 100,000 superficial feet over adjoining quays, and that it may be found possible to provide space within the city itself for exhibits to be made. In the opinion of the British Chamber of Commerce in Brazil the opportunity afforded to British manufacturers, not only of the United Kingdom but of the whole Empire, is a unique one, and should not be lost sight of. The exhibition will open some time early in September, 1922, and it is hoped that full information may be available at an early date.

New French Companies.—A new company has lately been formed in Paris (37, Rue Pierre Charron) with a capital of 38,000,000 fr., and the title La Société Union Hydro-Electrique U.H.E.

There has been formed at Grenoble (27, Rue de Turenne) the Société Hydro-electrique de la Basse Romanche with the object of developing waterfalls in the Department of the Isère, and more especially those on the right bank of the Romanche. The construction of one or several generating works is in contemplation. The capital of the company is 1,000,000 fr. in 500 shares.

At Levallois-Perret (Seine) has been formed into a company the Etablissements Paul Gadot with a capital of 2,600,000 fr. in 500 shares, 1,400 of which are allotted to M. Bertrand Parouty, as liquidator of the former concern of the same name. The company's operations are the manufacture, sale, and installation of electrical apparatus of all kinds.

The Engineering Wages Ballot.—The results in the ballot vote amongst the engineering and kindred unions on the proposed wages reduction have been officially issued to members as follows:—

	In favour.	Against.
Amalgamated Engineering Unions	71,862	63,624
Affiliated Societies	43,016	21,394
National Union of Foundry Workers	17,989	5,241
Societies affiliated to Federation of General Workers	42,278	18,710
	175,145	108,969

Majority in favour of acceptance, 66,176.—*Daily Dispatch.*

Book Notices.—"Some Notes on the Application of Oil Fuel to Steam Boilers, July, 1921." (11 pp.) Manchester: Taylor, Garnett, Evans & Co. (for the Manchester Steam Users' Association).—This pamphlet describes in some detail the advantages and disadvantages of the adaptation of coal-fired boilers to oil fuel.

A new arrangement has been adopted in the 1921 issue of

the *Electrician* annual tables of electricity undertakings (London: Bacon Press. Price 10s. net). Instead of the former form, the particulars of each undertaking are given separately; there is much to be said for this system, as tracing details across two pages often leads to errors. The details of generating and steam-raising plant, omitted during the war period, have been restored. Some information regarding oil-burning apparatus installed recently by several undertakings also appears.

"The Electrical Power Engineer," Vol. III, No. 2, August, 1921. Price 1d. Containing an instalment of a paper "Factors Affecting Power Station Efficiency," by J. N. Waite, A.M.I.E.E., and notes on recent happenings in the profession.

"The Mining Electrical Engineer," Vol. II, No. 11, August, 1921. Manchester: Association of Mining Electrical Engineers. The special articles include: "Early Electric Coal-Cutters," by E. Kilburn Scott; "Submersible Electric Motors for Mines' Pumps," by A. J. Ramsey; and "Tests on a Large Turbo-alternator," by W. D. Whewer.

"Journal of the American Institute of Electrical Engineers," Vol. XI, No. 8, August, 1921. New York: The Institute.—The following papers are included: "Electric Propulsion of Ships," by W. E. Thau; "On the Equivalence of the Two Theories of the Single-phase Induction Motor," by V. Karapetoff; "Voltage Regulation and Insulation for Large-power, Long-distance Transmission Systems," by F. G. Baum; "Dimensions and Output," by Lawrence E. Widmark; "Advances in the Art of Waterwheel Design and Settings," by W. M. White; and "Electrical Terminal Facilities," by C. S. McDowell.

"Financial Times Income Tax Guide." By H. W. Palmer. 1921 edition. London: *Financial Times*. Price 1s. net.

"Electrical Transmission of Energy." By W. M. Thornton. Pp. xii+116, figs. 49. London: Sir I. Pitman & Sons. Price 2s. 6d. net.

Holidays.—Messrs. E. Brook, Ltd., Empress Works, Huddersfield, announce that their works and offices will be closed from September 3rd to September 10th inclusive, for the annual holidays and stocktaking.

Electric Locomotives for Japan.—The Westinghouse Electric International Co. has received from the Imperial Government of Japan an order for two electric freight locomotives to be used in service in the neighbourhood of Tokio. These locomotives, which will weigh 62 tons and have a capacity of 1,000 h.p. each, will operate on the 1,500-volt direct-current system.—*Reuter's Trade Service* (New York).

The Engineering and Steel Trades.—Authorities speak of an approaching revival of the Sheffield steel trade.

The new steel works of Messrs. Baldwin at Port Talbot will be opened shortly. Orders for 17,000 tons of rails are said to have been received.

At Lincoln the position of the engineering trade has already improved, a number of important export orders for wagons, locomotives, &c., having been booked.

There is also renewed activity in connection with the blast furnaces of the Cleveland district.

Electrical Supplies in South Africa.—The *South African Mining and Engineering Journal* (Johannesburg), in its issue of July 30th, says: Trading in electrical goods in town and country remains pretty much the same; little activity is being shown generally, and apart from the usual repair work there is not much life in this section. Nor does the acknowledged inadequacy of the present power station, together with the very subdued scale of operations in the building trade, justify any promised improvement in the immediate future. As regards lamp prices, these are declining, and have already gone down about 10 per cent. Other lines remain without quotable change. Electrical wares from Britain are arriving steadily, with no present alteration in prices, but the tendency in consequence of the termination of the coal strike is towards lower levels, which may be felt, it is thought, sometime next month. Continental goods show no material change, but are, as previously pointed out, coming on to the market at prices much below British manufactures.

The National Bank of South Africa reports that German competition in South Africa has restarted in electrical machinery and electrical articles. Continental manufactures, it is said, are being offered at 20 per cent. less than English prices, and in many cases 50 per cent. cheaper, but the business in the market is inconsiderable as building trade operations are depressed.

An Indian Steel Contract.—According to a Bombay Press dispatch (*Exchange Telegraph Co.*) appearing in the London papers the fall in prices of steel is reflected in the tender for the supply and laying of 105 miles of water main in Bombay. The lowest tender was that of Messrs. Braithwaite, of Calcutta, which was approximately 256 lakhs of rupees (£1,640,000). The fact that the steel to be used is English, makes the acceptance of the tender of special interest. It was expected that American steel makers would be in a position to quote competitive rates, but the four tenders received varied between 377 lakhs (£2,520,000) and 609 lakhs (£4,050,000). The successful tenderers are said to be backed by Dorman, Long & Co. The next lowest tender, that of Sir John Jackson, was 350 lakhs (£2,333,000). The dispatch adds that "the result of the invitation of tenders is regarded as a triumph for English manufacturers."

Czecho-Slovakia.—**TRADE CUSTOMS TARIFF.**—Owing to the revision of the various Customs agreements between Czecho-Slovakia and other States all goods imported into Czecho-Slovakia will henceforth be subject to the general Customs tariff. —*Reuter's Trade Service* (Prague).

Prices Reduced.—The Automatic Telephone Manufacturing Co., Ltd., of Liverpool, has recently made considerable reductions in the prices of its "Need" heating and cooking appliances.

American Steel Workers' Wages.—The United States Steel Corporation announces that in view of the low selling price prevailing for steel, another reduction will be made in wages for the next month of 5 cents to 30 cents an hour. —*Reuter's Trade Service* (New York).

Syria.—In the course of a report on the trade of Syria (with special reference to Beyrout) for 1920, H.M. Consul-General at Beyrout mentions that two of the three public utility undertakings, the Tramways Co. and the Electric Light Co., give cause for complaint. The former's service is inefficient, the rolling stock requires renovation and the lines relaying. The Electric Light Co.'s power station is inadequate, so that the lighting of both of the streets and of private houses is very poor. The Gas Co., never a very prosperous concern, has ceased to function. It has just been invited to carry out the terms of its concession within six months, failing which it will lose it.

There is nothing definite to report as to the project for building a port at Alexandretta, but it will be realised in course of time. There are some schemes under discussion for obtaining electric power from streams in the Lebanon. A beginning has been made with one such scheme at the Nahr Ibrahim, north of Beyrout, but it has made little progress.

There is a vast amount of reconstruction and development to be done in Syria by the French to whom the mandate has been given. The difficulties are great and the complete reorganisation of the country will entail a large outlay of money. With the terms of the mandate not yet definitely approved, and the settlement of the country not yet completely effected, no striking developments can at once be expected, but progress if slow will undoubtedly be sure.

Leeds Tramways.—The seventeenth annual sports festival of the Leeds Tramways Employes' Social and Athletic Club took place at Headingley on August 17th, in the presence of a gathering of between two and three thousand spectators. The prize list amounted to about £120, and the events—for which there were many entries—included running, walking, and cycling races, most of which were open to entrants from other towns' tramway services. Music was provided by the Leeds Tramways Band. The Lord Mayor and Lady Mayoress and many members of the City Council and Tramways Committee were present.

Miners' Unions.—The National Engine-men, Stokers' and Electrical Trades Union has applied for affiliation to the South Wales and Monmouthshire Mechanical and Surface Workers' Union, as the Colliery Engine-men and Stokers' Association has been removed on its secession from the South Wales Miners' Federation.

Wages in the Contracting Industry.—A ballot vote is being taken of members of the Electrical Trades Union as to the acceptance or otherwise of a sliding-scale basis of remuneration for members employed on contracting work. The index figure of 150 will represent 2s. 3d. per hour, and for each variation of three points in the cost of living a corresponding increase or reduction in wages will be made, if an affirmative vote is recorded. —*Daily Herald*.

American Steel Production. The figures relating to electric steel for the last year are particularly interesting as showing the marked advance this process has made in the United States. During the year a total of 155,196 tons of electric steel was cast, as compared with 111,510 tons for the previous year and 108,236 tons during 1918. An increase of 43,686 tons is thus shown, representing an improvement of 39.11 per cent. on the last year's figures, and it may be noted that the total electric steel-casting production during 1920 was only a few tons short of the total output of the United States to the beginning of 1918, and was actually nearly 42 per cent. of the total electric steel production of the States up to the end of 1919. It may be noted, further, that the output of electric steel last year was only 3645 tons less than the total production of Bessemer, which was during 1918, and 50,000 tons less than the 1920 Bessemer figures. —*The Times* (London Correspondent).

German Pre-war Debts. The attention of British subjects resident in this country who have pre-war debts owing to them from companies outside Germany of German undertakings in Germany is drawn to the fact that apart from their remedy against the branch, they may be entitled to claim payment alternatively from the head office through the Enemy Debts Clearing Office. In the event of their being unable to do so, or in the event of such debts from the branch, British creditors will be well advised to file a claim against the head office with the Enemy Debts Clearing Office, General House, London, E.C. 4. It is essential, however, that any such claim should be received by the Clearing Office before September 30th.

Agency Arrangements in Constantinople.—Despite the depression and uncertainty which mark conditions in Constantinople, there are points worth examination in the report which the Department of Overseas Trade has just issued regarding trade and industry in Turkey.

Many of Britain's competitors have either resumed activities or paved the way for their resumption. For example, American firms and corporations which were totally unknown in Turkey in pre-war days have now established branches or have appointed agents. Italian competition, too, has to be met, as elsewhere in the Orient, owing to the advantage of geographical position, combined with an efficient merchant fleet.

Before entering into commercial transactions with firms in Turkey, of which the British manufacturer has no knowledge, he should invariably make inquiries either from the banks or the Consulate as to the integrity of the firm in question. There have been numerous cases during the current year of bands of swindlers who by their effrontery have pulled off successfully various commercial swindles.

A number of British firms have appointed agents and representatives in Constantinople and Smyrna, and a large portion of these are of foreign and in some cases of formerly enemy nationality. A Greek agent is liable to be called up for military service, and exemption is impossible. Stress cannot be too strongly laid on the inadvisability of appointing any other than a British subject as a representative. Cases have been reported of agents of foreign extraction obtaining representation of a British firm at the same time as of a firm of their own nationality, purely for the purpose of interfering with the former's sales. Largely owing to Russian influence in Constantinople advertising has become widespread. In pre-war days this science was in its infancy in the country. There are now numerous daily papers and weekly reviews, in which printed advertisements can be displayed to advantage, and in addition the whole town is covered with posters of all types of advertisements. The letterpress should be in French, and, if possible, Turkish.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries.

Sparta.—No. 404,410, Class 8.—Electric batteries. Fuller's United Electric Works, Grove Road, Chadwell Heath, Essex. May 20th, 1921.

Armalux.—No. 414,755, Class 8.—Electric primary batteries, electric wet and dry cells, &c. Arma Manufacturing Co., Ltd., 2a, Yonge Park, Seven Sisters Road, London, N. 4. April 29th, 1921.

J. Skinderviken.—No. 416,151, Class 8.—Electrical sound transmission instruments. Johan Skinderviken, 3, Colosseum Terrace, London, N.W. 1. June 15th, 1921.

The Drurion (lettering and design).—No. 415,552, Class 13.—Electric lamps, switches, sparking plugs, connections, and other like electrical accessories. J. M. Ukion and C. W. Drury, trading in co-partnership, Holborn House, 22, Gray's Inn Road, London, W.C. May 27th, 1921.

Engineering Employment in India.—As we so frequently receive postal inquiries regarding the chances of obtaining employment in overseas countries, it may be of interest to some of our readers if we quote from a letter recently written to *Indian Industries and Power* by Mr. Hugh W. Brady, as secretary of the Institution of Engineers (India), on the subject of engineering employment out there. He says: "Accounts of the hardships of the ex-service men now out of employment in large numbers in India are appearing in the Press. Many of the men are said to be trained engineers. Any such writing to me may have their names entered, free of all obligation, in the employment register maintained by the Institution of Engineers (India). Applicants for registration should (a) state nationality and date of birth, (b) give particulars of education and of engineering training, (c) give a synopsis of career, including experience in H.M. Forces and since demobilisation, (d) send copies only of testimonials, (e) state class of engineering work desired, and (f) not call at this office (Post Box 669, Calcutta) unless requested to do so. It is not considered likely that engineering employment can be found for any large number, but efforts will be made to put really well-trained engineers or engineering subordinates in touch with suitable vacancies."

The editor adds a foot-note to the letter stating that Mr. Brady has now been appointed Inspector of Factories of Bihar and Orissa, but letters to him or to the Institution of Engineers will receive prompt attention.

An Electrical Demonstration at Bournemouth.—The British Electrical Development Association informs us that Mr. E. Brontinan, of Parkstone, has arranged to give a lecture and demonstration on October 5th at St. Peter's Hall, Bournemouth. A number of prominent firms of electrical manufacturers and contractors are participating. An additional attraction, a "wireless" concert, is being arranged with the aid of the Marconi Scientific Instrument Co., Ltd.

Reval Port Improvements.—The Port of Reval is being enlarged to the utmost extent, and all modern improvements are being introduced in order to facilitate trade with Russia. —*Reuter*.

Inquiries.—The names and addresses of makers of machines for winding the cores of magneto-arrangements are required. The type needed has a hand-driven spindle, and is capable of holding different sizes of magneto cores. It is also fitted with some sort of reversible, geared, spiral drum, or a moving arm, to guide the wire on to the drum. A counting attachment is an extra refinement which can always be fitted afterwards.

The name of the makers of an electric curling iron bearing the letters "S.H.D.G." in the four quadrants of a circle, is required.

Rectifiers for the Chemins de fer du Midi.—We learn that in connection with the electrification of the above railway the Société Anonyme Brown, Boveri & Cie (the Swiss House of Power Rectifiers, Ltd.) has recently secured an important contract for the complete equipment of the five sub-stations of Pau, Lourdes, Tarbes, Montrejean, and Lannemezan, with mercury arc rectifiers. The contract comprises in all sixteen 1,200-kW rectifier sets to operate at a d.c. pressure of 1,500 volts. Each set consists of a single main transformer supplying two high-pressure rectifiers in parallel. The primary supply will be three-phase at 60,000 volts and a periodicity of 50 cycles. Everything from the high pressure to the d.c. side is included in the contract. The overload capacity for which the rectifiers are being designed is 50 per cent. for two hours and 200 per cent. for five minutes. The progress made during recent years with this class of plant is very marked, something like 160 individual equipments being either installed or in hand. They comprise roughly 340 separate rectifiers giving a total capacity of about 100,000 kW.

Engineering in China.—The North China Tung Chi Engineering Administration has been registered by the Ministries of the Interior and of Agriculture and Commerce.

Catalogues Wanted.—Mr. L. Henshaw, the electrical engineer, Public Works Department, Madras, India, wishes to receive price lists from suppliers of electrical machinery, fittings, and accessories; power plant up to 500 kW; and house lighting sets.

Messrs. H. Wogan & Co., 71, Stockport Road, Ardwick, Manchester, want catalogues of electric novelties, flash lamp cases, torches, and refills.

The Director of New Zealand Hospitals is anxious that equipment and supplies for those hospitals shall be obtained from the United Kingdom, and he has applied to H.M. Trade Commissioner at Wellington for assistance in obtaining catalogues from our manufacturers. American firms are noticeably enterprising in this respect, and we hope that British firms making a speciality of electro-medical, X-ray, and other such equipment will forward their catalogues, &c., in duplicate, direct to H.M. Trade Commissioner, P.O. Box 369, Wellington, N.Z., for transmission to the New Zealand Health Department.

New Indian Company.—The Godhra Electricity Co. is the name of a new undertaking which has lately been formed in Shahpur, Ahmedabad, with a capital of 1,000,000 rupees.

Calcutta Motor Show.—The Calcutta Motor Show will be held from December 19th to 24th. It will not be open to exhibitors from enemy countries.

Birmingham Trade.—Our Birmingham correspondent writes: "The condition of the Birmingham electrical industry shows a little more animation than recently, and while there is a good deal of short-time working, better hours are being maintained than was the case a month ago. There is rather more doing, too, in the accessory branches of the trade, and small castings in aluminium for a variety of electrical work are figuring much more prominently."

LIGHTING AND POWER NOTES.

Alyesbury.—**LOAN.**—A public inquiry is to be held on September 1st into the application of the Town Council for a loan of £27,632 for the purposes of the electricity undertaking.

Bath.—**PRICE INCREASE.**—Owing to the increased cost of production the charge for electricity for lighting is to be increased by 1d. per unit.

Belfast.—**FINANCE.**—The *Irish Independent* states that the Electricity Committee some time ago received a report from the consultants on the financial position of the undertaking as it was likely to be when the first section of the Harbour power station was completed. The city accountant stated that certain portions of this report could not be accepted, and others required explanation. The consultants thereupon desired to withdraw their report and to submit another, but it has been circulated to all the members of the Corporation and a summary has been published. From the report it is evident that the Corporation will have to increase its charges for electricity, although it is in the favoured position of owning the electric tramway system and of having the huge shipbuilding firms as customers for power supply. There is one very remarkable passage in the report. It is estimated that the contract prices for the electricity supplied to the shipyards would mean a deficit of over £50,000 a year.

Chester.—**THE QUEENSBERRY PLANT.**—The Queensberry T.N.T. factory, which has not been taken over by the Gasists Corporation, contains three 1,500-kW turbo-generators, one 1,000-kW turbo-generator; one 90-kW, 410-volt d.c. generator, and one 37.5-kW, 100-volt d.c. generator. The turbines are of the three-stage horizontal Curtis type with a working pressure of 160 lb. per sq. in., and the alternators are three-phase, 440-volt, 50-cycle machines running at 3,000 r.p.m. A fourth 1,500-kW set was retained for emergency purposes. At the full productive period of the factory there were motors with a total horsepower of 2,500 and the highest recorded climate generated in one month was 2,588,991 units in November of 1917.

China.—The Sui An Electric Light Co. at Han Ti, Sui An, Chekiang has been registered by the Ministry of Agriculture and Commerce, and has also the Electric Light Co. of Hai Chia Chen, Taichow, Chekiang.

Continental.—**FRANCE.**—The price of electricity in Paris has been reduced by 10 per cent. for lighting and by from 25 to 50 per cent. for power.—*Reuter's Trade Service* (Paris).

SWEDEN.—A general outline of the present progress and future intentions of the Swedish Waterfall Board with regard to the State provision of electricity from water power is conveyed in a report to the Department of Overseas Trade by the Commercial Secretary to H.M. Legation at Stockholm (Mr. H. Kershaw), who recently visited the well-known installation at Trollhattan and the one in process of construction at Motala.

Trollhattan power station is situated about two or three miles from Lake Wennern, from which it draws its water supply. The superficial area of this lake is about 5,570 sq. km. At Trollhattan the Gota river is divided into three sections, one forming the traffic canal, the second being the canal which conveys the water for the power station, and the third being the original river proper which conveys the surplus water not required for the traffic canal or the power station. Lake Wennern can, however, be dammed at will, and it may be that in course of time, if the large extensions in contemplation are carried out, the whole of this large force of water from the lake will eventually be diverted for the production of electric energy. The present power station consists of eight turbines of 12,500-h.p. each, and five of 13,200-h.p. each, making an aggregate of 166,000 h.p.

The total energy delivered from Trollhattan in 1920 amounted to 431,500,000 kWh. The height of the fall at the works is 30 m., and the volume of the fall of water varies from 300 to 900 cu. m. per second; the average fall for the past two years has been 500 cu. m. per second. Trollhattan has 12 sub-stations equipped to transform down from 50,000 V to 20,000 and 10,000 V, for country purposes mostly, and down to 6,000 or 3,000 V for use in cities. Gothenburg, for example, is supplied at 6,000 V. The farthest transforming station is situated at Skofdo, a distance of about 100 km.

Motala lies about midway between Lake Born and Lake Wetteren. Work on the construction of the electric generating station and damming operations were begun in October, 1918, and it is expected that they will be completed (with two turbines) in April, 1922. The estimated cost of the undertaking with two turbines working and foundations ready for the installation of three other turbines is 12,000,000 kr. Arrangements are being made to operate eventually five turbines, each of 6,000 h.p., which will be directly coupled to generators. The current will be alternating 3-phase, 50-cycle, 6,000-V, which will be transformed up to 70,000 V.

Edinburgh.—**EXTENSIONS.**—Tenders are being invited for work at the new Corporation power station at Portobello. The erection of the pump house is now to be proceeded with as soon as possible. Sub-stations are also to be constructed at Gorgie and Morningside.

Hitchin.—**BULK SUPPLY.**—At a meeting of the Council a letter from the Electric Supply Corporation, Ltd., was read. It stated that although the taking of a bulk supply from Lechworth would be more expensive than a supply from Hitchin, the difference would not be great. If the Council did not agree to this it would necessitate new plant at Hitchin which would further increase the price.

Inverness.—**COST OF HYDRO-ELECTRIC SCHEME.**—At a special meeting of the Town Council to consider the hydro-electric scheme drawn up by Messrs. Buchanan & Partners (ELECTRICAL REVIEW, June 24th, p. 818), it was stated that the cost would be approximately £230,000. The Council decided to obtain expert advice on the procedure necessary to secure legislation giving it powers to carry out the scheme.

Keighley.—**ELECTRICITY ORDER.**—The town clerk has received notice that the Keighley Corporation Electric Lighting Order, held up since 1915, will come into operation on September 1st, the official termination of the war. The order gives authority to supply light and power to out-districts such as Oxenhope, Oakworth, Steeton, Eastburn, Sutton, and Morton Banks. In recent times there has been a considerable demand for electricity in most of these districts. At Eastburn an overhead high-pressure cable, to supply large quarries there, is on the point of completion. This supply will augment the supply along the railless car route to Sutton and serve the districts through which the cable passes.

Newport (Mon).—A LARGE SAVING.—A saving of £15,000 will be effected through an agreement come to after considerable negotiation between the Corporation and the local Harbour Trust whereby the cables conducting electric power to certain big industrial consumers on the west side of the river Tsk will be laid six feet below the river bed, instead of carrying them across the bridge, a considerable distance away.

Rochdale. LOAN SANCTIONED.—The Gas and Electricity Committee has obtained sanction to a loan for the purpose of extending, new mains, and other work in connection with the electricity undertaking. A sub-committee has reported that it is having estimates prepared for lighting, both by gas and electricity, the Spotland and Turf Hill housing sites, and also for the better lighting of Drake Street and Oldham Road.

Selby. TERMS OF SUPPLY.—At a meeting of the Urban District Council, last week, a letter was received from the Electricity Commissioners stating that the maximum charge under the Order applied for by the Electrical Distribution of Yorkshire, Ltd., with respect to the supply of electricity to the area, would be 10d. per unit. The order also provided that the company should have two years in which to carry out its scheme. The terms were accepted by the Council.

Skegness. STREET LIGHTING.—Owing to the poor quality and low pressure of the gas supply, there have been complaints of inadequate street lighting, and a member of the Town Council has intimated that he will shortly introduce a scheme for providing public electric lighting.

Southend. REPAIRING DAMAGE BY FIRE.—The Electricity Committee has arranged to repair the damage caused by a fire at the electricity works last month, at a cost of £285.

Stirling. BULK SUPPLY ENQUIRIES.—The Town Council has decided to apply for terms for a bulk supply of electricity to the Scottish Central Power Co., and to the Alloa Town Council. Application has been made for a loan of £6,700 for a generating set.

Swansea. SUPPLY FAILURE.—Owing to a failure of the power at the electricity station, caused by the poor quality of some of the coal used, the tramway system was at a complete standstill for an hour on August 22nd.

United States.—PRODUCTION OF ELECTRICITY.—The United States Geological Survey has completed a tabulation of the operation reports for 1920, supplied by approximately 3,000 public utility power plants having a capacity of 100 kW and over. According to these figures the average daily output of electricity for each month of the year ranged from 115,000 kWh in May to 124,000,000 in January, the average for the whole year being 120,000,000. The proportion of this output resulting from water power varied from 33 per cent. in January to 42 per cent. in May. The total production for the year was 43,900 million kWh, an increase of 12.9 per cent. over 1919. Water-power supplied 37½ per cent. of this total, or practically the same proportion as in 1919. The amounts of coal, fuel oil, and gas employed to generate electricity in 1920 increased by 6, 18.4, and 13.6 per cent. respectively over the preceding year. If the fuel oil, gas, and wood consumed in generating electricity were converted into the equivalent amount of coal, the coal consumption would have been 38,500,000 tons in 1919 and 41,200,000 tons in 1920, an increase of 7 per cent. This increase in the amount of fuel consumed was, however, accompanied by an increase of 12.9 per cent. in the output, indicating a much more efficient consumption of fuel in 1920. On the basis of the equivalent coal consumed in each of the two years, the public utility plants burned 3.17 lb. of coal in 1919 to produce 1 kWh of electricity, and 3.01 lb. in 1920.—*The Times Engineering Supplement.*

Wales. ELECTRICITY ORDERS APPROVED.—The Panteg, Bed was and Machen, Mynyddiwyllwyn and Risca Electricity Orders have been approved by the House of Lords.

Wrexham. SUGGESTED CURTLEMENT OF STAFF.—Owing to the loss of £2,353 which has been incurred during the past three months, Mr. Coe, the engineer, is being strongly urged by the Council to reduce the staff at the works, but he replies that, though he is very anxious about the whole concern, he cannot further decrease the staff, having already cut it down to an absolute minimum. It is felt that increased prices will kill the demand, and the Council is to hold a special meeting at which its policy will be decided. Meanwhile, Mr. Coe has been asked to go carefully into the matter again and give to the Council a return of the staff which the undertaking "can afford to pay."

Hendon.—TRACK RECONSTRUCTION.—After long delays and negotiations between the Hendon District Council and the Middlesex County Council, the work of reconstructing the tramway track along the Edgware Road from Cricklewood to Edgware has been begun. The whole work is estimated to cost £184,000, of which Hendon is to provide £26,000. This sum works out at £84,000 per mile. Prior to the war the undertaking would have been done for about £20,000. For a considerable distance a single track is now being used.—*Evening Standard.*

Lancaster.—ACQUISITION OF TRAMROAD.—Lancaster and Morecambe Town Councils have appointed sub-committees to negotiate jointly for the purchase of the road rights held by the Lancaster and District Tramways Co. on the main highway between the two towns. The object, it is understood, is to get rid of the ancient horse tramcars still run by the company and, doubtless, to substitute electric or some other modern type of cars. Former attempts to secure the rights have failed.

Leeds.—FARE INCREASE APPROVED.—Ministry of Transport sanction has been received to the increase of maximum tramway fares from 1d. to 1½d. per mile. There has been a good deal of opposition, both locally and by out-districts served by the Leeds tramways, to the application, and it is not yet established that the increase will be applied to the full. The reduction of the amount of loss during July, as against previous months, gives the Tramway Committee grounds for hope that increases beyond the present advanced fares may be avoided, particularly if general industrial conditions—and thereby tramway traffic—improve.

London.—"STRAPHANGING" ORDER.—At a meeting of the London M.P.'s held recently at the House of Commons, Mr. Gilbert presiding, strong objection was raised to the order of the Home Secretary, which comes into force on October 1st, prohibiting straphanging in the tramcars and omnibuses. The view was taken that great public inconvenience would result, and that numbers of people would be unable to get to and from their work. A deputation consisting of Mr. J. D. Gilbert, Sir Reginald Blain, Mr. Purchase, Sir W. Lane-Mitchell, Sir Alfred Yeo, and Lord Curzon was appointed to interview the Home Secretary on the matter.

Manchester.—EMPLOYEES' WAGES.—Mr. J. M. McElroy, the general manager of the Corporation tramways, states that when the adjustment of the wages of tramway employés, according to the fluctuations of the cost of living, was decided upon, on a national basis, the Manchester employés asked that their case should be considered separately. They contended that their wages were not equal to those paid by other undertakings of comparable size and conditions. This question was considered by the District Council on August 16th, when the employers maintained that the national character of the adjustments should be adhered to, and that the District Council was not competent to deal with departures from a national award. The matter is, therefore, to be decided by the National Joint Industrial Council of the industry.

"STRAPHANGING."—The proposed revival of the regulations forbidding vehicles in the Metropolitan area to carry more passengers than they are licensed to carry, is not viewed with favour in Manchester. The Tramway Committee states that at present it cannot afford to buy new stock, and "straphanging" seems to be a simple solution of the traffic problem.

Nottingham.—FALLEN TROLLEY WIRE.—On August 19th a car had turned off Derby Road when the trolley pole swung loose and snapped the wire used for the purpose of keeping the live wire taut. The live wire also broke, but the repair staff were soon in attendance, and in three-quarters of an hour cars were again running, temporary repairs having been effected.—*Nottingham Guardian.*

Sheffield.—YEAR'S WORKING.—The accounts of the Corporation Tramways Department for the year ended March 31st last record a total income of £998,427, as compared with £825,642 in the previous year. Working expenses amounted to £817,314, as against £679,173, leaving a gross profit of £181,113 (£146,469). After the payment of capital charges a net profit of £66,616 remained. Of this amount the greater part—£60,684—was transferred to the renewals fund.

South Africa.—RAILWAY ELECTRIFICATION.—The South African Government, acting upon advice given by British electrical engineers, had determined to adopt the direct current system, but some prominence has recently been given in the Press of the Union to the statements of Dr. William Macdonald, who has just returned to South Africa after a visit to Italy, that the improved three-phase system which has been installed on railway lines in northern Italy is the most efficient system of electric traction in the world. An invitation has been extended to the Union Government to send electrical engineers to Italy to investigate this system from the technical standpoint, and it is suggested that pending such an inquiry no further steps should be taken by the Union Government to convert existing steam railways to direct-current working. It is quite unlikely that this controversy will exercise any influence on the policy of home railways, among the officials of which there is a strong consensus of opinion in favour of direct current installations.—*The Times Trade Supplement.*

TRAMWAY AND RAILWAY NOTES.

China.—The Ministry of Communications has registered the Shanghai-Paoshan Tramway Co., for constructing tramways along the new roads between Shanghai and Paoshan Hsien.

Halifax.—TRACK RENEWALS.—The Tramways Committee is attending to the relaying of track, which is very badly needed. The committee has provisionally accepted tenders for 250 tons of rails and two other contracts for smaller quantities of tramway track metal.

TELEGRAPH AND TELEPHONE NOTES.

Belgium.—AUTOMATIC TELEPHONES.—The Central Telephone Bureau, Brussels, is installing an automatic exchange, and the system is later to be extended to other offices in the district. The first one will be put into service in April next.

France.—STORM DAMAGE.—The Doria wireless station, near Lyons, has been considerably damaged by a violent storm, two of the masts, more than 100 ft. high, having fallen. Communication with America and the Far East is consequently suspended for the present.

India.—WIRELESS TELEPHONY.—The first practical use of wireless telephony in connection with the Press in the East was made recently when *The Times of India* received racing results by that method direct from Poona racecourse. The experiment by the postal authorities is attracting the widest interest, says *The Times*.

Jersey.—TELEPHONE SYSTEM.—The report of the expert recently appointed to study the local telephone system declared it to be most satisfactory, and it was decided to send a delegation to interview the Postmaster-General on the questions of staff and salaries.

Poland.—NEW WIRELESS STATION.—It is stated that the Polish Government has made a contract with the Radio Corporation of America for the construction of a \$3,000,000 high-power radio station at Warsaw, having direct connection with Rocky Point, Long Island. It is understood that the Polish Government will own the station, which will be operated in conjunction with the Radio Corporation for a period of 30 years.—*Financial Times*.

Russia.—CABLE PARTY CAPTURED.—The *Social Demokrat* learns from the Great Northern Telegraph Co. that the members of a caravan expedition sent from Peking to Kiachta (Mongolia) in connection with the effort to re-establish communication with the Far East, via Russia, have been taken prisoners by freebooters in Russian Mongolia. So far the company has not received any confirmation of the concession from Russia.—*Evening News*.

Wireless Telegraphy.—COMPANIES' FUSION.—The Stockholm *Svenska Dagbladet* states that the negotiations for the amalgamation of the English Marconi Co. and the Swedish Radio Co. have led to positive results, but the majority of the shares will remain in Sweden.—*Financier*.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Australia.—MELBOURNE.—October 19th. Victorian Government Railways. Three-phase motors, starters, circuit breakers, and switches. Contract No. 34,181.*

P.M.G.'s Department, Queensland. October 12th. Galvanised iron and steel wire. Schedule 537, October 19th. Insulated wire. Schedule 538. (August 19th.)

Belgium.—Ministry of National Defence. September 14th. Establishment and equipment of a number of wireless telegraphy and telephony receiving and dispatching stations. 3^e Direction Générale du Ministère de la Défense Nationale, 10, Rue du Meridien, Brussels.

Bristol.—September 16th. Electricity Department. One 500-kW rotary converter. (See this issue.)

Dorchester.—September 10th. Electricity Committee. Replating battery, &c. (See this issue.)

France.—September 1st. The Etablissement Centrale du Materiel de la Radiotelegraphie Militaire, 51, dis Boulevard de la Tour Maubourg, Paris.—2,000 40-volt, 3-amp-hour accumulators.

Halifax.—September 10th. Electricity Committee. Steelwork in connection with foundations for new turbine set at the electricity generating station.—Mr. A. C. Tiplie, acting borough engineer, Crossley Street.

Holsworthy.—September 1st. Urban District Council. Poles, fittings, &c., for electric lighting installation.—Mr. F. Vanstone, Surveyor, Council Offices.

Horsham.—September 3rd. Electricity Department. One 3-crank, triple-expansion engine, coupled to a 300-kW d.c., 460/500-V generator, or alternatively, one 2-crank compound engine, coupled to generator as above. (August 19th.)

Ilford.—September 9th. Electricity Department. Air compressor, motor and starter. (August 19th.)

India.—High Commissioner for India.—August 30th. Telegraph cable. (August 12th.)

London.—FULHAM.—September 10th. Electricity Department. A.c. motor-driven centrifugal circulating pump with pipework and valves. (August 19th.)

Metropolitan Asylums Board.—August 31st. Electric lighting installation at the Grove Hospital, Tooting Grove, S.W. (August 19th.)

I.M. Office of Works. September 16th. Supply of electrical and mechanical material stock in the Cardiff district. (See this issue.)

Laurence Marques. September 30th. Department of Posts and Telegraphs. 4,200 iron telegraph poles, 15,000 G.I. insulator stalks, 11,000 G.I. insulator brackets, 15,000 porcelain insulators, 320 tons G.I. wire, 90 tons H.D. copper wire.*

Malta.—September 15th. Government of Malta. Single-phase a.c. meters. (August 19th.)

New Zealand.—WELLINGTON.—September 27th. Public Works Tender Board. Six sets 3-phase, 50,000-V air-break switches for the Waikato electric power scheme.*

November 28th. Public Works Department, Mangahao electric power scheme: 3 water wheels, three 6,000-kVA and two 3,000-kVA a.c. generators, two 3-unit exciter sets, seven 4,000-kVA single-phase transformers, insulators, lightning arresters, switchboard, &c.*

Portsmouth.—August 30th. Tramways Committee. Stores, 12 months (including insulating materials, lamps, line materials, &c.). (August 19th.)

South Africa.—PRETORIA.—October 4th. Electric Light and Power Department. Coal-handling plant, 6,600-V cables, induced-draught and ash-handling plant, pumps, piping, &c.—Mr. T. C. Wolley Dod, General Manager, Municipal Electricity Supply, P.O. Box 123, Pretoria.

DURBAN.—August 31st. Corporation. One 3,000-kW, three-phase, 50-period, 6,600-V turbo-alternator with condensing plant, circulating water pump and piping. (August 19th.)

September 28th. Corporation. Two 500-kW rotary converters, switchgear, and automatic controlling devices, also h.p. supply feeders.*

JOHANNESBURG.—November 7th.—South African Railways and Harbours. 85,560, incandescent train lighting lamps (tungsten filament) for 24 volts, 8 to 10 candle power. 8,125, engine headlight lamps, 150-watt, 32-volt (gasfilled type with concentrated filament). 50,472, incandescent lamps (tungsten filament), and 5,545, incandescent lamps (carbon filament).*

Salford.—August 29th. Coal supplies for Electricity Department for six months.—Borough Electrical Engineer, Frederick Road, Salford.

Southampton.—August 30th. Electricity Department. E.h.p., 3-phase cable. (August 12th.)

Stockton-on-Tees.—August 31st. District Fund, Gas and Electricity Committees. Articles and stores for six months. (August 5th.)

Uruguay.—September 19th. Board of State Electrical Stations. Generating plant for four electrical groups, consisting of a.c. and d.c. generators, Diesel engines, &c.*

West Ham.—September 8th. Board of Guardians. Three months' supply of electrical fittings. Mr. T. Smith, clerk to the Guardians, Union Road, Leytonstone.

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CLOSED.

Blackpool.—Accepted:—

Wiring the new secondary school at Prudhoe Road. R. Warren, Blackpool.

Battle.—Board of Guardians. Accepted:—

Renewal of plates in storage battery, 1145. Taiter Accumulator Co.

Pewsey.—Board of Guardians. Accepted:—

Electric light installation, 1148. Lott & Co.

Government Contracts.—The following Government contracts were placed during July, 1921:—

ADMINISTRATIVE (CONTROL AND PURCHASE DEPARTMENT).

Electrical installations. Johnson & Phillips, Ltd.
Switches. A. Graham & Co., A. Graham & Co., General Electric Co., Ltd., W. McGosch & Co., Ltd., Plaxet & Mitchell, Ltd., W. W. Sweet & Co., Ltd., Electrical Manufacturing Co., Ltd.

Overhead electric trolley for Sir W. Arrol & Co.

ADMINISTRATIVE (CIVIL ENGINEERS-IN-CHIEF'S DEPARTMENT).

Battery repairs. R.N.V.R., St. Leonard-on-Sea. G. Lynn & Son.

X-ray Treatment of Cancer.—The following statement has, according to *The Times*, been issued by the Council of the British Association for the Advancement of Radiology and Physiotherapy, in view of the publicity that has been given to radiotherapy in the treatment of cancer by the publication of laudatory articles in the medical and lay Press, and the extraordinary claims that have been put forward by the authorities of the West London Hospital. The treatment referred to has not yet been thoroughly tested. It possesses great potential dangers, and may not prove as efficacious as the claims now made would suggest, however, no certainty can be arrived at for some years. The unwarranted laudation of this change in technique will probably lead to a reaction, and bring discredit upon X-ray treatment in general.

The claim put forward by the Erlangen school is that it is possible to administer a dose of X-rays which will cure cancer in one application. This claim is commented on as follows by *The Lancet* of July 2nd, 1921:

"The suggestion that cases of malignant cancer should go to the radiologist immediately the diagnosis is made, and before operation, is based on the observation of competent observers. There is little doubt that the time has come for us to reconsider our position in dealing with the situation."

This is regarded as a most ill-advised pronouncement, and the Association emphatically disagrees with the conclusions expressed. The time has not yet come when radiotherapy may be regarded as the first choice in the treatment of the majority of cases of cancer.

The Association believes that, of any single method, surgery still offers the best prospect of cure in nearly all cases of cancer, and that until much more convincing proof of the efficacy of X-rays or other form of radiation is forthcoming it would be extremely dangerous to encourage patients to trust to X-rays treatment alone.

It is, however, of the opinion that a closer co-operation between the surgeon and the radiologist would lead to a clearer appreciation of the value of radiation in treatment. Combined treatment offers the greatest hope of success.

Radiologists in this country have, during the past few years, so far perfected their technique that the risk of any injury to the patient is now small, provided that his treatment is under the direction of a medical man of wide experience in this class of work, and the public may rest assured that if the prospects held out by the more drastic procedure prove to be better than those offered by existing methods full advantage will be taken of it in this country.

The Association holds that the real contribution to progress on the part of the Erlangen school is that it has employed in suitable quantities X-rays of a higher penetration than those hitherto used, and has also carefully systematised already known methods of measuring dosage. Several firms in this country are now making the requisite equipment, so that difficulty of obtaining plant will not be a bar to research.

X-rays have already relieved suffering and prolonged active life in thousands of cancer victims. They have even effected a few apparent cures; and their value in helping to prevent return after operation is now generally recognised. It would, therefore, be neither more nor less than a calamity if public disappointment resulting from unfulfilled promises were to bring discredit on radiation therapy, which is in reality a powerful agent in the warfare against disease.

Power Station Employes' £5,000 Claim.—A few months ago two employes at the Johannesburg power station were dismissed by the municipality and expelled from the Engineering Union. The expulsion was declared illegal by the Court, and one of the two men (Mr. Young) has commenced an action against the Union claiming £5,000 damages. The action will shortly be heard in the Supreme Court.

Appointments Vacant.—Power station maintenance engineer (£392) and resident station engineer (£534), for the Yorkshire Electric Power Co.; assistant sub-station engineer, for the Shanghai Municipal Electricity Department (350 taels per month, tael=3s.); shift engineer, for the Doncaster Corporation Electricity Works; teacher of electrical engineering and mathematics, for the Doncaster Technical College. (See our advertisement columns to-day.)

Petrol electric Buses for London.—Messrs. Tillings, Ltd., announce that they are shortly introducing an improved type of omnibus to replace those which they are now running in London. The drive will be effected by motors supplied with electricity generated by a petrol engine. The carrying capacity will be for 48 passengers, and about 150 of these vehicles are to be put into service.

Speech Projection.—The *Electrical World*, in a recent issue, reproduced a photograph of a speech-projection equipment constructed by the American Telegraph & Telephone Co. This consists of a tower about 30 ft. in height, on the top of which four loud-speaking projectors are mounted. Under the tower is a speaker's platform on which are fixed a number of electrostatic transmitters. About twelve feet above this platform a single speech projector is installed, and this created a record by rendering speech audible at a distance of 3.8 miles. The energy amplification is stated to have been 10^{10} .

Making Ice Cream Electrically.—Keeping a community cool in the summer is a task that demands as much ingenuity as that of keeping it warm in winter. An interesting description of ice-cream making in the *Journal of Electricity* is typical of the extent to which manufacturing plants of all kinds is becoming dependent on electric power. The Benham Ice Cream Co., of Chicago, U.S.A., has an output of 500,000 gallons per year; during the summer the plant is run on a 24-hour basis, and 1,500 gallons of cream are used per day, representing the yield of 5,000 cows. About 500,000 lb. of sugar and 500 tons of salt are consumed a year, and all the ice needed is manufactured in the factory, the daily "refrigerating capacity" of the plant being 80 tons and the output of the two ice crushers 20 tons per hour. The four 100-gallon per hour freezers are each driven by a 7.5-h.p. motor, and the 12 40-gallon ones by 2-h.p. motors. The plant includes a 50-h.p. steam boiler for sterilising and heating purposes, and for condensing the surplus milk. Water is pumped from private wells for all uses in the factory; the principal compressor is driven by a 75-h.p. motor, and there are two smaller ones driven by 25-h.p. machines. There are 34 motors in all with a total capacity of 226 h.p., and the maximum 15-minute demand to date is 181 h.p. The company operates specially built trucks for distributing its product locally; it uses 20 vehicles, part of which are Walker and part General Vehicle "electrics," having a capacity of 300 gallons of ice cream and two tons of ice and salt. Some of the vehicles are nothing less than refrigerating rooms on wheels, being fitted with brine circulating pipes so that the compartments in which the ice cream is stored for delivery are kept cool. One of the most novel features is the latest electric truck, which has been equipped with a complete refrigerating plant; the truck has two product compartments and is fitted with an electrically-driven system instead of refrigerating by means of salt and ice. The company operates its own vehicle-charging outfit, using a motor-generator set for the purpose. The use of electricity in ice cream plant facilitates a process which is very exacting, is subject to very heavy demands during the rush season, and requires great flexibility. On account of the requirements for complete sanitation, individual electric drive is considered the only satisfactory method; operators, in fact, never have to think of their driving apparatus and are free to give all their attention to the manufacture and delivery of a product in which uniformity and reliability are particularly to be desired.

The plant represents an investment of over a quarter of a million dollars, and it is said that it is the most complete and largest of its kind west of Chicago, not even excepting the San Francisco and Los Angeles factories.

Closed Labour Exchanges.—In accordance with the policy announced in the House of Commons on August 4th, the Ministry of Labour is closing down country labour exchanges in North Devon. "I am taking steps to close 84 rural exchanges immediately, and 150 or more will be shut down by the end of the year," Dr. Macnamara is reported to have said.

Educational.—BACHELOR OF COMMERCE DEGREE.—At the beginning of the autumn session of the University of London in October next, four students will begin four years' training for the degree of Bachelor of Commerce. They are the successful candidates for the four £250 Scholarships offered by *The Daily Mail* in connection with the Efficiency Exhibition held in February last.

The qualifying examination was the Matriculation Examination of the University of London, held in June last. The winners of the scholarships are the students who, having completed *Daily Mail* entry forms, were placed highest on the list of candidates for that examination. Each of the winners is engaged and has undertaken to continue to be engaged in whole-time employment in business while pursuing a regular course of study for the degree of Commerce.

The administrative work in connection with the scholarships will be carried out by the authorities of the University of London.

Institution Note. ASSOCIATION OF ENGINEERS-IN-CHARGE. The 21st Annual Dinner of the Association which was postponed owing to the coal miners' strike, will take place on Saturday evening, October 8th, at the Holborn Restaurant at 6 p.m. Mr. W. H. Patchell (president) will preside, and the principal guest of the evening will be Engineer Vice-Admiral Sir George G. Goodwin, K.B.C., I.L.D., Engineer-in-chief of the Fleet, who will be supported by many eminent representatives of the engineering world.

A Ladies' Night, consisting of a dinner and dance, will be held by the Association at the Holborn Restaurant on Saturday Evening, November, 12th. The Chairman of the Association (Mr. J. E. Watkins) will preside.

Medals for Resuscitation.—The Accident Prevention Committee of the Canadian Electrical Association offers a medal to any person who saves the life of another, who has received an electric shock, by artificial respiration. The first lot of these medals will be struck, very appropriately, from copper taken from the first high-pressure transmission line in the British Empire, installed 30 years ago.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted in their movements.

We shall be glad if electrical and allied men who are proceeding overseas on business visits, will acquaint the Editors of the ELECTRICAL REVIEW with their movements. Equally acceptable to us will be notification from our overseas friends when they are visiting this country, the date of arrival and their address here, if known, would be of interest to our readers, and of value to the trade, while the objects of the visitor might be more easily attained, and the visit made more successful. Many of our friends already keep us posted, but we should like more to do so.

Mr. E. A. GATEHOUSE, until recently assistant manager of the contract department of the British Thomson-Houston Co., Ltd., has relinquished that position in order to join the staff of the ELECTRICAL REVIEW. On leaving Rugby Mr. Gatehouse (who is the son of the late Mr. T. E. Gatehouse, well known as the editorial and technical editor of the ELECTRICAL REVIEW) was entertained at dinner by a large number of the staff, who presented him with some handsome Georgian silver plate as a token of their regard.

Mr. H. NORTH, of the Engineer-in-Chief's Office, General Post Office, retires this month. He has been connected with the Post Office for upwards of 40 years. Some of our readers will remember his work in connection with the Ghent International Exhibition in 1913. He organised the Post Office exhibit in the British section, and superintended the erection of representative apparatus from the various sections of Postal telegraph, telephone, pneumatic, savings bank and money order departments, and was awarded a diploma for his services. On the outbreak of war, Mr. North took a prominent part in the volunteer movement, and early in 1915 opened a free school for instruction in signalling, at the Inns of Court Hotel, London. Lord French inspected the school on June 6th, 1915, and was very favourably impressed. Upwards of 1,200 students were passed into the various signal units from this school. In retirement Mr. North will be devoting his energies to electrical matters, for he now represents the Farnestock Electric Co., of New York, Ferodo, Ltd., &c., whilst at his rooms at 264, High Holborn, W.C.1, he will continue his experiments in wireless telegraphy.

Mr. H. W. PUTTICK, A.M.I.Mech.E., A.M.I.E.E., has resigned his position under the Calcutta Electric Supply Corporation, Ltd., and will be returning to England at the end of October.

Mr. J. WALLIS BAILEY, the hon. secretary of the South Midland Students' Section of the Institution of Electrical Engineers, has changed his address to c/o Messrs. General Electric Co., Ltd., Witton, Birmingham. He will be glad to hear from student members desirous of reading papers during the forthcoming session.

The Southport Corporation Electricity Committee has decided that the salary of the new borough electrical engineer, when appointed, shall be at the rate of £800 a year, rising by annual increments of £50 to £1,000. The salary of the present borough electrical engineer, Mr. A. S. BLACK, who has been appointed borough electrical engineer and tramways manager at Ipswich, is £400, plus £300 bonus. At Ipswich he will receive £900.

It is refreshing to note that there are no fewer than three engineers standing for Parliament in the bye-elections now proceeding. Mr. ARNOLD LUTTON, the Liberal candidate for Westminster, is a mining and civil engineer in practice there. Sir ALAN HUTCHINGS, the Conservative candidate for Louth, is a member of the Surveyors' Institution, and Sir PHILIP DAWSON, the well-known railway electrical engineer, is standing for Leamington as a Conservative. Apart altogether from their politics, we should rejoice to see practical and constructive men of this type in Parliament.

Mr. WILFRED EVANS, foreman for four years of the electrical department of the Briton Ferry Chemical Works, has been appointed, out of a large number of applicants, head of the electrical department of the State railways of the Malay Peninsula at a commencing salary of £750 per annum, and sails for Malaya on October 1st. Mr. Evans is a member of the Technical Advisory Committee of South Wales for Electricity and chairman of the Port Talbot Branch of the Electrical Trades Union.

The marriage took place on August 17th, at the Cathedral Church, Chelmsford, of Mr. CYRIL HERBERT FORD, A.M.I.E.E., of the staff of the Marconi Co., Chelmsford, and Miss Kathleen Millient Manning.

SIGNOR MATEOSI, who has been spending a few days at Aberdovey in connection with wireless experiments he is making on his steam yacht *Electra* off the Welsh coast, has been presented with an address by the Aberdovey Council.

Mr. C. H. DOLLING, who has been appointed tramway permanent engineer to the Halifax Corporation at new office created by the taking over of the whole of the lines (formerly partly under Highways Department control) by the Tramway Committee—was on the staff of the Rochdale borough engineer.

Mr. W. G. WICKHAM, H.M. Senior Trade Commissioner in South Africa, who is at present in this country on an official

visit, is prepared to interview at the Department of Overseas Trade in London, from September 1st to 16th, firms who desire to consult him regarding South African trade possibilities, &c.

The following appointments have been made in the Faculty of Engineering at University of London, University College: Mr. M. T. M. ORMSBY (previously reader in surveying), to be Chadwick Professor in Municipal Engineering; Mr. BERNARD H. KNIGHT, to be Assistant in Municipal Engineering; Mr. H. T. DAVIDGE, to be Senior Lecturer in Civil and Mechanical Engineering.

The RT. HON. EARL BUNTON, G.C.M.G., has accepted an invitation to join the board of the British Thomson-Houston Co., Ltd.

Obituary.—SIR SAMUEL DAVIDSON.—We regret to record the death of Sir Samuel Davidson, K.B.E., founder of the Sirocco Engineering Works, which occurred at Belfast on August 18th, at the age of 75 years. It will be remembered that on the occasion of the recent visit of the King to Belfast the honour of knighthood was conferred upon the deceased gentleman, who was too ill to be present in person. We published an account of Sir Samuel's career, together with a photograph, in the ELECTRICAL REVIEW for July 1st, 1921 (p. 20).

ALD. H. LINSLEY.—The death took place last week, at the age of 73 years, of Ald. H. Linsley, chairman of the Salford Corporation Tramway Committee since its inception twenty years ago.

NEW COMPANIES REGISTERED.

Frank Rawcliffe & Co., Ltd. (176,278).—Private company. Registered August 16th. Capital, £12,000 in £1 shares. To take over the business of an electrical engineer and fitter carried on by F. Rawcliffe at 8, Nun Street, 16, Westmoreland Road, and 49, Westgate Road, all in Newcastle-on-Tyne, and 34, Victoria Road, Kingston, as Frank Rawcliffe and Co. The first directors are: F. Rawcliffe (managing and permanent director), 9, Queen's Gardens, Benton; J. McGehe, 9, Queen's Gardens, Benton. Qualification, 1 share. Remuneration as fixed by the company. Registered office: 8, Nun Street, Newcastle-on-Tyne.

Modern Electrical Supply Co., Ltd. (176,286).—Private company. Registered August 14th. Capital, £1,500 in £1 shares. To take over the business of electrical engineers formerly carried on by G. F. A. Stone and G. A. Davenport at 14, High Street, Pinner, and to carry on the same and the business of dealers in electrical goods, &c. The permanent directors are: A. T. Whittle (governing and managing director and chairman), Finsbury Lane, Pinner; G. F. A. Stone (sales manager), 14, High Street, Pinner; G. A. Davenport (works manager), 14, High Street, Pinner. Qualification of managing director 400 shares; of other directors 1 share. Remuneration as fixed by the company. Registered office: 7-9, Whitecross Place, Wilson Street, Finsbury Square, E.C.2.

Ohms, Ltd. (176,318).—Private company. Registered August 16th. Capital, £400 in £1 shares. To carry on the business of electricians, electrical engineers, and contractors, &c. The subscribers (each with one share) are: W. J. Wood, 34, Shakespeare Road, Acton, W.3, solicitor's clerk; W. J. Lovell, 110, Maryland Road, Wood Green, N.22, solicitor's clerk. The first directors are to be appointed by the subscribers. Solicitor: A. L. Horner, 109, Piccadilly, W. Registered office: 41, Upper Berkeley Street, W.1.

Wren Three Link Patent Safety Coupler, Ltd. (176,331). Private company. Registered August 16th. Capital, £1,500 in £1 shares. To carry on the business of electrical, mechanical, motor, and general engineers, iron and brass foundries, boiler makers, wire drawers, iron and steel cable makers, &c., and to adopt an agreement with A. Wren. The subscribers (each with one share) are: G. T. Little, 7, Dorncliffe Road, Fulham, S.W.6, clerk; F. W. Eve, 38, Salmon Lane, Limehouse, E.14, clerk. The subscribers are to appoint the first directors. Solicitor: A. Barrie, Balfour House, Finsbury Patent, E.C.

Engineers' Club (London), Ltd. (176,343).—Registered August 17th as a company limited by guarantee. To promote the interests of engineers generally and provide a club house for a club in connection with the club to be known as the Engineers' Club. The first directors are: E. Manville (M.P. for Coventry), 39, Coventry Street, W.; E. L. Hill, 39, St. James's Square, S.W.1; D. G. B. Wootton, Tooting, Surrey; E. Manville, M.P., is the first president. Registered office: 39, Coventry Street, W.1.

British Samples, Ltd. (176,336).—Private company. Registered August 17th. Capital, £3,000 in £1 shares. To organise and conduct exhibitions in the United Kingdom and other countries with the object of promoting British manufacture and trade, and fostering the relationships between manufacturers and consumers throughout the world, and between exporters abroad and consumers in the United Kingdom and other countries, and for that purpose to co-operate with newspapers in cataloguing and advertising of exhibits; to act as agents for exhibitions organised by other concerns, &c. The subscribers (each with one share) are: G. B. Crowder, 51, Lincoln's Inn Fields, W.C.2, solicitor; H. G. Russell Smith, 51, Lincoln's Inn Fields, W.C.2, solicitor. The subscribers are to appoint the first directors. Registered office: 51, Lincoln's Inn Fields, W.C.2.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Illuminated Sign Co., Ltd.—Particulars of £10,000 debentures, authorised 1st July, 1921. Capital, £10,000, divided on the company's undertaking and property, present and future, including uncalled capital.

A. Hirst & Son, Ltd. (57,889).—Return dated July 5th, 1921. Capital, £20,000 in £10 shares (100 preference and 1,900 ordinary); 100 preference and 1,220 ordinary shares taken up; £2,200 paid; £11,000 considered as paid. Mortgages and charges: Nil.

Metropolitan-Vickers Electrical Co., Ltd. (62,919).—Return dated May 1st, 1921. Capital, £5,325,000 in 616,525 ordinary shares of £2 each, £1,336,950 ordinary shares of £1 each, and 500,000 deferred shares of 1s each, 616,525 preference, 1,136,950 ordinary, and 500,000 deferred shares taken up; £2,345,000 paid; £150,000 considered as paid. Mortgages and charges: £1,395,153.

Rangoon Electric Tramway & Supply Co., Ltd. (86,932).—Return dated June 1st, 1921. Capital, £500,000 in 50,000 ordinary shares of £5 and 250,000 ordinary shares of £1 each; 50,000 preference and 177,001 ordinary shares taken up; £982,001 paid on the preference and 112,001 ordinary shares; 245,000 considered as paid on 65,000 ordinary shares. Mortgages and charges: £249,739.

CITY NOTES.

**Vera Cruz
Electric Light,
Power and
Traction, Ltd.**

The annual meeting was held in London on August 17th. Mr. Vincent W. Yorke (chairman), who presided, said that the gross earnings of the company continued to increase satisfactorily although operating expenses had also increased. A serious strike of the tramway employés in September had reduced the income considerably. To meet an increase in wages awarded to the men, the company had been permitted to increase its fares. The lighting and power business had shown good results, the combined net earnings for the current year being about 25 per cent. in excess of those for the corresponding period of 1920. The opening up of a bathing resort, in which the company had an interest, near Vera Cruz, would add considerably to the earnings of the tramways. The stand-by Diesel plant, which was used in the event of a failure of the supply from the Puebla Tramway, Light & Power Co., was very old, and it would be necessary to install a steam turbine within the next few months. The political conditions in Mexico remained satisfactory, and if these continued so, and if labour troubles could be avoided, 1921 should prove a very satisfactory year.

**Swiss
Companies.**

The Watt A.G. für Elektrische Unternehmungen, of Glarus, which is associated with the Zurich Bank for Electrical Undertakings, reports a slight increase in the

deficiency in 1920-21 to 2,891,000 fr., and the loan capital again receives no interest.

The report of the *Maschinen Fabriken Escher Wyss & Co.*, of Zurich, states that the volume of the turnover in the year ended on March 31st, 1921, was approximately the same as in the previous year, although sale prices considerably declined. After making provision for depreciation, the accounts record net profits of 899,000 fr., as against 804,000 fr. in 1919-20, and the dividend remains at 6 per cent. as in the preceding year.

The report of the directors of *Brown, Boveri & Cie.*, of Baden, dealing with the year ended on March 31st, 1921, states that the sudden falling off in the sales of electric motors which took place in September was followed by stagnation of business in large machines in the following month. This change would have had no direct consequences on the activity of the works at first, as orders were on hand for a long time forward. But the stagnation led to a rapid fall in the prices for all raw materials and for manufactures, which decline reached extraordinary dimensions in the first quarter of 1921. If this situation had not arisen, the working results for the year would have been entirely satisfactory despite other unfavourable factors. The accounts show net profits of 666,000 fr., as compared with 5,084,000 fr. in 1919-20, when a dividend at the rate of 8 per cent. was paid. As a consequence of the depreciation of raw materials and manufactures, the valuation of the stocks at the end of the financial year represented a loss of about 7,000,000 fr. on an ordinary share capital of 56,000,000 fr. It is stated that this is the first time during the 30 years' existence of the company that no dividend has been paid.

France.—*COMPAGNIE CONTINENTALE EDISON.*—The ordinary meeting approved the accounts for the year 1920, leaving a debtor balance of 65,666 fr. Taking into account credit carry overs from former years' working of 126,021 fr., a final balance of 60,508 fr. remained, which it was decided to carry forward. The Nevers installation during 1919 was in the preparatory stage, but developed in an encouraging manner in the course of 1920. In January only 161,588 kWh were sold, but by December that figure had risen to 496,292 kWh, the total for the year being 3,451,511 kWh. If the industrial conditions had not caused various important customers to restrict their operations considerably, the consumption of electricity would have more than doubled that actually attained. In 1920 the City of Paris carried out long experiments in the Vals-de-Loire district in deep pumping to tap underground water supplies, for which the company furnished the electrical equipment. The operations were completely successful and are still being continued. The report passed in review the position of the various undertakings in which the company has shares, namely, the *Société Hydro-électrique de Lyon*, the *Société de Distribution de l'Électricité de l'Ouest*, and the *Compagnie Parisienne de Distribution de l'Électricité*. An extraordinary meeting which followed sanctioned the raising of the capital from 10,000,000 to 25,000,000 fr. by the issue, on one or more occasions, of 30,000 500-fr. shares.

Tyneside Tramways & Tramroads Co.—The report for the half-year ended June recommends dividends at the rate of 5 per cent. per annum on the preference and 3 per cent. per annum (both less tax) on the ordinary shares; £500 to reserve and £140 carried forward. Increase in traffic receipts, £1,181.

City of London Electric Lighting Co., Ltd.—The directors have declared half-yearly dividends on the 6 per cent. first and 8 per cent. second preference shares; and at the rate of 10 per cent. per annum on the ordinary shares, all less tax.

Prospectus.—The list is due to close to-day (or earlier) in the issue of £750,000 in 6 per cent. debentures at 9 per cent. by the County of Southland Electric Power Board. The principal and interest are unconditionally guaranteed by the New Zealand Government.

Aberdeen Suburban Tramways Co.—Profit for the half-year ended July 31st £1,771, plus £3,808 brought forward. After putting £1,000 to renewals and depreciation, a dividend at the rate of 7 per cent. per annum is to be paid £2,232 carried forward.

Oxford Electric Co., Ltd.—A dividend at the rate of 5 per cent. per annum, less tax, on the ordinary shares for the half-year is announced.

Clyde Valley Electrical Power Co.—An interim dividend at the rate of 5 per cent. per annum, less tax, is announced on the ordinary shares for the past half-year.

British Electric Transformer Manufacturing Co., Ltd.—An interim dividend on the ordinary shares at the rate of 6 per cent. per annum, less tax, for the half-year, is announced.

STOCKS AND SHARES.

TUESDAY EVENING.

THE markets are not lacking in points of interest, although general business continues quiet. Money is said to be getting cheaper, but this may be a transitory matter: the usual tendency is for rates to stiffen as autumn approaches. Investment securities remain firm. The new General Electric 7 per cent. debenture is again better at 94½, a premium of 2 points, as against the discount of 4 to which it fell soon after allotment, when the stags were hastening to get out. Other new issues in this market are inclined to be irregular. North Metropolitan has risen to 7 premium, Metropolitan Electric Extension debenture is unchanged at 8 premium, and the Shropshire 7½ per cent. debenture weakened to 96½, which is ½ discount.

The Marconi report, given on p. 255 of last week's issue, caused a sharp drop, to 33s. 9d., in the ordinary shares. Support was quickly forthcoming, and a rally to 1 13/76 ensued. As announced here, the dividend on the ordinary shares is to be made up to 15 per cent. for the year, while the preference receive 12 per cent. This is a reduction of 10 per cent., in both cases, upon last year's dividends. Moreover, a bonus payment of 25 per cent., free of tax, was distributed a year ago, out of money received from the Government. It is interesting to trace the net profits record for six years, which stands as follows:—

1913	£122,300	...	1918	£597,900
1916	£318,400	...	1919	£1,220,740
1917	£383,800	...	1920	£237,082

Unfavourable rates of exchange are declared to be largely responsible for the shrinkage in the net profits. Because of these rates, substantial sums have been retained abroad on deposit, or invested in foreign Government securities. There are still outstanding claims against British Government departments, and it is difficult to appraise what may be the value of the shares from the standpoint of the permanent investor. The company has plenty of scope for expansion, in spite of the official "wireless chain." To the Stock Exchange eye, the shares retain attraction from the fact of their being a popular medium for speculation wherever there is "anything doing," which at present (save amongst investment stocks) there is not.

Following upon the payment of a healthy string of coupons upon Mexican Light & Power, Mexican Electric & Pachuca bonds, there comes the modest announcement that the March, 1915, coupon upon Mexico Tramways first mortgage bonds is to be met. Not much more than this had been anticipated. The price of the bonds is a little better at 54. The coupon, it may be useful to state, can be sold at £3 7s., less tax, in the Stock Exchange, whereas the company is paying, of course, only £2 10s. The Mexican Light & Power coupons can be sold at £37 5s. and the Pachuca coupons at £33, both less tax. British Columbia Electrics have gone back a little after their sharp rises last week, and Brazilian Tractions at 29 are ½ up.

Electrical manufacturing shares are inclined to be heavy. Edisons have dropped 1s. 3d. to 8s. 3d. English Electrics are down 1s. 6d. to half-a-guinea. General Electric ordinary can be bought at £1. Other manufacturing shares manifest a similar disposition to dullness. The reason is that people are beginning to get a little afraid lest German competition may

the acute in this industry. To what extent the apprehension is justified, those connected with the business can judge better than I can write upon financial subjects, but it is certainly having its effect upon prices, and the market is a bit more nervous than of late.

The electrical supply group, however, is generally firm. Currents of ordinary size 2 up to 2½, though Charing Cross at 12½, met the last noteworthy improvement which they put on a week ago. City of London at 12 are unaffected by the selling dividend announcement of 1s. per share. York time has for Power ½ per cent. debenture stock has eased off to 111. The prospectus of the Southland 6 per cent. debenture, as advertised by the New Zealand Government is not out. As a matter of domestic interest, it may be mentioned that the bonds will be dealt in, not by the electrical market, but by jobbers in Colonial Government securities.

Changes in the cable market are few and insignificant. Great Northern Telegraph have put on another 2½ d., but United River Plates, after the sharp advance they had enjoyed, lost 1½ at 94. Anglo-American Telegraph deferred is still being bought by the investor, and the price is better at 171. The Eastern group shows no alterations, except for a rise of 4 in cable preference.

Barbcock & Wilcox remain steady at 27½, while other engineering shares, together with those in the coal, iron and armament list, move narrowly, and, on balance, slightly downwards. Progress is being made this week with the formation of a new Rubber Shareholders' Association, and a preliminary meeting took place on Wednesday. The intention is to afford support to the proposals for enabling to be put into force a programme of further restriction of output, and control of the sale of the raw material. So far as market prices are concerned, however, these activities have had no influence in helping quotations. In fact, rubber shares are mostly lower on the week.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.						
	Dividend		Price		Yield.	
	1919.	1920.	1921.	Rise or fall.		
August 23.						
Brompton Ordinary ..	12	12	6	—	410	0 2
Charing Cross Ordinary ..	7	7	4	—	9	8 1
do. do. 4½ Pref. ..	4½	4½	8½	—	7	4 4
Chelsea ..	4	8	8½	—	9	4 8
City of London ..	18	14	12	—	10	3 0
do. do. 6 per cent. Pref. ..	6	6	17½	—	7	1 0
County of London ..	8	8	85	—	9	6 8
do. do. 6 per cent. Pref. ..	6	6	8½	—	7	7 4
Kensington Ordinary ..	7	9	4½	—	10	18 4
London Electric ..	14	24	1	—	7	10 0
do. do. 6 per cent. Pref. ..	6	6	2½	—	9	6 8
Metropolitan ..	6	7	8½	—	9	6 8
do. 4½ per cent. Pref. ..	4½	14	2½	—	10	18 4
St. James' and Pall Mall ..	8	12	6	—	10	10 0
South London ..	8	7	15½	—	8	17 10
South Metropolitan Pref. ..	7	7	15½	—	8	17 10
Westminster Ordinary ..	10	10	6½	—	8	13 10
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref. ..	6	6	85½	—	7	0 4
do. do. Def. ..	1½	1½	17½	—	8	14 2
Chile Telephone ..	6	6	5½	—	6	11 3
Cuba Sub. Ord. ..	7	7	7½	—	9	6 8
Eastern Extension ..	10	10	16½	—	8	2 0
Eastern Tel. Ord. ..	10	10	16½	—	8	2 0
Globe Tel. and T. Ord. ..	10	10	16½	—	8	2 0
do. do. Pref. ..	6	6	92	—	8	8 0
Great Northern Tel. ..	22	24	24½	—	9	17 6
Indo-European ..	20	20	80	—	8	8 8
Marconi ..	20	20	100	—	8	16 6
Oriental Telephone Ord. ..	13	12	2½	—	16	16 8
United R. Plate Tel. ..	8	8	6½	—	16	10 4
West India and Panama ..	Nil	Nil	6½	—	Nil	Nil
Western Telegraph ..	10	10	15½	—	16	1 2
HOME RAILS.						
Central London Ord. Assented ..	4	4	49½	—	8	1 8
Metropolitan ..	12	12	25	—	6	0 0
do. District ..	Nil	Nil	17½	—	Nil	Nil
Underground Electric Ordinary ..	Nil	Nil	22	—	15	8
do. do. "A" ..	Nil	Nil	8½	—	Nil	Nil
do. do. Income ..	4	4	7½	—	2	15 8
FOREIGN TRAMS, &c.						
Anglo-Arg. Trams, First Pref. ..	6½	12½	2½	—	10	0 0
do. do. 2nd Pref. ..	Nil	6½	2½	—	10	0 0
do. do. 6½ Deb. ..	6	6	6½	—	7	15 0
Brazil Tracings ..	Nil	Nil	Nil	—	Nil	Nil
British Columbia Elec. Ry. Pice. ..	6	6	—	—	8	9 2
do. do. Preferred ..	5	4	25½	—	11	2 1
do. do. Deb. ..	42	42	69½	—	10	1 4
Mexico Trams 5 per cent. Bonds ..	Nil	Nil	69½	—	7	2 10
do. do. 6 per cent. Bonds ..	Nil	Nil	95	—	Nil	Nil
Mexican Light Common ..	Nil	Nil	9	—	Nil	Nil
do. Pref. ..	Nil	Nil	17½	—	Nil	Nil
do. 1st Bonds ..	Nil	5	33½	—	9	7 0
MANUFACTURING COMPANIES.						
Barbcock & Wilcox ..	15	16	2½	—	6	3 0
British Aluminium Ord. ..	10	10	17½	—	11	8 6
British Insulated Ord. ..	15	15	17½	—	7	12 0
Callenders ..	15	15	17½	—	10	8 8
do. 6½ Pref. ..	6½	6½	17½	—	7	8 7
Crompton Ltd. ..	10	10	15½	—	13	6 8
Edison & Co. ..	10	10	—	—	1/3	—
do. do. 6 per cent. Deb. ..	6	6	68	—	7	7 1
Elect. Construction ..	10	10	16½	—	11	14 10
Ed. & Electric ..	8	8	14½	—	15	1 10
do. Pref. ..	6	6	11½	—	8	12 0
En. Elec. Pref. ..	6½	6½	17½	—	7	13 0
do. Ord. ..	10	10	20½	—	9d.	10 0 0
Harley ..	15	15	17½	—	10	5 0
do. 4½ Pref. ..	4½	4½	6½	—	8	16 6
India-Rubber ..	10	10	—	—	—	—
Mess. Vickers Pref. ..	8	8	11½	—	8	16 10
Siemens Ord. ..	10	10	14	—	16	18 3
Telegraph Cos. ..	30	30	81	—	16	14 1

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, August 23rd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	.. per lb.	8½d.	..
a Ammonia Sal	.. per ton	456	..
a Ammonia, Murate (large crystal)	..	438	..
a Bisulphide of Carbon	..	..	..
a Borax	..	231	..
a Copper Sulphate	..	431	..
a Potash, Chlorate	.. per lb.	6d.	..
a Perchlorate	..	8d.	..
a Shellac	.. per cwt.	£14 10s.	£1 dec.
a Sulphur, Sublimed Flowers	..	216	21 dec.
a Lump	..	216	..
a Soda, Chlorate	.. per lb.	3½d.	3d. dec.
a Crystals	.. per ton	27	..
a Sodium Bichromate, cakes	.. per lb.	7d.	..
METALS, &c.			
a Babbitt's Metal Ingots	.. per ton	£90 to £275	£5 to £25 dec.
a Brass (rolled metal 3" to 12" basis)	.. per lb.	10½d.	..
a " Tubes (solid drawn)	..	1½d. to 1½	3d. dec.
a " Wire, basis	..	11½d.	..
a Copper Tubes (solid drawn)	..	1½d.	..
a " Bars (best selected)	.. per ton	£101	4½ dec.
a " Sheet	..	£101	4½ dec.
a " Rod	..	£101	4½ dec.
a (Electrolytic) Bars	..	£101	4½ dec.
a " Sheets	..	£145	..
a " Wire Rods	..	£40	£2 10s. dec.
a " H.C. Wire	.. per lb.	11½d.	3d. dec.
a Elconite Rod	..	7½	..
a " Sheet	..	8½	..
a German Silver Wire	..	2/9	..
a Gutta-percha, fine	..	13/7	..
a India-rubber, Para fine	..	1/4 to 1/8	1d. in.
a Iron Pig (Cleveland Warrants)	.. per ton	Nom.	..
a " Wire, galv. No. 8, P.O. qual.	..	£35	..
a Lead, English Pig	.. per ton	£21 6s.	13s. dec.
a Mercury	.. per bot.	£10 7s. 6d. to £10 10s.	7½ to 10½ dec.
a Mica (in original cases) small	.. per lb.	3d. to 3½	..
a " " medium	..	3½ to 4	..
a " " large	..	10½ to 20½ & up	..
a Phosphor Bronze, Plain castings	..	2½ to 3	..
a " rolled bars and rods	..	2½ to 3	..
a " rolled strip & sheet	..	2½ to 2½	..
a Silicon Bronze Wire	.. per lb.	1/3	3d. dec.
a Steel, Magnet, in bars	..	1/4	..
a Tin, Block (English)	.. per ton	£119 to £150	£12 dec.
a Wire, Nos. 1 to 16	.. per lb.	3/9	..
a White Anti-friction Metals	.. per ton	£65 to £275	£3 to £10 dec.

Quotations supplied by—

a G. Boor & Co.	g James & Shakespear,
a South, Bolton & Sons, Ltd.	h Edward Tilt & Co.
a Frederick Smith & Co.	i Bolling & Lowe.
a F. Wiggins & Sons.	j Richard Johnson & Nephew, Ltd.
a India-Rubber, Gutta-Percha and	p O. Permiston & Sons.
Telegraph Works Co., Ltd.	p
	r W. F. Dennis & Co.

Film Studio Lights.—The Departmental Committee appointed by the Minister of Health to investigate the causes and prevention of blindness, of which Mr. C. H. Roberts is chairman, has just issued an interim report dealing with the injuries to the sight of actors and actresses alleged to be due to the powerful lights used for the production of films in kinematograph studios. Complaints on this matter were made by the Actors' Association last year. The Committee traces the trouble to the use of open arc lights without diffusing screens, and finds that some transient eye injuries have thus been caused, but that there is no evidence of permanent damage to sight. It states that the evidence given is to the effect that unscreened arcs are not only unnecessary, but give less satisfactory photographic results, and the Incorporated Association of Kinematograph Manufacturers has given an undertaking to the Minister of Health that its members will not permit the use of open arc lights without filters in their studios. The committee accepts this undertaking, but points out that the industry is in a state of development, and that research is needed as to the best types of lamp for the purposes. *Daily Telegraph.*

Fire.—There was an outbreak of fire at the premises of Mr. G. Blackburn, of Crown Street, Bolton, on August 19th, the cause being unknown. When the brigade arrived the building was well alight. Electrical appliances, valued at over £500, were destroyed.

Insufficient Foreign Postage.—The Postmaster-General draws attention to the fact that considerable numbers of insufficiently stamped letters are being sent through the post to places abroad, and more especially to the Continent. The prepaid rate of postage on letters for all foreign countries (except the United States of America and Tangier) is 3d. for the first ounce and 1½d. for each succeeding ounce or fraction of an ounce; from the United Kingdom to British Possessions generally, the United States, Tangier and H.M. ships and troops on foreign stations, the letter rate is 2d. for the first ounce and 1½d. for each succeeding ounce or fraction thereof.

LEAVES FROM AN INSPECTOR'S NOTE-BOOK.

By "ANODE."

ONE of the most disagreeable duties of an electrical inspector is in connection with the inspection of storage batteries, it being an extremely dirty and tedious undertaking, and in the majority of cases, any suggestions put forward for the maintenance of the battery are ignored, with the result that one sees a steady depreciation in its efficiency and performance.

Another point is that one's clothes are not benefited by sundry drops of acid being sprinkled upon them, and where the battery is situated at some distance from a station, it is not always possible to carry overalls, especially if burdened with a megger and other indispensable instruments.

It is really marvellous what a storage battery will stand up to in the way of bad treatment, and there is no doubt that battery makers generally can congratulate themselves on the superb qualities of their goods.

One of the best examples of how not to treat a battery came before me not long after I started out on the road, and being new to the job, and this my first battery inspection, I went into the matter very thoroughly and scientifically.

The first thing was a general look round, and from the appearance of the battery, I came to the conclusion that it was, and had been, out of use from time immemorial.

The attendant was a sort of combined groom-ostler-coachman-knife-boy-estate engineer generally, with a predilection for wisps of straw, those not in his hair being in his mouth, and I regret to say that he did not look a budding Faraday.

I asked this worthy whether the battery was ever used, and when did he think it was charged last, and to my astonishment he gravely informed me that it was in regular use, charged every day, and what was more, that it had been charged about twelve hours prior to my visit!

After a definite statement like this, I thought it better to get down to the job properly, and see exactly where we stood, and find out something definite about this happy battery.

The level of the electrolyte was extremely varied, in some cells the bridges being covered, while in others there were several inches of the plates uncovered; the density was all over the hydrometer, and in several cells so low that the hydrometer went straight to the bottom, giving me a nice job fishing it out again, to the detriment and soiling both of my suit and my soul.

The deposit in the cells in nearly all cases reached to the bottom of the plates, and reminded me of strata of multi-coloured sand, pointing to the fact that both the charge and discharge were extremely varied.

At the time of inspection there was no load on the battery, so voltmeter readings were of little, if any, use, the total reading being 115 for 55 cells.

Several cells were not in use, and in order to give these every chance when they were eventually taken out for overhaul by my G.O.C. friend, the attendant, instead of cutting out the defective cells simply short-circuited them with a piece of 19/16 cable.

I next turned my attention to the charging arrangements, and found that the dynamo and main switch board were half a mile away.

The G.O.C. next took me to see the dynamo, and said he would now put the battery on charge. Simplicity itself; run the volts up to 150, slam the switch in, let it rip for four hours, and there you are! What more is wanted or required?

I was next shown the battery maker's record book, and this I found had been filled up daily, giving the

density of electrolyte and voltage without any variation from the day when the makers handed it over; on asking how the G.O.C. accounted for the discrepancy between his and my figures, he quite candidly informed me that he filled the sheets up from the previous day's readings, and so back to page 1.

I took the G.O.C. into my confidence, and told him what he should do to get the battery back into decent condition as far as possible, especially pointing out the necessity and urgency of correcting the density of the electrolyte, all of which he promised faithfully to do. Yet on my next visit of inspection I found that all he had done was to top up the cells with water from a rusty tank.

Another battery that fell by the wayside was installed in a club, and was well and carefully looked after until on one unlucky day the gas engine broke down, and owing to the fact that a certificate could not be obtained (this was in the days of the great war) it did not appear that the battery was likely to be charged for some time. I visited the club about a month after the disastrous occurrence, and found the battery right down, and suggested that under the circumstances the best thing to do was to take the plates out, wash and dry them, and when the engine was repaired, to allow me to superintend the battery being recharged.

This was agreed to, but on calling round some months later, I found nothing had been done, the battery being by this time sulphated up. My advice was now asked for, and I suggested that the club committee should get into communication with the battery makers, and obtain a price for overhauling, &c.

But the committee, instead of giving the makers a free hand in the matter, sent for the local cycle and sewing-machine mechanic and asked him for his price and, needless to say, he quoted a considerably lower price than the makers and got the job.

On my next visit, I found the gas engine in full swing, but, unfortunately, the battery had been charged wrong way round. What should have been positive was negative and *vice versa*.

Again I informed the committee that the advice of the makers should be obtained without delay, but to crown all, they called in the sewing-machine mechanic who just ran the battery down, and charged up again in the opposite direction. The result was that the plates shed 75 per cent. of their active material, and in the end the committee had to install a new battery at war prices. Serve 'em right.

A peculiar case of battery trouble occurred at a brewery situated not a hundred yards from this club.

The battery was apparently of ample capacity for its work, was well erected and maintained, properly charged and looked after, yet for some reason the plates were continually buckling and shedding their active material, and it was quite by accident that I found the cause of the trouble.

I happened to miss my usual train on one occasion, and as it was a wet day I decided to remain on the brewery premises till the next train went, in about a couple of hours or so.

I filled in my time as best I could going over my notes, and about an hour after the regular staff had gone, the watchman suggested that I should partake.

Needless to say, the offer was accepted, and he led the way to the lift, which in due course landed us up in the regions where the bottling was done. After I had partaken, I had a brain wave, and asked the watchman to take me to the bottom again. I then asked him to take the lift up and down a few times while I remained in the power house. I found that the lift took 60 amps. at 110 volts, and this was the cause of the trouble, the battery being only of 200 Ah capacity.

Still, all batteries do not get this class of treatment, and I know of one battery which gave 18 years' continuous service, and was then in good condition, and was only put out of service owing to the fact that the local supply company ran a main out to the estate. This battery was cared for by a first-class type of man, not

an electrician by any means, but a man who was content to do what he was told, and do it thoroughly.

In circumstances like these, a battery will do all, and more, than the makers claim for it, and as I said at the beginning, "it is really marvellous what a storage battery will stand up to in the way of bad treatment."

WORKING CONDITIONS IN FACTORIES.

REPORT OF H.M. INSPECTOR OF FACTORIES.

(Concluded from page 241.)

Industrial Diseases. It is recorded that the total reported cases of lead poisoning during the period under review numbered 243* (the 1919 figures being 297²⁹), of which 47* cases occurred in the electric accumulator industry (the 1919 figures for which were 48⁷).

The figures for electric accumulators continue to be the highest. The principal chemist of the Government Laboratory was asked to assist by determining the amount of lead fume and dust given off in lead burning and chemical plumbing in this industry. An interesting inquiry followed, and after tabulating several estimations made of lead fume and dust, with knowledge of the processes and of the incidence of lead poisoning in them, it was concluded that if the amount of lead present in the air breathed contains less than five milligrammes per 10 cu. m. of air, cases of encephalopathy and paralysis would never, and cases of colic very rarely, occur. And this figure is a quite practical one to expect in any process amenable to locally applied exhaust ventilation. Somewhere about two milligrammes of lead are regarded as the lowest daily dose which (inhaled as fume or dust in the air) may, in the course of years, set up chronic plumbism. Arranged in this way the figures given in the report show that in experiments in lead burning and wire brushing in smoothing the lugs and in the pasting room, the standard laid down is considerably exceeded. The experimenters, moreover, said: "It is probable that the air breathed is richer in lead than that drawn through the apparatus. It would be very difficult—if not impossible—under ordinary working conditions to catch and trap in the apparatus all the lead rising from the burning operations."

There were five cases of mercury poisoning; two in the manufacture of clinical thermometers, one in the testing of electric meters (the only case in this factory for many years past, occurring during alterations to the premises when the exhaust fan was out of use), one in the manufacture of corrosive sublimate, and one of a man employed as an electrode cleaner in the manufacture of caustic potash and bleaching powder by electrolysis.

Dermatitis in electro-plating works has also been investigated and is largely due to the lime and caustic solutions used in the preliminary processes of cleaning.

Investigating a complaint of vesicular dermatitis among women electro gilders it appeared that the contact with the wire carrying the very weak current set up the primary skin irritation, as it was chiefly limited to the inside of the fingers coming in contact with the wire.

The Medical Inspector of Factories was asked by a coroner to assist in determining the cause of a condition of the skin found after death. The deceased was in charge of a small electrical station supplying an institution, and on the evening of his death had complained of not feeling well, attributing this to a commencing attack of malaria. About midnight he was found lying dead on the floor of the station, and at the inquest medical evidence showed that there was heart disease sufficient to account for sudden death, but attention was directed to a condition of the skin simulating burns which it was thought might have been caused by electricity. The skin showed a condition not unlike a superficial burn but without any surrounding inflammation, the superficial layer of the skin being removed as though by vesication and subsequent rubbing. Apart from its superficial character, the area was too extensive to admit of the possibility of an electric burn, and this opinion was subsequently endorsed by the Electrical Inspector of Factories, who found the pressure of the electric current in the plant too low to produce even a slight shock. The deceased had in falling upset a hurricane lamp containing paraffin and on examining the clothes—which had remained on the body for five or six hours after death—it was found that the parts corresponding with the affected skin areas were saturated with paraffin. There was no indication of the clothing having been burnt either by acid or heat, and the condition, it is considered, was produced by the prolonged action of the paraffin on the skin.

Electric Arc Welding.—During the year Dr. Bridge completed an inquiry with Mr. Scott Ram into the danger to the eyes of workmen employed in the process of electric arc welding. As a clear view of the work is required in order to strike the right place with the arc, and skill is necessary so that the arc is used to protect the eyes may be interposed at the right moment, learners suffer more than experienced men.

* Principal figures refer to cases; the small ones to fatal cases.

The symptoms, which occur from four to eight hours after exposure, are a feeling of sand in the eyes accompanied by intense pain, conjunctivitis, photophobia, lachrymation, with blurring or temporary loss of vision. Severe headache is also frequently experienced. These symptoms gradually subside, the time varying according to the intensity, and length, of exposure to the arc, recovery being generally complete in from 24 to 48 hours.

Dr. Bridge found no evidence of permanent scarring of the cornea, such as might have been produced by a previous keratitis. It is, however, possible that with inflammation and abrasion of the superficial layers of the cornea the ulceration would leave a permanent scar.

The rays also affect those parts of the skin which are exposed, and the effects closely resemble a severe sunburn, the skin peels, and recovery is complete. Slight pigmentation of the skin has been observed on those who have been affected, but no evidence of ulceration or cell proliferation has been seen. The length of exposure to the rays necessary to produce the eye symptoms described above is difficult to determine accurately, but is very short and may be calculated in seconds (a flash being sufficient) so that, when the symptoms occur, the man is said to have "caught a flash." It is for this reason that the difficulty of providing full protection is increased, for a man passing from one place to another where electric welding is in progress, may receive a flash as he passes; or again, two welders working near one another may receive side flashes from each other's work unless they are carefully screened. The exact distance at which it is safe to receive a flash or to look at the arc when the work is in progress is also difficult to estimate, but at a distance of 15-20 feet a flash does not appear to produce symptoms, in fact, at this distance the arc itself can be looked at for a few seconds. A longer exposure at this distance, however, possibly might produce symptoms.

Dr. Bridge obtained no evidence that permanent injury to the eyes resulted from exposure to the rays produced by electric welding. Electric welding has not been carried on in this country to any great extent until the last few years, and therefore the number of men exposed for any length of time in the past has been few. It was suggested that cataract might be produced by the rays given off from the arc. Here again, the length of time in which the work has been in operation in this country is short, and while it is too early to state positively that cataract (a disease of slow growth) will not occur among electric welders, there are essential differences in this occupation and that of glass workers which is known to produce cataract, both in the rays which affect the eyes and the length of exposure to them, which makes this highly improbable. Experiments would seem to demonstrate clearly that cataract is not produced by the light from welding or from flashes from a short circuit, but that it may follow injuries by short circuit when the current passes through the body of the injured person. The flash which frequently accompanies a short circuit is the explanation of cataract being produced by the light.

The precautions taken in all the works visited were very much on the same lines and generally consist of a hand screen to protect the face and eyes, and gloves or gauntlets to protect the hands. The hand screen, which is sometimes of metal and, therefore, offers certain dangers from contact with a live cable, is provided with a handle and with a window of coloured glass, an effective combination being a ruby glass between two blue glasses. Such a combination of coloured glass is practically opaque to ordinary light, but the molten metal and the point of the electrode when the work is performed can be seen clearly through it. Helmets of various types have also been seen, and have the advantage of screening the worker from side flashes from the arcs of adjacent welders on either side. A similar protection is afforded in a simpler manner by providing, in addition to the screen, ordinary clear glass spectacles fitted with side pieces which have the additional advantage that they protect the eyes when the slag is chipped from the weld.

To protect the hands and arms, gloves or gauntlets are generally provided, and where the cuff of the shirt is brought down over the glove and fastened, burning of the skin is avoided. In certain situations, such as work overhead, protection is required against falling particles of molten metal. Leather capes and leather aprons afford good protection:

The Batti-Wallahs Look Ahead.—The Committee of the Batti-Wallahs has been discussing provisional arrangements for the winter of 1921 and the summer of 1922. The proposals include the monthly luncheons, four informal gatherings, a ball, a smoking concert, golf, tennis, billiards, and snooker competitions, a summer outing, and an annual dinner. Members are at present being circulated by Mr. Greenly, the hon. entertainment secretary (37 and 38, Strand, W.C. 2), asking them to make their wishes known regarding these events, also to indicate the amount of support that they are likely to be able to give. Only one smoking concert is proposed (as last year) as the attendances have not been sufficient to cover the cost. The Batti-Wallahs' quarterly *Journal* may be revived if sufficient support is forthcoming to cover the cost.

THE SUPPLY OF ELECTRICAL ENERGY IN BIRMINGHAM AND DISTRICT.

By FRANK FORREST, M.I.E.E.

(Abstract of paper read at the BIRMINGHAM & DISTRICT ELECTRIC CLUB by the chief assistant electrical engineer of the City of Birmingham Electricity Department.)

JUST prior to 1914 the equipment of the Summer Lane station was completed, and work had already been commenced upon the foundations of a proposed new generating station at Nechells, which was designed for an ultimate capacity of 100,000 kW. Immediately upon the outbreak of war, however, work in connection with this new generating station was stopped at the request of the Government. By the end of 1914 the department was faced with a rapidly increasing load which, in the national interests, had to be supplied at the earliest possible moment. As it was clear that if work was resumed on the new permanent station it would be at least two years before it could be put into operation, the Electric Supply Committee decided to erect a temporary generating station with a plant capacity of 10,000 kW.; this station started work in 1915, within the record time of nine months from the date when it was commenced. It, however, proved quite inadequate to meet the ever-increasing demand for electric power, and extensions were taken in hand, bringing the total plant capacity in this station up to 22,000 kW.

As the demand for war purposes still continued to grow (it increased from 73,000,000 to 160,000,000 units in four years), in 1917 arrangements were made for the Dunlop Rubber Co. to supply an additional 9,000 kW; even with this assistance it was necessary to restrict all new connections and to run the plant practically without any stand-by at times of heavy load.

After the war was over, the demand very soon began again to increase, and last winter it was roughly 14,000 kW in excess of the highest war demand.

Shortly after the armistice was signed, work was again commenced on the Nechells permanent station, and this is being pushed on with all possible speed. Unfortunately, however, largely owing to the moulder's strike, but also to the slow rate at which work is now carried out, very serious delays have occurred, with the result that it will not be until the end of the current year that the first section of this station, totalling 30,000 kW, will be ready for running. A strong recommendation was recently made to the City Council to sanction the installing of a further 30,000 kW, bringing the capacity of this station up to 60,000 kW. Unfortunately the financial stringency of the times made it necessary to rule out this extension, but it has been decided to install an additional 5,000-kW set next year to tide over until money is easier.

At the rate of increase that is anticipated during the next few years it is pretty clear that the ultimate capacity of the Nechells permanent station, viz., 105,000 kW, will all be taken up within a measurable period of time, and in order to make still further provision for the future a large site has already been acquired close to the Midland Railway, between Water Orton and Whitacre, where there are ample facilities for a station having, if necessary, an ultimate capacity of 1,000,000 kW. The position of this site, being so close to the large industrial demand of Birmingham and district, should ensure a supply being given at a more economical figure than could be obtained from a super-station at a greater distance.

Nechells Temporary Generating Station.—This station was built in the yard of the dust destructor close to the site of the permanent station, it being realised that by doing this, the feeders supplied from this station could be most economically and easily transferred to the permanent station next door when the time came for shutting it down. The comparatively small space available made it necessary to put up two distinct boiler houses and turbine houses; the cooling-tower equipment also had to be erected in two sections.

No. 1 turbine house contains two 5,000-kW turbo-alternators and surface condensers installed by the Metropolitan-Vickers Electrical Co.; No. 2 turbine house contains two 6,000-kW turbo-alternators installed by the British Thomson-Houston Co., with surface condensers by Messrs. Worthington-Simpson, Ltd.

All these turbines run at a speed of 1,500 revolutions per minute, and the alternators generate three-phase, 25-period energy at a pressure of 5,000 volts between phases.

A complete set of circulating water, air, and water extraction pumps, each driven by a small steam turbine, is installed in connection with each condenser. These small turbines run at a very high speed, and are geared down through special gearing so as to enable the pumps to run at a lower speed.

The two boiler houses contain 12 marine-type water-tube boilers, by Messrs. Babcock & Wilcox, fitted with chain-grate mechanical stokers and superheaters. The steam pressure is 200 lb. per square inch, and the steam is superheated to a total temperature of 700 deg. F. Induced draught is supplied to these boilers by means of the "Prat" system.

No economisers are installed, but feed-water heaters are arranged to utilise the exhaust steam from the station auxiliaries, and in this way the temperature of the feed water is raised to 180 deg. F.

The overhead coal bunkers are supplied by electrically-driven

overhead telfers, made by Messrs. Herbert Morris, Ltd. The circulating water is pumped through the condensers and through a system of wooden cooling towers. The make-up water required to replace that evaporated in the towers is obtained from the effluent that is discharged from the bacteriological filter beds on the sewage farm. This effluent is practically free from germs when it is obtained, and after it has been once through the cooling towers, it is sufficiently aerated and purified to remove any trace of germs that may be in it. Exhaustive tests have been carried out which prove that no deleterious effect is caused by the use of this water. At the same time it is found that the nature of the effluent is such that the condensers are kept absolutely clean by its use; no scale formation takes place in the tubes, and no corrosion of any kind is set up.

The station is built upon a ferro-concrete raft upon the surface of the ground. The structure itself consists only of a steel framework covered with corrugated asbestos sheeting, which is the lightest construction that could be obtained for the purpose.

Nechells Permanent Station.—In the scheme, this station is laid out for an ultimate capacity of 100,000 kW. It will comprise an engine house and boiler house located side by side, with a switch house built out at one end of the engine house.

The nature of the soil on this site is poor, and it was decided to drive ferro-concrete piles into the hard subsoil about 12 or 15 ft. down. These piles are arranged either singly or in groups to take the concentrated loads of the steel structure, whilst ferro-concrete beams are constructed between, which form the footings of the brick walls which are filled into the steel structure.

The initial installation in the turbine house will consist of two British Thomson-Houston 15,000-kW turbo-alternators supplying three-phase energy at 5,000 volts, 25 cycles, running at 1,500 r.p.m. The surface condensers are by Messrs. G. and J. Weir, Ltd.

The boiler house will be divided up into sections, each section containing six boilers, a total of twelve boilers being put in for the first instalment. These boilers are of the Babcock & Wilcox marine pattern, each being capable of evaporating 40,000 lb. of water per hour from and at 212 deg. F. They are equipped with balanced draught mechanical chain-grate stokers, and with superheaters, and supply steam at a pressure of 325 lb. per sq. in. at a total temperature of 700 deg. F.

An overhead steel tube economiser is fitted to each boiler, the boiler and economiser acting as one unit.

The boilers are being set 2 ft. higher than the standard setting, in order to allow of ample combustion space between the boiler fire and the bottom row of tubes. This is found to be of great advantage in obtaining perfect combustion and mixing of the furnace gases before they reach the comparatively cool surface of the tubes.

Forced-draught fans are installed in the basement of the boiler house, one fan for every line of three boilers, and these deliver air under pressure into the closed ash pits of the mechanical stokers. The air that is used for cooling the windings of the main alternators and which becomes heated in this operation is led to the suction of these forced-draught fans, so that the heat dissipated from the alternators is utilised in the boiler fires.

Overhead coal bunkers are provided in the boiler house, which are fed by electrically-driven overhead telfers. These telfers can draw their coal by means of grabs either from pits external to the boiler house into which the railway trucks are discharged, or from canal barges lying in the private canal basin, or from a coal store on the far side of the canal basin.

One electric telfer is provided for each line of three boilers, and by means of switches in the overhead runways it will be possible to interchange telfers between one boiler house and another, should this be necessary.

At the high duty at which this modern type of boiler works, viz., an evaporation of about 8 lb. per sq. ft. of heating surface per hour, it is necessary to ensure that the internal tube surfaces are kept absolutely clean and free from scale. Water with practically no hardness in it, therefore, has to be used, and it is found that when this is done, internal corrosion of the feed pipes and economisers is very liable to take place. This corrosion is largely due to the presence of air and carbonic acid gas in the water, and arrangements have, therefore, been made, as far as possible, to prevent the feed water coming in contact with the air. The make-up water before it is introduced into the system is subjected to a vacuum in order to extract the air from it, and the combined condensate and make-up water on its way to the suction of the feed pumps is passed through a de-aerating heater. In this way the large quantity of air that is usually pumped into the boilers with the feed water will be, as far as possible, kept out of the system, and internal corrosion will be eliminated.

The large condenser-reservoir will be divided up into sections, and a certain number of wooden cooling towers will be erected over each section. Each turbo-alternator has its own circulating water pumps which draw the water from these reservoirs, pump it through the condensers, and on to the cooling towers. The suction of each pump is distinct, but the deliveries go into a common header from which connections are taken to each tower. The evaporation can be made up from three sources: (1) The effluent from the bacteriological filter beds on the sewage farm; (2) the discharge from an artesian well, which has been sunk on the site, and (3) the town water supply. The first of these will normally be used, whilst the second will be run every day in order to keep the artesian well in working order, the third being kept as a stand-by.

A large area of ground to the north of the station has been reserved for coal storage. The final arrangement for handling the coal into and out of this store has not yet been decided upon.

The switchgear which is contained in the switch house, and which controls both the main turbo-alternators and the outgoing circuits, is all arranged to be operated from the control room by means of electrical connections. This room is being arranged so that the operator in charge of it is really in control of the whole electrical system throughout the city. A diagram of every high-pressure main and connection will be kept in this room, showing every switch controlling either a generator or a circuit. Whenever a machine or a circuit is switched in or out, or whenever any alteration is made in the distribution system outside the station, the information will at once be given to the operator, who will reproduce it on the diagram. He will then be able to see at a glance exactly how the load is being distributed throughout the system, what machines are carrying it, and at the same time he will be kept informed of the amount of load that has to be dealt with. Any disturbances, breakdowns, or other occurrences will be immediately reported to him, and he will have to decide what steps have to be taken either to restore the supply if it is interfered with, or to readjust the load between the various stations. The operator in this control room, therefore, really acts as a "load dispatcher" in a somewhat similar way to a load dispatcher on a railway system.

Extra high-pressure energy will be supplied from this switch house, partly at a pressure of 30,000 volts between phases and partly at a pressure of 5,000 volts between phases. The 30,000-volt energy will be stepped up by means of groups of transformers installed in the switch house from 5,000 to 30,000 volts. Each 30,000-volt circuit will have a capacity of 10,000 kVA, and the trunk cables will be run to various centres in the town, where the energy will again be transformed down to 5,000 volts for distribution in the district.

The rotary converters in the sub-stations are divided into two sections, one for the supply of traction power at 550 volts and the other for low-pressure lighting and power supply at 440 volts between the outer conductors of a three-wire network.

Storage batteries are installed partly to carry the peak load in the winter afternoons, and partly to float on the lighting busbars in order to maintain a steady voltage. End-cell regulation is provided on these batteries in order to meet the variation in the busbar voltage which is required at different times of the day.

The low-pressure direct-current cable network supplies from each of the generating stations and sub-stations are isolated from one another, so that a disturbance in one area will not affect the supply in any other area. The low-pressure traction supply is divided up in the same way, but in both cases means are provided for connecting stations together through the low-pressure network, should this be necessary at any time.

The extra-high-pressure supply to large consumers is given by means of ring mains, which can be controlled at the generating stations and sub-stations, and the switchgear and mains are so arranged that any consumer can be fed from either of two stations or sub-stations.

The Birmingham Corporation electricity supply undertaking up to the present has been practically confined to the area contained within the city boundary; it is, however, probable that in the near future Birmingham will not be allowed to remain in isolation.

The West Midlands area delimited by the Electricity Commissioners, which affects the Birmingham district, includes the four counties of Shropshire, Staffordshire, Warwickshire, and Worcester. By far the larger portion of the demand in this area, about 85 per cent., will be concentrated in the industrial district comprising Birmingham, Wolverhampton, and the Black Country, whilst other towns such as Lichfield, Coventry, Rugby, Warwick, Leamington, Redditch, and Worcester, added to any demand required in the agricultural district, will account for the balance.

At present Birmingham, Wolverhampton, and the Midland Electric Corporation supply current at 50 cycles per second, whilst Birmingham and the Shropshire, Staffordshire, and Warwickshire Electric Co. supply 25-cycle electricity. It is a well-known fact, and an expensive matter to make such energy interchangeable in any quantity. In all probability, therefore, the Birmingham district will be divided up into two sections, one at 50 cycles per second and the other at 25 cycles per second.

A proposal is already on foot to combine the 50-cycle under-

takings into a Joint Authority under the new Electricity (Supply) Act* and it is suggested that large power stations should be erected at Rugeley and Stoke on the river Trent, and at Ironbridge on the river Severn. These sites are situated a considerable distance from the centres of demand, but energy will probably be transformed to a very high pressure and transmitted by overhead trunk lines.

For the two 25-cycle undertakings, that is, Birmingham and the Shropshire, &c., Power Co., Birmingham is already building a large station at Nechells, and has obtained a further site for a station of a still greater capacity at Hams Hall, close to Water Orton on the Midland Railway. The Shropshire Power Co. has already developed plans for erecting a large power station at Stourport on the river Severn. These sites are much nearer to the great centres of demand, and the cost of transmission will, therefore, be considerably less than for the 50-cycle section. At the same time, Nechells and Hams Hall will be obliged to use cooling towers for condensing purposes instead of river water, and the extra cost of this will be a set-off against the lesser cost of transmission. The net result to the consumers, therefore, should be very much the same in both cases.

At the Hams Hall site, which has an area of a thousand acres, it will be possible to obtain a very large quantity of the effluent from the bacteriological filter beds on the sewage farms. About 25 million gallons a day are at present running from these beds into the river Tame, and this quantity, if utilised in cooling towers, could easily provide the make-up required by the evaporation in the towers for a station capacity up to one million kilowatts.

The site is also situated very conveniently for three coal-fields: The Cannock Chase district; the Nottingham and Derby district; and the Warwickshire and Leicester district.

The Stourport station on the river Severn could easily develop 100,000 kW by using the river water through the condensers, without the necessity for installing cooling towers. For a greater capacity, cooling towers will probably be required during dry seasons.

In the future, in all probability, Stourport, Nechells, and Hams Hall will be linked-up by means of heavy trunk mains, so that the spare plant in one station can be made available for assisting another in case of emergency. In this way great reliability of supply given from these stations should be obtained.

It will probably be a good many years before the whole of this scheme is brought into being.

A commencement has already been made at the Nechells station, and an early start is contemplated with the Stourport station. The development of the scheme will proceed gradually but on bold lines, in order to meet the gradual growth in the demand.

A recent estimate that has been prepared of the requirements in the district goes to show that from nine hundred thousand to one million kilowatts will be required in the Birmingham and district industrial area. This will, of course, take some years to develop, but it must be regarded as certain that it will be required sooner or later, and the plans for dealing with the district will have to be developed with this end in view.

THE MAGNETIC PROPERTIES OF MONEL METAL.

DURING recent years monel metal has come to be used quite extensively. It is a useful nickel-copper alloy which has definite magnetic characteristics that are well below those of soft iron, but the critical temperature at which it becomes non-magnetic is very low, near the boiling point of water—a property which should make the metal of importance for such use as in relays for temperature-control equipment. Moreover, monel metal resists corrosion, and is tough, strong, and elastic.

In view of its growing importance, and the complete lack of information concerning its magnetic properties, the results of an investigation of the magnetic nature of monel metal, as communicated to the *Electrical World* by Mr. C. W. Burrows, are of interest. The material used in the experiments was the standard product regularly supplied commercially by the International Nickel Co., and an analysis of the samples tested showed the following average percentages: Ni 65.636, Cu 29.37, Fe 1.13, Mn 1.178, C 0.16, Si 0.376, S 0.0315.

The samples of monel metal were examined magnetically by placing them in the uniform field of a long magnetising solenoid and suddenly withdrawing them therefrom. The resulting change in magnetic flux threading the small detector coil which at the beginning surrounded the metal portion of the test bar was indicated by the ballistic deflection of a galvanometer, and this quantity, added to the strength of the magnetic field as determined by a separate measurement, gave the true induction in the specimen. Full induction curves of typical samples are shown in fig. 1, while fig. 2 illustrates the relative magnetic characteristics of monel metal and the usual magnetic materials.

* *Elect. Rev.*, August 5th, 1921.

The critical point was determined by placing a small slug of the material under test in a beaker of paraffin, at a temperature differing only slightly from that of the paraffin, to pass through the critical temperature. During this operation the slug was repeatedly tested with a small pointed electromagnet, and the temperature at which the magnetic change occurred was noted. In the samples tested there was no appreciable difference between the temperature at which the magnetisability of the material disappeared on heating and that at which it reappeared on cooling. The average critical point for a number of sheet and rod samples, hot and cold

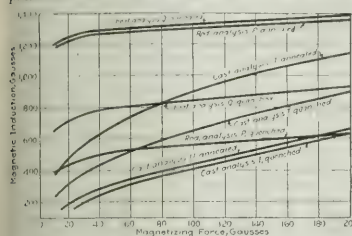


FIG. 1.—MAGNETIC DATA OF MONEL METAL.

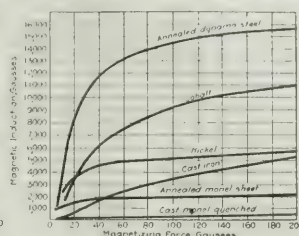


FIG. 2.—MAGNETIC CHARACTERISTICS OF VARIOUS METALS

rolled, was 203 deg. F., compared with 670 deg. F. for nickel, 1,440 deg. F. for iron, and 2,000 deg. F. for cobalt.

Experiment showed that the heat treatment which produced the lowest permeability in monel metal consisted in heating to a temperature of 1,300 deg. F., cooling slowly to 350 deg. F. and finally quenching in brine at 16 deg. F. The highest permeability resulted from furnace annealing at approximately 1,300 deg. F. The influence of hot working upon the magnetic properties of monel metal is shown by a comparison of the magnetic results obtained from cast and hot-rolled materials. The former in the annealed state exhibits the lowest induction, annealed hot-rolled sheet shows the highest permeability, and hot-rolled rods take an intermediate position. In general, the effect of hot working is to increase the magnetic softness of monel metal, the cast metal being the hardest magnetically, and sheet which has received a maximum of hot working, the softest.

Magnetising force.	TABLE I.
1	100 per cent. increase.
2.5	17 per cent. decrease
5	27 per cent. decrease
10	29 per cent. decrease
25	28 per cent. decrease
50	28 per cent. decrease
100	14 per cent. decrease
200	12 per cent. decrease.

Cold working changes the magnetic characteristics of monel metal. For large magnetising forces the magnetic changes are similar in nature and magnitude to the corresponding ones in the properties of steel. To determine the effect of cold working, a 10-in. rectangular bar of monel metal was hammered while cold until it increased 2½ per cent. in length; Table I shows the relative change in permeability between the original specimen and the hammered bar.

ing to the minimum illumination required, &c., and to investigate other lighting effects.

In its present report the Committee deals only with the problems of suitable artificial lighting, and states *inter alia* that some misconception and ignorance of these problems exist, and that unsuitable systems of lighting are still common in factories and workshops. This condition has been accentuated recently by the extending use of high intensity, enclosed electric lamp, which in many instances are used to replace tungsten lamps in show windows and are added to the latter, whereas to insure suitable lighting, change of type of lamp often necessitates change of type or adjustment of the shade.

The requirements of suitable lighting are quite definite, they are: Absence of glare and of troublesome shadows, a steadiness and constancy of the light source, together with a moderate degree of uniformity of illumination and of surface brightness over the plane of work. Certain other factors bearing on suitable lighting are:—

1. Diversity, i.e., the ratio of maximum to minimum illumination. This is closely related to adequacy, since upon the maximum illumination depends the extent to which the illumination may fall before it becomes inadequate.

2. Contrast due to difference of surface brightness. Further experiments may show that some regulation as to the surface brightness of any two visually contiguous surfaces may be required.

3. Colour and composition of the light. The introduction of new high-intensity light sources of different types may, eventually, make it necessary to consider how far this factor affects the suitability of lighting, but no requirement dealing with this point is called for at present.

with this point is called *ray*, and covers the effect (a) of looking directly at a bright source of light so that the observer is for the time being dazzled and his vision is impaired for a short period after the light has ceased to enter his eye; (b) produced by the presence of one or more bright sources of light towards the edge of the field of vision so that the rays enter the eyes obliquely from them. An observer may never look directly at such sources of light, but he is nevertheless troubled by their presence near to the object at which he is looking. This is the commonest form of glare; (c) produced when the surface of the material being worked upon is shiny or polished, and reflects light directly from some source into the eyes of the worker, causing work with such materials to be very trying unless the worker is so placed with reference to the source of light that none of the rays can be directly reflected from the material into his eyes.

All three forms of glare are still to be met with in factories. The possible effects of the first two (which are most commonly due to absence or imperfect protection of the light sources) are twofold. Discomfort may be caused to the worker by the presence of a strong light in or near his line of vision, or a worker or other person entering a room may be temporarily dazzled by the light, so that he is unable to see his way about, and may incur additional risk of accident.

The first essential of suitability, therefore, is *proper shading* of the light sources. The effect of a shade is to reduce the intrinsic brilliance of the source, and proper shading could accordingly be defined by the simple criterion whether the incandescent filament, mantle, or flame, is distinguishable as such when viewed through the shade.

So far as glare is concerned, the viewer need only be screened when in or near the line of vision, and then only in the direction towards the eye; accordingly the framing of a screen, which, without insisting on complete screening of the source, will ensure that no bright surface is visible except when considerably away from the usual line of vision, takes two factors into consideration: (1) The distance of the source from the eye; (2) the angle at which the light from an unscreened or improperly screened source may enter the eye without producing objectionable glare.

(1) If an unscrubbed source is situated beyond a certain distance, which for all sources commonly employed in factories may be taken as 100 ft., its apparent size and the amount of light entering the eye will be so small as to render the glare effect much less evident, and any such sources may be excluded from the requirement which we propose.

(2) Conversely, as the distance between the eye and the source decreases, the apparent size of the source and the influx of light from it will increase, and glare can then only be avoided by screening the source or by increasing the angle between the central line of vision and the source.

Therefore, in practice a suitable requirement might be expressed in terms of the distance of the source and of a limiting value of the angle between the line from the source to the eye and a horizontal plane, within which angle no such source should be directly visible. In the case of sources used for general lighting for the purpose of a legal requirement, the limiting value of the angle specified should be 20 deg., but in the case of very near sources such as are employed for local lighting, an angle of 30 deg. should be substituted. The Committee accordingly recommends that there should be a provision as follows:—

THE LIGHTING OF FACTORIES AND WORKSHOPS.

SECOND HOME OFFICE REPORT.

By January, 1913, the Home Secretary appointed a (Home Office) Departmental Committee to inquire into and report on the conditions necessary for the adequate and suitable lighting (natural and artificial) of factories and workshops, having regard to the nature of the work carried on, the protection of the eyesight of the workers employed, and the various forms of illumination. In 1915 the Committee issued its first report* dealing with the general lighting of factories, and further inquiry was then postponed until the termination of the war. In November, 1920, the Committee resumed its work, but owing to the urgent need for economy it has since been found necessary to restrict its inquiries. Nevertheless the Committee has issued a second report† on the conditions necessary to secure suitable artificial lighting, and recommends certain requirements which if applied to all factories and workshops will, in its opinion, ensure that artificial lighting shall be suitable for its purpose. Moreover, the Committee promises to report separately, in due course, on the subjects of mixed natural and artificial light, classification of processes accord-

* Civil 8,000. Elec. Rev., Sept. 17th, 1915, p. 356

† Cmd. L.418. H.M. Stationery Office, Kingsway, W.C. 2;
price 1d. net.

"... Every light source (except one of low brightness*) within a distance of 10 ft. from any person employed shall be so shaded from such person that no part of the filament, mantle, or flame is distinguishable through the shade, unless it be so placed that the line between the line from the eye to an unshaded part of a source and a horizontal plane is not less than 20 deg., or in the case of any person employed at a distance of 6 ft. or less from the source, not less than 30 deg."

The third form of glare (which is common in factories where smooth or polished material is used) is generally caused by unsuitable placing of the source, and may be remedied either by changing the position of the source relatively to the eye, or by increasing the diffusion of the light by enclosing the source in some diffusing material.

Shadows.—Troublesome shadows (frequently to be found even with systems of lighting which are good in themselves) are generally due to unsuitable placing of the light sources, whereby the shadow of the worker himself or of some part of the plant or material is cast on the place of work, and are particularly objectionable when thrown by some object in motion. Apart from the annoyance caused and the interference with the proper execution of the work, deep shadows, by concealing dangerous parts of machinery, may lead directly to accidents.

Constancy.—Constancy in artificial illumination is a matter of great importance. Unsteadiness and flicker have an injurious effect on vision, and if pronounced, increase the risk of accidents. Therefore, flicker which can be remedied should be prohibited.

In arriving at the above conclusions the Committee considered the codes of lighting which have statutory force in many of the American States and the recommendations for industrial lighting formulated by the Illuminating Engineering Societies of America and Germany.

HOPEFUL SIGNS IN AUSTRIA.

VIENNA hopes fervently to resume her position as an important intermediary of exchange between Middle and Western Europe on the one side and the Near East on the other. The time when that hope may be fulfilled seems remote, and other cities in the reconstructing States are competing for the place—Budapest, her old rival, Belgrade in the new and rapidly-reviving Serb-Croat-Slovene Kingdom, and last, but not least, Prague, in Czecho-Slovakia.

Vienna's chances have recently been improved by the arrangements which are being made for Austria to enter into the advantages of the Ter Meulen credit scheme. They would, of course, be improved, too, by the economic recovery of Russia, but that contingency is also remote. H.M. Commercial Secretary at Vienna says, in his recent report, that the Austrian capital must inevitably lose some of the business it has hitherto done, to the merchants, banks and insurance houses in the capitals of the other Succession States. Moreover, the head offices of most of the important Bohemian undertakings are already being removed to Prague. Yet, in spite of all, there is no doubt, in the Commercial Secretary's view, that Vienna will remain the most important city in that part of Europe.

The new Austria presents several features of interest to the engineering trades. In the Erzberg, Styria, it possesses one of the most valuable iron deposits in Europe. The necessary supply of coke, which was cut off when the Monarchy was broken up, will henceforth be furnished by Herr Stinnes, one of whose companies has acquired a large interest in the deposit. Consequently, Austria will soon be producing enough steel and iron to cover its requirements, and later be in a position to export. There is a very large machine industry, including the manufacture of locomotives, wagons, automobiles, and agricultural machines.

Owing to the shortage of coal and oil and the high prices that have prevailed for fuel during and since the war, attention has been drawn to the ample water-power available in the Alpine districts of Austria and in the Danube. Elaborate surveys and plans were already made before the war, and the total amount of available water-power is calculated at 2,250,000 h.p., of which, however, only 9 per cent. is employed. In Switzerland, which has about the same available power, 22 per cent. is in use.

Repeated endeavours have been made during the last two years to induce American, British and other foreign capitalists to assist in the exploitation of the Austrian water-power, but so far without success. The Austrian Government has now itself started work on a five years' programme for the electrification by means of water-power of 652 km. of the most western part of the State railways, in Arlberg, Tyrol, Salzburg and Carinthia, as the most remote from the coal supply, and considerable progress has been made, though the lack of coal for transport and cement-making delays the work. The expense in the depreciated crown currency appears alarming, but the cost of labour has not risen in proportion to the fall

* By "low brightness" is meant an intrinsic brilliancy of not more than five candles per sq. in.

in the value of the currency, and it has been calculated that the average outlay per h.p. has fallen 62½ per cent. between 1913 and 1920. Since the crown has fallen further since October the cost now is probably still less. The expense of constructing the new locomotives will, however, be very heavy, and it is doubtful whether the electrification of the railways can really be carried through without any foreign help.

Though the programme provides for the electrification of only one-seventh of the State railways, it is estimated that when completed it will save 450,000 tons of coal and 32 locomotives, and 1,000 coal wagons now used for its transport. Before the war only 250 kilometres of the railways, mostly of narrow gauge, had been electrified, as the military authorities were always opposed to the electrification of the main lines.

Power for the numerous factories of Vienna and neighbourhood and for the electricity works of Vienna and other towns could also be obtained with advantage from water-power, particularly if coal is to remain dear and scarce in this part of Europe; but, unless foreign capital will assist, any developments on a large scale will probably have to wait until the country is more prosperous.

Whatever may be the result of the present financial negotiations for the relief of Austria, H.M. Commercial Secretary adheres to the opinion that the country sooner or later will emerge from its present troubles, and that Vienna will continue to play its leading rôle in South-Eastern Europe. British business men should remember that there are a large number of thoroughly sound commercial and manufacturing houses in Austria which may be inconvenienced and hampered but are not endangered by the unfavourable condition of the Austrian public finances. Lastly, it should be mentioned that this country has, in spite of all its troubles, managed successfully to preserve public order since the end of the war, and that the following of the Bolsheviks is so small that they have obtained no representation in the National Assembly.

TRADE STATISTICS OF SOUTH AFRICA.

THE following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1920, has been compiled from the recently-issued official trade statistics. The figures for 1919 are added for purposes of comparison, and notes of any increases or decreases are made:—

	1919 £	1920 Inc. or Dec. £	
<i>Electrical cable and wire.</i>			
Total	272,000	417,000	+ 145,000
From Great Britain	182,000	394,000	+ 212,000
" Japan	25,000	2,000	- 23,000
" United States	62,000	20,000	- 42,000
<i>Batteries, primary.</i>			
Total	17,000	30,000	+ 13,000
From Great Britain	2,000	6,000	+ 4,000
" United States	14,700	18,000	+ 3,300
<i>Batteries, secondary.</i>			
Total	63,000	74,000	+ 11,000
From Great Britain	11,000	26,000	+ 15,000
" United States	52,000	47,000	- 5,000
<i>Heating and cooking apparatus.</i>			
Total	24,000	41,000	+ 17,000
From Great Britain	10,000	31,000	+ 21,000
" United States	14,000	9,000	- 5,000
<i>Insulators, porcelain.</i>			
Total	4,000	7,000	+ 3,000
From Great Britain	3,700	6,000	+ 2,300
<i>Insulators, all other.</i>			
Total	500	1,500	+ 1,000
From Great Britain	350	1,300	+ 950
<i>Lamps, incandescence.</i>			
Total	94,000	78,000	- 16,000
From Great Britain	16,000	25,000	+ 9,000
" Holland	28,500	21,000	- 7,500
" United States	47,000	32,000	- 15,000
<i>Motors.</i>			
Total, kW	15,600	12,000	- 3,600
From Great Britain, kW	95,000	151,000	+ 56,000
" United States, kW	8,200	5,600	- 2,600
" United States, kW	49,000	80,000	+ 31,000
" United States, kW	6,770	6,000	- 770
" United States, kW	45,000	68,000	+ 23,000
<i>Transformers.</i>			
Total	17,000	30,000	+ 13,000
From Great Britain	4,600	10,000	+ 5,400
" United States	12,000	20,000	+ 8,000
<i>Electrical machinery, other.</i>			
Total	180,000	321,000	+ 141,000
From Great Britain	62,000	109,000	+ 47,000
" United States	117,000	113,000	- 4,000

	1919	1920	Inc. or Dec.
Electrical material, other.—	£	£	£
Total	195,000	482,000	+ 287,000
From Great Britain	120,000	362,000	+ 242,000
United States	64,000	90,000	+ 26,000
Japan	9,000	9,000	—
Holland	500	5,000	+ 4,500
Cranes.—			
Total	11,000	60,000	+ 49,000
From Great Britain	8,000	47,000	+ 39,000
United States	3,000	13,000	+ 10,000
Elevators and lifts.—			
Total	10,000	27,000	+ 17,000
From Great Britain	7,000	24,000	+ 17,000
United States	3,000	3,000	—
Mining machinery.—			
Total	715,000	618,000	— 97,000
From Great Britain	303,000	419,000	+ 116,000
Sweden	1,000	—	— 1,000
United States	406,000	195,000	— 211,000
Switzerland	1,000	—	— 1,000
Telegraph and telephone material.—			
Total	17,000	32,000	+ 15,000
From Great Britain	8,000	24,000	+ 16,000
Sweden	1,500	2,000	+ 500
United States	7,000	6,000	— 1,000
Tramway rails.—			
Total	4,500	21,000	+ 16,500
From Great Britain	1,500	20,500	+ 19,000
United States	3,000	500	— 2,500
Tramway rolling-stock.—			
Total	29,000	87,000	+ 58,000
From Great Britain	10,000	34,000	+ 24,000
United States	19,000	53,000	+ 34,000
Other tramway materials.—			
Total	7,500	17,000	+ 9,500
From Great Britain	1,500	3,000	+ 1,500
United States	—	13,000	+ 13,000
In addition to the above the following goods were imported as "Government stores":—			
Batteries, primary.—			
From Great Britain	6,000	3,500	— 2,500
United States	11,000	—	— 11,000
Batteries, secondary.—			
From Great Britain	1,000	21,000	+ 20,000
United States	—	16,000	+ 16,000
Heating and cooking apparatus.—			
From Great Britain	1,000	—	— 1,000
Insulators, porcelain.—			
From Great Britain	4,000	10,000	+ 6,000
Motors and parts.—			
From Great Britain kW	67	100	+ 33
£	1,100	1,800	+ 700
Electrical cable and wire.—			
Total	99,500	86,000	— 13,500
From Great Britain	84,000	74,000	— 10,000
United States	15,500	5,000	— 10,500
Canada	—	7,000	+ 7,000
Telegraph and telephone material.—			
Total	78,000	125,000	+ 47,000
From Great Britain	59,000	107,000	+ 48,000
United States	10,000	6,000	— 4,000
Sweden	9,000	10,000	+ 1,000
Transformers.—			
From Great Britain	137	—	— 137
Electrical machinery, other.—			
From Great Britain	1,500	24,000	+ 22,500
United States	400	—	— 400
Electrical material, other.—			
From Great Britain	3,000	11,000	+ 8,000

REVIEWS.

Winning the Public. By S. M. KENNEDY. New York and London: McGraw-Hill Book Co., Inc. 1920. Pp. 168; 4 plates. Price 15s. net.

The author of this work is described as the "vice-president in charge of public relations and business development" of the Southern Californian Edison Co. Most of the chapters of the book appeared serially in the *Journal of Electricity* or the *Electrical World* during the year 1920, and some have been read before meetings of people interested in the subjects dealt with.

There are fifteen chapters, and the object of all of them is the same, that of understanding the public, with the view

of inducing the public to understand and trust the undertaking with which they are dealing. Patience, courtesy, cheerfulness, conciliatory bearing, co-operation, and general friendliness are urged in all cases, so that it may be clearly shown that the supplier is interested in the purchasers having a square deal first, last, and all the time.

The philosophy of the square deal is preached nowadays to an extent which might lead the cynically-minded to imagine that it had only been discovered of late years, and particularly, perhaps, since 1492. It is, however, not an exotic, nor exclusively American. It is realised even by political economists, that value must be given for value received, and that these values do not take long in mutually adjusting themselves to changed conditions. Nevertheless, it is well to bring out the desirability, not only of the square deal in itself, but of the best atmosphere in which to do business. Habits have changed in a very marked degree in the last 15 or 20 years in this respect. It is no longer considered necessary to spend considerable sums on entertaining, mainly of an alcoholic nature, in order to induce the mutually trustful frame of mind in which the transaction is best concluded. The generally friendly bearing, the willingness to give a patient hearing to what may seem to be a trivial complaint or an impracticable suggestion, the readiness to impart information on all sorts of subjects and details—in short, a desire to render service, and to give quality—these are the better things that have superseded the grosser methods formerly in vogue.

The book now before us does not seek to show how to win the public by advertising, although publicity is not neglected. It seeks instead to show how to advertise by winning the public. To some it may seem a labouring of the obvious, but as we have often remarked before, a thing does not cease to be true because it is trite. Rather does it become the more necessary to repeat the truism in a thoughtful and discerning manner, in order that we may be sure that we appreciate its full meaning, and all that its originator intended to convey. In spite of a certain amount of what the Prince of Wales graphically describes as "pi-jaw," and notwithstanding sundry liberties taken with the English language and literature, the book will serve a useful purpose, and those whose duties bring them into contact with the buying public should absorb its principles.

Dynamo and Motor Erection and Management. By A. H. AVERY, A.M.I.E.E. Pp. 152; 91 figs. London: Cassell and Co., Ltd. Price 1s. 6d. net.

Though the scope of the work is indicated on the first page by the author, as follows: "Every one who owns, or has charge of, a dynamo or motor cannot be a skilled electrician; but he can, and should, soon acquire sufficient practical acquaintance with certain technical facts and details essential to the proper operation of such machinery," even more is included in this handy little volume, e.g., cable installation. The first chapter forecasts the arrangement of the matter commencing with the purchase, then the installation, cabling, and connecting up starters and control gear, transmission of power, attendance, and finally, troubles. While set forth in a simple manner, the warnings as to risk of shock (page 6) might with advantage be much more strongly impressed. It is very mild to say "220 volts is distinctly unpleasant and painful, while accidental contact with 440 volts might prove fatal." The definition of power, at the foot of page 7, is confused with that of work or energy. It would be an improvement if power and watt were defined in conjunction with one another, and then work or energy defined with watt-hour and kilowatt-hour. The definition of phase is difficult in an elementary work, but that given on page 8 is too brief to be clear. The chapter on selection of machines gives many valuable hints, and there will be those who are in sympathy with the rather complicated remark that "there are always machines on the market that it is worth paying a little to avoid the annoyance of owning." This impresses the desirability of witnessing a thorough test at the maker's works before purchasing a dynamo or motor of any considerable size. The temperature limit (page 19, at the foot) of 80 deg. F. rise above that of the room seems rather stringent compared to the figures of the British Engineering Standards Association (1917), which allow 90 deg. F. to 99 deg. F. for various parts of machines. A noticeable misprint occurs on page 23, line 4, where "pile-tips" should read "pole-tips," and another seven lines lower down, "radiates" for "radiates." On page 38 a numeral 1 being omitted gives the result of the problem worked as 9/16 S.W.G. instead of 19/16 S.W.G., marring the effect of a good example. The notes on the installation of overhead bare transmission lines for medium pressures are very good and well illustrated. The customary description of standard types of switches and fuses is given, followed by a chapter on starters, controllers, and switchboard connections. Chapter XI on drives and couplings is very clear on points to be observed and characteristics required for belt or chain driving. Then follows a chapter on the elementary principles of dynamo construction. The final Chapter XIII deals with faults and troubles of the commoner kinds and their remedies. The results of the racing away of two motors are very well shown by reproductions from two photographs of the armatures. The book should prove a useful and interesting guide to those for whom it is written.—W. N. Y. KING.

Lubricating and Allied Oils. By ELLIOTT A. EVANS, F.C.S.
1 Pp. 128, figs. 23. London: Chapman & Hall, Ltd. Price
9s. 6d. net.

Occupying as he does the position of chief chemist to the well-known oil firm of Messrs. C. C. Wakefield & Co., Ltd., Mr. Evans's experience in all branches of his subject is beyond question.

Such a book from such an author, one might reasonably expect to be highly technical, and we were pleasantly surprised to find it couched throughout in the plainest terms. Nevertheless the subject-matter has been drawn from the author's experience and close association with the science of lubrication, both in the laboratory and in the workshop, and where outside information is necessarily included the name of the author and source of reference are given.

After briefly sketching the history of petroleum, oil refining, and the occurrence of fatty oils, the author deals fully with physical tests, including the electrical resistance method of determining the specific heat of oils, and with the chemical tests of transformer and other oils. The oxidation of petroleum, oleography, and the selection of lubricants are also treated succinctly, while in the final chapter, "Oils Employed," typical examples of mechanical parts and the lubricants employed therewith are given, reference being made to the most suitable oils for use with dynamos and motors, transformers and switches.

We have no hesitation in commending the book to those who, wishing to master some of the fundamental factors in the problem always facing the actual users of lubricating oils, have hitherto had to rely upon the experience of others for their facts.

Industrial Control. By F. M. LAWSON. Pp. 130; figs. 19.
London: Sir Isaac Pitman & Sons, Ltd. Price 8s. 6d. net.

The six lectures originally delivered by the author at the Mappin Hall, Sheffield, after being subjected to considerable revision, are embodied in this helpful volume, the *raison d'être* of which lies in the fact that most of the industrial unrest of to-day is due to the inability of many directors of industry to direct. In other words, to their failure to recognise and to meet the needs of the laws of mutual accommodation and unity of control.

If, as the author states, the safety of the future depends upon the true records of the past, then, judging by the diagrams and charts he has selected to illustrate the results obtained at works where his system is now in use, he has well accomplished his avowed purpose of setting before those who are engaged on organisation work the true fundamental laws governing direction, whether they be applied collectively or individually to the nation, the factory, the men, or the machine.

The book is not written so that "he who runs may read"; if anything the style lacks clarity, but the man who is looking for more output and less dissatisfaction in his works will find it well worth reading.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C.1.

- 20,957. "Average method transformers and cables on electric transmission systems." A. M. Turner. August 8th.
20,958. "Control devices for electrical telephone transmitters." H. J. Henson. August 8th.
20,959. "Electric cable connectors, &c." W. J. Seven Nibbs. August 8th.
20,960. "Electric cable connectors, &c." J. Schmitt. August 8th.
20,961. "Means for making a tight connection between cables and cable leads." H. A. Owen and M. J. Keating. August 8th.
20,962. "Electromagnetic power transmission for automobiles, &c." W. W. Harry. August 8th.
20,963. "Heater for electric incandescent lamps." J. W. Moxley. August 8th.
20,964. "Apparatus for stress of telegraph cables." J. S. Entwistle. August 8th.
20,965. "Wireless telegraph systems, &c." Radio Communication Co., Ltd. 1. New England. August 8th.
20,966. "Transmission method for telegraph systems." Victoria Electric Co., Ltd. August 8th.
20,967. "Transmission method for telegraph systems." R. A. Allen. August 8th.
20,968. "Means for controlling current in electric circuits." British Electric & Cable Co., Ltd. August 8th.
20,969. "Means for controlling current in electric circuits." Siemens-Schuckertwerke. August 8th.
20,970. "Means for controlling current in electric circuits." Siemens-Schuckertwerke. August 8th.
20,971. "Means for controlling current in electric circuits." Siemens-Schuckertwerke. August 8th.
20,972. "Means for controlling current in electric circuits." Siemens-Schuckertwerke. August 8th.
20,973. "Means for controlling current in electric circuits." Siemens-Schuckertwerke. August 8th.
20,974. "Means for controlling current in electric circuits." Siemens-Schuckertwerke. August 8th.
20,975. "Means for controlling current in electric circuits." Siemens-Schuckertwerke. August 8th.
20,976. "Means for controlling current in electric circuits." Siemens-Schuckertwerke. August 8th.
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20,998. "Means for controlling current in electric circuits." Siemens-Schuckertwerke. August 8th.
20,999. "Means for controlling current in electric circuits." Siemens-Schuckertwerke. August 8th.
21,000. "Means for controlling current in electric circuits." Siemens-Schuckertwerke. August 8th.

- 21,232. "Telephone exchange systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 10th.
21,230. "Means for regulating strength of electric currents." C. S. Agnew and E. E. Hill. August 10th.
21,233. "Electric torches, &c." Ever Ready Co. (Great Britain), Ltd., and F. S. Johnson. August 10th.
21,231. "Spark plug." J. de la Bossiere. August 10th.
21,234. "Starting crank for internal combustion engines, fitted with flywheel magnetic systems." A. D. Macklow. August 10th.
21,232. "Switches for electric vehicles." W. Rogers and Wingrove and Rogers, Ltd. August 10th.
21,233. "Induction coils for currents at radio frequencies." W. R. H. Long. August 10th.
21,234. "Magnetic cores having an electrically insulating and mechanical structure." J. Krupp Aktiengesellschaft. August 10th.
21,235. "Mine rescue, &c., telephone apparatus." R. L. Murray Telephone Manufacturing Co. (1920), Ltd. August 10th.
21,236. "Hydroelectric generating plant." M. Payne. August 10th.
21,237. "Automatic telephone transmitters." E. S. Hearley and Murdoch and Co., Ltd. August 10th.
21,238. "Electrical gear for operating theatre curtains, for pool domes, lifts, &c." A. Bibby and J. Houghton. August 10th.
21,239. "Winding, forming, &c., coils for dynamo electric machinery." E. J. 10th. August 10th.
21,240. "Driving mechanism for gramophones, &c., actuated by an electric motor." C. Below. August 10th.
21,241. "Wave transmission." Western Electric Co., Ltd. August 10th.
21,242. "Wireless signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co.). August 10th.
21,243. "Control of electric motors." British Thomson-Houston Co., Ltd., H. F. Farmer and H. C. Hastings. August 10th.
21,244. "Control of electric motors." British Thomson-Houston Co., Ltd., H. F. Farmer and H. C. Hastings. August 10th.
21,245. "Electric starters for internal-combustion engines." A. H. Midgley. August 10th.
21,246. "Electric controllers." Electro-mechanical Brake Co., Ltd., and M. J. Pittman. August 10th.
21,247. "Telegraphs." J. S. Hearley. August 10th.
21,248. "On-line make and break switches." P. W. Davies and F. H. Reeves. August 10th.
21,249. "Electric lamps and switches therefor." O. J. Hughes. August 10th.
21,250. "Electrically-operated polishing, burnishing, and grinding apparatus." A. V. A. C. Nobbs. August 10th.
21,251. "Casings for electric cut-outs, &c." W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nichols. August 10th.
21,252. "Means for connecting electricity meters, &c., with supply mains." W. T. Henley's Telegraph Works Co., Ltd., and P. Rosling. August 10th.
21,253. "White electrical insulating plastic mass, and process of manufacturing same." J. F. E. Grant. August 10th.
21,254. "Apparatus for condensing mercury vapour in metal vapour rectifiers." Siemens-Schuckertwerke. (Germany, August 10th, 1920).

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

19,990. "Fekometers." A. Shtschukin. September 30th, 1916. (166,905)

1916.

94. "Electric valve or lamp relay and interval transformer." G. A. Mathew. May 1st, 1920. (166,915)
1,152. "Electric welding." B. Longbottom and E. Greenhalgh. January 14th, 1920. (Cognate application 21,745, 1920.) (166,914).
1,673. "Electric switches." J. B. Tucker. October 21st, 1920. (166,918).
8,450. "High-frequency alternating current." O. Billieux. (Patent of addition not granted.) January 24th, 1919. (149,773).
10,709. "Electric relays." W. H. Eccles. April 17th, 1920. (166,940).
11,165. "Electric magnets." J. Neale. April 22nd, 1920. (166,951).
11,311. "Wireless direction finding apparatus." C. K. Chandler. April 23rd, 1920. (166,958).
11,401. "Protective devices for electric apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). April 24th, 1920. (166,968).
11,436. "Duplex and like telegraphic systems." H. W. Sullivan. April 24th, 1920. (Cognate application 5,006, 1921.) (166,970).
11,482. "Spark plugs." G. Howell. April 27th, 1920. (166,985).
11,557. "Holders or fittings for incandescent electric and like lamps." W. E. Shuttleworth. April 30th, 1920. (167,001).
12,252. "Electric tumbler switches." M. J. Railing and W. Manchester. May 6th, 1920. (167,011).
12,720. "Means for driving ink and discharging electricity in printing." W. H. Chapman. May 7th, 1920. (167,014).
12,820. "Magnets for internal combustion engines." H. Schmid and G. Prager. July 19th, 1917. (162,869).
13,160. "Radiogoniometers especially suitable for use in wireless direction finding." G. M. Wright. May 12th, 1920. (167,018).
13,417. "Electric switches." R. H. Baker and C. W. Parsons. May 15th, 1920. (167,019).
13,928. "Electric bells or similar apparatus." A. Fisk. May 20th, 1920. (167,027).
14,343. "Means for suspending bowls, shades, and the like, for electric and other light." E. Richardson. May 28th, 1920. (167,032).
14,630. "Electric burglar alarms." W. Doms. April 11th, 1918. (143,922).
15,349. "Manufacture and production of graphite electrodes for use in electrolysis." C. L. Higgins, D. A. Pritchard, and United Alkali Co., Ltd. June 7th, 1920. (167,040).
15,378. "Transmission of messages and signals by electrical means." Evered & Vignoles, Ltd., and A. G. Moore. June 7th, 1920. (167,044).
16,170. "Electric generating systems." British Thomson-Houston Co., Ltd. (General Electric Co.). June 10th, 1920. (167,049).
17,901. "Electrode for use in depositing molten metal." W. H. Boone. June 30th, 1920. (167,063).
19,292. "Thermal generating units having an internal combustion engine as the prime mover." H. B. Shamburg. July 9th, 1919. (147,214).
19,332. "Telegraphic transmitters employing thermionic generators." Ges. für Drahtlose Telegraphie. July 15th, 1915. (147,429).
19,345. "Method for directing wireless telegraphs with several separated motors." Ges. für Drahtlose Telegraphie. July 15th, 1915. (147,442).
19,346. "Wireless telegraph transmitters." Ges. für Drahtlose Telegraphie. September 12th, 1918. (147,698).
21,212. "Electric motor attachment for both chain, sprocket, and the like." A. G. Voth. August 10th, 1920. (167,092).
24,059. "Electric direct current circuits." H. J. Warner. August 18th, 1920. (167,097).
26,350. "Winding pad holders for telephone instruments." S. Woodward. September 15th, 1920. (167,104).

1921.

- 8,495. "Switch lamps." Westinghouse Electric & Manufacturing Co. April 16th, 1920. (167,094).
11,240. "Tungsten arc lamps." Patent Treuhänder Ges. für Elektrische Glühlampen. April 30th, 1920. (166,901).

THE ELECTRICAL REVIEW.

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SEPTEMBER 2, 1921.

No. 2,284.

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The address of Mr. Edgar Crammond to the Institute of Bankers ought to be circulated at Government expense for the education of the nation. Though many people might cast it aside as dealing with a dull and difficult subject, intelligent persons who began to read it would in all probability read it to the end, as the facts set forth are of supreme importance, and the form of the address is clear and in every way excellent.

The speaker commenced by comparing the national income of 2,400 million pounds in 1913 and 4,400 million pounds in 1920—a nominal increase of about 2,000 million pounds, or 83 per cent. increase over the national income of 1913. This increase was, of course, not represented by a corresponding increase of the national production for 1920, which as a matter of fact was 20 per cent. below that of 1913. It was due entirely to inflation of values.

Mr. Crammond gave an analysis of the manner in which the national income was spent in 1907 and 1920. He pointed out that the most striking features were an increase in the percentage of the national income spent on food (including drink) in 1920 as compared with former years, and an enormous increase in the cost of national services. In 1907 the cost of national services was 8.5 per cent., whereas in 1920 it had risen to 23 per cent. of the total national income.

He proceeded to show that the same economic forces which carried the nominal national income up were now carrying it down with even greater rapidity. The highest point of prices of commodities shown by the *Statist* Index Numbers was 266 in April, 1920, whereas at the end of May, 1921, the average had dropped to 162.2. In fact, prices had fallen three times as rapidly as they had risen, and it was not quite certain that the end had been reached.

We should like to point out, as we have done before, that the Excess Profits Duty has had a very large share of responsibility with regard to the fall in prices in general, as manufacturers and merchants were glad to throw their stocks on the market at any price so long as they were in a position to set off their losses against the Excess Profits Duty, which they would otherwise have had to pay.

Foreign trade returns (imports and exports) show a falling off of 41.7 per cent., and the earnings of our shipping a decline of 23 per cent. in the first five months of 1921, as compared with the same period in 1920.

Mr. Crammond estimated that the national income for 1921 would not exceed 2,800 million pounds, whereas the budget for the present year provides for an expenditure of 1,039 million pounds. This, however, is by no means the worst of it, as it is now clear to everybody that the Budget will be down on the receipts side by many millions and up on the expenditure side also by many millions, and as a matter of fact the position is very much worse than it appeared on the Budget figures. The revenue return for the first two months of the current year showed a decrease of 100 millions. It is already apparent that it is a sheer impossibility for any great industrial nation in urgent need of capital to afford anything like 32 per cent. of its entire national income for the purpose of national services, which is Mr. Crammond's estimate for the current year. On the Budget Estimates we should all (or rather all those of us who are at work) have been working for four months out of the twelve for national services, but in view of the worsening of the position since the Budget was intro-

duced it would appear that six months out of the twelve would be nearer the mark.

Such are the facts as set forth without any unnecessary comment by Mr. Crammond. The second half of his paper was devoted to the question of the policy which must be adopted to meet this appalling situation.

In the first place, Mr. Crammond estimated that if the real wealth of the country increased in the same proportion as formerly, we ought to be able to pay off the war debts in the course of the next two generations, but in order to achieve this result it is evident that we must adopt a policy which will enable our manufactures and our volume of trade to be restored and increased above the former rate. In this connection Mr. Crammond pointed out that the economic interests of Great Britain and France were not quite identical. We have over two million persons registered as unemployed, while France has only a hundred thousand. Great Britain is mainly a manufacturing country, while France is mainly an agricultural country. Our exports for the first five months of this year show a decline of 36.5 per cent., whereas the exports of France during the same period show an increase of 12.7 per cent. The effect of the German indemnity as at present settled is shown to be that Germany, in order to fulfil her external obligations, must increase her exports (which will, of course, be chiefly manufactured goods) up to 16 hundred or 18 hundred millions per annum. In the past Germany has supplied one-tenth of the world's consumption of manufactures, whereas in the future she will, in order to fulfil the terms of the Reparations Settlement, have to increase her share to 40 per cent., taking the place of a corresponding proportion of competitors' goods.

Mr. Crammond's most important proposals might be summarised very briefly, as requiring first an enormous cut in the cost of our national services, and the total of our national Budget; secondly, a greater proportion of contribution to the needs of the Empire by the Colonies and Dependencies; and thirdly, he urged that either with or without similar action on the part of the United States we should cancel the war debts owed to us by our Allies, and also, if thought desirable and possible, the war debts owed to us by our Colonies, thus setting our debtors free to order and pay for more of our goods. His view was that if on the contrary we continued to collect interest and repayment of these war debts, we should lose far more than the sums they represented in the reduction of our export trade. Mr. Crammond did not suggest that the United States should cancel our debt to it of one thousand million pounds, but he did suggest that the United States, with great advantage to itself and us, might cancel the debts due to it by the other Allies in the Great War.

The only alternative to some such strong remedial policy is that we shall have to relinquish a great proportion of our foreign trade; and Mr. Crammond pointed out that if the people of these islands became self-contained and self-supporting, it would only be possible to support a population of 20 millions, and the other 26 millions or so would be compelled to seek occupation abroad.

We trust that this extraordinarily illuminating statement of the present state of our financial affairs will receive the attention of the whole British public.

ELECTRICITY IN MINES.

An excellent little publication has been issued by the Mines Department and published by H.M. Stationery Office, which should certainly be in the hands of every colliery manager and electrician, as no doubt it will be—and we would certainly recommend every one engaged or interested in the manufacture of mining electrical plant to obtain a copy* without delay.

* Coal Mines Act, 1911. General Regulations as to the Installation and Use of Electricity, with Explanatory Memorandum. Mines and Quarries Form No. 11. (April, 1921.) One shilling net.

Its value lies in the explanatory memorandum forming Part II, and covering 54 out of its 73 pages—which is the official interpretation of the "Regulations" as given in Part I.

The first regulation relates to "the duty of the mine owner, agent, or manager to comply with and enforce the regulations," but there is also a duty laid upon *all employés*, and particularly those who operate the plant, to carry out their work so as to comply with the regulations. It is of little use to install first-class plant unless this is adequately maintained and properly worked, and therefore it is pointed out that improper use, or interference, or gross negligence, may cause a breach of the regulations, and render a "safe" piece of apparatus dangerous to handle or operate. The whole of the plant, therefore, is to be under the effective supervision of the "electrician," and it is the duty of the manager to ensure that the former satisfactorily carries out his duties. The "electrician," or in cases where the size and complexity of the plant requires them, "assistants," must be appointed in writing, and their duties properly apportioned. Moreover, the "electrician" must be in daily attendance at the mine, and if he be absent for more than one day, the manager must appoint an efficient substitute. On the question of efficiency or competence, it is pointed out that an assertion of competence by the person appointed will not absolve his superior from responsibility, but it is the duty of the "electrician" to satisfy himself by observation and instruction that the person selected to assist or operate any machinery does really understand the work, and is capable of performing it without "danger." A "log-book" must also be kept, in which all records and tests must be entered as evidence of such work being duly carried out, but apart from the legal aspect of this matter, it is quite rightly pointed out that a concise and systematic record is of great value in securing proper maintenance, in forestalling breakdowns, and in avoiding interruption of service.

Notes on the various notices and returns to be given to H.M. Inspector for the Division, and notices to be exhibited against "unauthorised interference," in case of "fire," and "electric shock," are given, the latter being especially interesting, as showing how important it is to resort to, and persevere with, artificial respiration. The notes on "Working space and access to apparatus," "General requirements for avoidance of danger," "Switchgear cables," and "Earthing," are dealt with in a practical and common-sense way, and should be read and carefully studied by those concerned in the management and control of electrical apparatus in and about mines.

Undoubtedly the publication is intended to assist and help those in charge of mining plant thoroughly to grasp and understand clearly the meaning of the regulations which are designed for the sole purpose of safeguarding life and property, and which, to this end, should be faithfully studied and obeyed.

On Wednesday next the eighty-ninth annual meeting of the British Association for the Advancement of Science opens at Edinburgh, where, exactly 50 years ago, Lord Kelvin (then Sir William Thomson) presided over a meeting in which electricity took a most important part.

This year, as was the case at Cardiff in 1920, the matters which will occupy the attention of members are not predominantly electrical, although a number of topics of interest to electrical engineers will be discussed. The proceedings of Section G—Engineering—will embody at least three important contributions to the study of the utilisation of water power. In his address the President of this Section, Prof. A. H. Gibson, will give a review of the subject; Dr. T. F. Wall will present an ingenious scheme for overcoming some of the difficulties raised by the varying force of tides; and Prof. F. C.

Lea will also deal with the subject of tidal power. In this Section, also, Mr. S. B. Donkin is to contribute notes on the new power station of the Corporation of Edinburgh, and Mr. J. Scott-Taggart will describe two new negative-resistance devices for use in wireless telegraphy.

In the Mathematical and Physical Science Section (A), the President, Prof. O. W. Richardson, will deliver an address on "Problems of Physics." "The Einstein Theory" will be dealt with by Prof. Eddington, and the Rev. A. L. Cortie, of Stoneyhurst, is to read a paper on "Magnetic Storms of the Present Solar Cycle." Wages and conditions in industry naturally, at this time, find an important place in the Economics Section (F). Miss G. Jebb is to discuss "The Cost of Living and Sliding Scales," and a paper on "The Breakdown of the Minimum Wage" is to be contributed by Mr. A. A. Mitchell. Those who consider that, in this country, the limit has been reached, will await with some apprehension Sir Josiah Stamp's paper on "The Taxable Capacity of a Country." Dr. Mary Ranken will speak on "Arbitration in Recent Industrial Legislation."

An endeavour has been made this year to arrange that there shall not be more than two sectional addresses or important discussions in progress simultaneously, and another innovation is the decision to permit discussions upon sectional addresses.

A number of visits have been arranged, and it is to be hoped that the weather will be favourable, although no doubt Edinburgh needs rain as badly as the rest of the Kingdom.

At the beginning of last month, **Classics and Business.** Dr. Walter Leaf, who is one of the leading bankers in the City of London, and who is also chairman of the

Classical Association, delivered an address at Cambridge to a distinguished company, including representatives of the American Philological Association.

Dr. Leaf began his address with a reference to the tightening of intellectual bonds between this country and the United States, and as evidence of the vigour of the classics in the Middle West, he spoke of a meeting which he attended in Chicago where they sang "The Star-spangled Banner" and "Three Blind Mice" in Latin. He also referred with the relish of the scholar to certain discussions upon passages from Thucydides which had taken place at the board meeting of an electricity company in London. He referred to the popular estimate of the Classics having been at its lowest in the early stages of the war, when it seemed that nothing could win a victory but pure science; and that no education which did not lead directly to the discovery of a new poison gas was worth the attention of rational people. There was a jeer at some statesman who did not know the origin of glycerine, and it was inferred that no one could lead the people in war if he did not know the chemistry of fats. Dr. Leaf rejoiced that there was now clearly a reaction against that extreme view, in favour of the "Large humanism" based upon the classics. He said that classical teaching produced the power in dealing with men for putting oneself in their place, in sympathy with their ideals and sentiments; and said that this precious gift had never been more needed than now in the constant expansion of international relations in business of every sort.

While we have the greatest respect for Dr. Leaf as a scholar and a business man of the greatest eminence, we are bound to say that we differ from him fundamentally on the subject of education. If science is really losing ground as compared with the Classics, it is in our view only to be deplored.

Either the whole educational mechanism would have to be immensely speeded up, or the educational period of life would have to be greatly lengthened to enable the average student to become a classical scholar as well as a scientific man. Even regarding the classics merely as a medium for exercising and enlarging the thinking faculty, we doubt if anything less than scholarship is

of much use. The ordinary grounding in Latin which enables a boy to read "De Bello Gallico" with difficulty and loathing is, in our view, a waste of time which would be much better spent in obtaining a knowledge of modern languages. In any case, it seems to us perfectly clear that any man who is to succeed in any branch of applied science will only do so provided he gives practically the whole of his time to science from the age of 15 upwards. The "large humanism" of which Dr. Leaf speaks is not, so far as we are able to learn, regarded by the business community as a prominent feature in the make-up of the bankers of to-day; and if, as we believe, a very large proportion of the persons ruling us from official and semi-official arm-chairs have either received a classical education or practically none at all, it does not seem to have saved them from making an impossible mess of the nation's affairs, financial and political.

We hold that what is required to-day in executive chiefs is not so much an acquaintance with dead languages as of living men; and we hold that a year's commercial travelling on the Continent would help a man more to understand and sympathise with the foreigner's point of view than any amount of Latin and Greek. An elementary acquaintance with the science of Political Economy would be of more value to our Chancellors of the Exchequer than ripe classical scholarship. With regard to the nation's production, both in peace and war, if we were asked to choose between handing over as hostages to the enemy the whole of our classical scholars, or as an alternative all our chemists and engineers, we fear that we should promptly decide to part with the former. The experts in poison gas successfully used their brains and risked their lives in discovering the protective masks, and precious little thanks they got for it.

The salaries paid to chemists and other scientifically trained men during the war showed very plainly the value placed on their services by the classical rulers of the country. For our part, we look forward to a time when the rôles will be reversed, and the practical and scientific men will hold the reins. The country may then have a chance of recovery.

YESTERDAY, as we have previously **The Engineers' Club (London).** announced, the Engineers' Club was to open its doors, and thus at last a project long cherished by those who had enjoyed and appreciated the amenities of its Manchester prototype has come to fruition. The difficulties—as we foreshadowed last December—that had to be overcome were great, perhaps greater even than the promoters anticipated, and it has taken many months of investigation and negotiation to surmount them; indeed, had not the Provisional Committee had the good fortune to enlist the whole-hearted and indefatigable support of Mr. E. L. Hill, one-time hon. secretary of the Manchester Club, whose enthusiasm never wearied and whose dictionary does not contain the word "defeat," we doubt whether the movement could ever have been brought to a successful issue.

We understand that the Club is to be above all an Engineers' Club in fact as well as in name, and that the qualifications of candidates in that respect will be strictly scrutinised; nevertheless, the term will not be interpreted so as to exclude those—architects, for example—who, while not usually classed as engineers, are intimately connected with that profession. The best way to find out whether one comes within the category of "eligibles" is to file an application, and as an entrance fee is to be imposed when this month ends, the sooner the better.

The membership roll is approaching 3,000, but there is ample accommodation in the spacious premises in Coventry Street for more than that number, which, of course, includes a large proportion of country and overseas members. Extending our congratulations to the Committee and the members, we wish the Engineers' Club every success.

MR. GEORGE ELLISON'S SWITCHGEAR WORKS.

Not very often does one come in contact with an establishment that was initiated for the set purpose of producing a commodity and which has continued throughout the whole of its existence to manufacture the same product and that one only. Yet such is the history of Mr. Geo. Ellison's undertaking at Perry Bar, Birmingham, the more recent extensions of which we had the pleasure of viewing last week. These works, which have been laid out and built with much care and forethought, are devoted exclusively to the design and construction of

design and construction of industrial switchgear. Standardisation and interchangeability are insisted upon wherever possible, and the special conditions imposed by the character of the work, such as mistake- and weather-proofness, dust-tightness, simplicity, strength, compactness, and above all, reliability, are fulfilled in no uncertain manner. It must be added that the solutions of the problems encountered in this respect are not always the cheapest, but they are sound, and that is what really matters.



FIG. 1.—OFFICE AND STORES FRONTAGE.

electric control gear for industrial installations, and are worthy of note inasmuch as they possess several features uncommon to similar establishments.

Foremost amongst these is the fact that in contrast to the more or less co-operative method of governing most industrial establishments, this concern is controlled

A view of the office and stores frontage is given in fig. 1, which shows the goods receiving deck on the left and the new research house and office accommodation that is nearing completion on the right. The smoke stack seen in the illustration belongs to the refuse destructor, the heat from which is utilised to warm



FIG. 2.—MAIN ASSEMBLY BAY.

and regulated by one man. No female labour whatever is employed, and every employé without exception is paid by time, so that no night work is allowed, and strange as it may seem to some, the policy adopted answers splendidly well, not least the most cordial relations exist between Mr. Ellison and his employes.

By concentrating upon one line of manufactures, the firm has been able to gather together a specialist staff, and has acquired unrivalled experience in the successful

the establishment. The whole works are thoroughly well lighted, both naturally and artificially. Fig. 2 shows the main bay assembly benches, with a part view of the machine shop on the right; the works are electrically driven throughout at a pressure of 440 volts, which is stepped down in the works sub-station from the public supply pressure at 5,000 volts. Fig. 3 is a view of the test room, while fig. 4 shows a "Unit" type distribution board, including oil-break,

circuit breakers and busbars; it is made for all industrial purposes, and is intended to cover the field between the ordinary switch and fuseboard and the elaborate cellular ones for large power stations. The arrangement lends itself to the building-up of quite complicated boards, yet each part is simply and robustly constructed.

The open circuit breaker illustrated in fig. 5 is of practically the same design as the breakers which were selected for use on the Paris tramway system in 1899, after severe tests in competition with other well-known

of the electrical gear on the crane when the supply fails; an overload inverse time-element relay in the circuit of each motor, to trip the main breaker when a motor is overloaded or fails; pilot lamp with plug, socket and switch, and indicating instruments if required. This method of employing one circuit breaker only reduces the number of elements to the minimum and increases the ease of manipulation. It is convenient for a quick re-start after a temporary stoppage, and there are no troublesome fuses to "blow" and be re-wired.



FIG. 3.—TEST ROOM.

makes. Since then the only alterations which have been found necessary are in details, in order to cheapen and simplify the manufacturing processes. The breakers are mounted on slate bases and are made up in numerous combinations of single, double, triple and four-pole patterns, with or without magnetic blow-outs, open type or with protecting covers. Every form of automatic feature is provided, and they can be supplied to satisfy any condition for which switchboard circuit breakers may be required. The exceptionally long carbon break and the simplicity of design are factors in the success of the breaker. There are six standard sizes, for currents ranging up to 3,500 amperes. Finished parts are stocked to enable the works to supply promptly any of the 20,000 variants which are possible with the different sizes, types of handles, number of poles and automatic releases, blow-outs and covers, interlocks and contactors.

The crane control panel shown in fig. 6 is part of the Ellison patented system of complete electric crane control equipment for d.c. and a.c. motors, which also includes controllers, resistances, limit switches and brake solenoids. All live parts are enclosed, and the panels comply in all respects with the requirements of the Home Office and Factory Acts. The gear on each panel includes a main air-break circuit breaker, with overload and no-volt releases, of ample size and breaking capacity to interrupt the supply with safety and certainty under the worst conditions of service, and to isolate the whole

There are many situations in factories and non-flery mines where a convenient plug arrangement for connecting up portable tools is of great utility, and a suitable fitting is made by the firm to facilitate the use of trailing cables and sockets and plugs for air-break gate end boxes. A substantial socket and plug are mounted

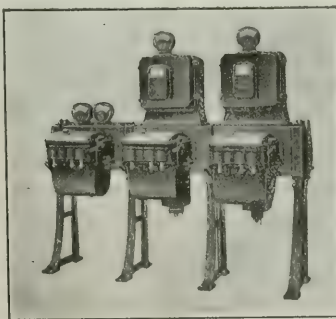


FIG. 4.—"UNIT" TYPE DISTRIBUTION BOARD.

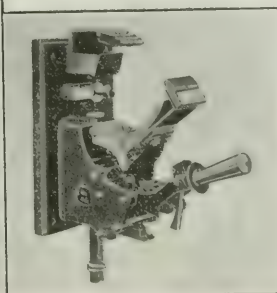


FIG. 5.—OPEN TYPE CIRCUIT BREAKER.

direct on a standard "Mill" type circuit breaker, and the plug is interlocked with it to prevent the plug being withdrawn while current is flowing. A similar piece of apparatus is illustrated in fig. 7, being an oil-break circuit breaker mounted on a stand with an interlocking plug and socket for use as a gate end box; the plug is shown removed and a cap screwed over the socket.

These few examples of Mr. Ellison's products will

serve to show that he is thoroughly acquainted with the methods of combining a maximum of those good qualities which go to the making of reliable apparatus and also of satisfactory manufacture. The subject of interlocking and correct sequence of operation is, in any case, of vital importance, and the care and thought that has been devoted to the problem ensures that the apparatus works satisfactorily and safely however unskilled the personnel under whose charge it may be.

From the electrical point of view, the switchgear is equally worthy of study. The fixed and moving contacts are separately attached to their supports, are readily adjustable for wear, and are easily replaced. The oil-cooled rotor starters made by the firm are of special interest; they are designed for starting slip-ring induction motors, and are weather-proof and dust-tight. They control the rotor circuits only, and separate circuit breakers should be used for the stators. Starters are built up to 1,500 b.h.p. and 1,000 amperes rotor current.

The contacts and resistance elements are submerged completely in oil. The contact dial is at the bottom of

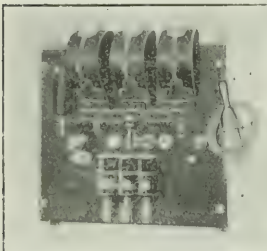


FIG. 6.—CRANE CONTROL PANEL.

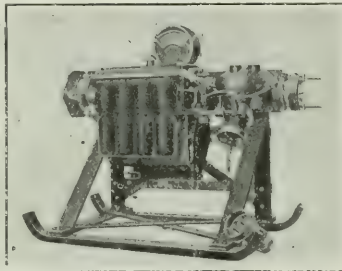


FIG. 7.—GATE END BOX.

the tank under a very ample head of oil, and in the coolest part, eliminating danger, which otherwise might occur if the oil level falls. The complete starter can be removed bodily from the tank for inspection.

The moving contacts consist of heavy copper rollers, which are free to rotate and swivel on copper ball joints carried on a brass spider. They are forced against the fixed contacts by strong springs, so located that each roller is positively controlled and can surmount a roughness or obstacle on the dial without relieving the pressure on the others. The rollers are, therefore, self-seating and self-aligning.

The resistance element consists of a wire of high resistance alloy with a negligible temperature co-efficient that is wound on strong stoneware cylinders which support the wire throughout its length, and being threaded, effectually prevent short circuits from turn to turn.

A slow-motion device is fitted to the operating mechanism, thus ensuring a quick movement from contact to contact, but with a pause at each contact.

In concluding this brief survey of the Perry Barr works, it remains to be said that no amount of care in design will produce satisfactory plant if the workmanship is indifferent. But such a contingency is avoided by the severity of the conditions under which the employees work. They are allowed privileges, such as smoking during working hours, which are not tolerated in other establishments: excellent cloak-room and canteen facilities are provided—and it pays, because a satisfied workman gives satisfactory service.

NOTES ON THE GRINDING OF COMMUTATORS.

By OWEN LINLEY.

WHEN the bars of a commutator begin to show signs of the development of flats, it is necessary for these to be removed.

Performing this operation by turning is open to many objections. Those who have had any experience in turning copper know how troublesome that metal is to operate on under ordinary conditions, and in the case of a commutator it is worse, for the following reasons: First, the metal has been hardened by the friction of the brushes, and the bars, not being very rigid (especially towards the centre), are inclined to spring, so that the curve produced by the tool does not coincide with the circle of the commutator, as it should do. Moreover, the tool, as it leaves the bar, is apt to tear off small portions of the metal, and these are likely to break the mica. Apart from these matters, there is another point which should be considered as regards turning a commutator in a lathe. Every one who

has had much to do with turning will have noticed that it is very seldom that anything will run true in a lathe other than the one in which it was turned.

This is mostly due to the carelessness of turners as regards the state of their centres and the countersinks in the ends of the shafts of the commutators. A commutator should be trued or corrected when running in its own bearings, under its normal conditions and speed, and not on its centres. There is also to be considered the time and trouble spent in getting the commutator in and out of its place.

There is now no need to attempt to turn a commutator or take it out of the dynamo. There are machines for grinding commutators so designed that they can easily be attached to any type of dynamo. Some are specially designed for dynamos on board ship (although they can be used for other purposes), which as a rule are erected close to the bulk-heads, thus allowing but little room for operating. This type of machine is invaluable when a commutator goes wrong at sea. Other types are designed for the motors of tramcars and electric trains.

The driving of these machines may be effected in two ways, in one of which the spindle which carries the grinding wheel is actuated by a rubber disk resting on the commutator itself, while the other and more elaborate type has its own motor, and is specially suited for turbo-generators and the largest sizes of dynamos, being able to grind up to 32 in. face and any diameter of commutator.

Many dynamo manufacturers use a machine in the first instance after the armature has left the ovens in preference to turning it in the ordinary way, as the work done by it is more satisfactory, the waste of copper less, and what is of the utmost importance, the mica is not disturbed.

When a machine has been obtained and is fixed up for grinding, its use is very simple, but there are certain points which should be borne in mind. One is to use the wheels which are supplied by the makers of the machines, as they have found out from years of experience the grit and grade which are most suitable for the purpose. Ordinary wheels are of but little use, as they quickly clog with the copper dust. Specially insulated wheels can be obtained when it is required to true up live commutators.

Again, in the actual application of a grinding machine, some users are inclined to allow the grinding wheel to press too hard on the bars of the commutator, being under the impression that they will get through

A Strike at Lima. The railwaymen and electricians here have gone on strike, and the tramway employees and workmen in the factories are taking sympathetic action. It is feared that a general strike will be declared. *Reuter's Trade Service* (Lima, August 23rd).

the work more quickly by that means. Experience, however, has shown that a wheel will do its work faster if it is run lightly in contact with the bars of the commutator. The best guide in this matter is the sound given out by the wheel while it is running. If this is a clear ringing sound, the wheel is working as it should, but, on the other hand, if the sound is dull and muffled, the wheel is being clogged. It is usual to use two wheels, a coarse one for roughing-down the bars of the commutator, and a finer one for finishing.

SUBMARINE TESTS WITH THE NEALE ELECTROMAGNET.

AN interesting and successful demonstration of the capabilities of the Neale electromagnet as applied to submarine purposes was carried out at the Albert Dock, Silvertown, on August 24th, in the presence of representatives of the Admiralty and the Port of London Authority, officials of many of the leading salvage and ship-building companies, and lighthouse and harbour authorities.

The magnet used for the test was octagonal in shape, 36 in. in width between opposite sides, $2\frac{1}{2}$ in. in depth, and weighed, approximately, 7 cwt.

The tests consisted in depositing on the bottom of the dock by means of the magnet, swung for the occasion from a dock-side crane, several pieces of metal, varying from a portion of iron ship's plate weighing some 10 cwt. to three steel girders strapped together and aggregating about $2\frac{1}{2}$ tons.

At the time of the demonstration the depth of water in the dock reached 36 ft., and in the 5 ft. or 6 ft. of mud, silt, &c., on the bottom of it, the objects destined to be ultimately "fished" out by the magnet were pro-

four slots, cut round the face of the magnet, which is provided with an appropriate number of radial pole pieces. As in practice the actual contact obtainable will not be perfect, provision is made for such a contingency by having an extra number of ampere turns to allow for any air gap that may occur.

In this connection we may mention that one of the pieces we saw "salvaged" at the demonstration weighed approximately 16 cwt., and was lifted with clinker-impregnated mud interposing between quite 70 per cent. of the surfaces that should have been in metallic contact.

Owing to the sub-division of the poles the magnet can be designed to attain the greatest efficiency in handling any particular class of work, while the method adopted for cooling the magnet body and windings by water, or compressed air, the latter for land use, permits the windings to be operated at a high current density.

Owing to its general arrangement the Neale magnet, compared with the present stock magnet, has a greatly reduced weight and consequently lower crane power costs; a reduced power consumption for a given load giving lower running costs; and a lower first cost, due

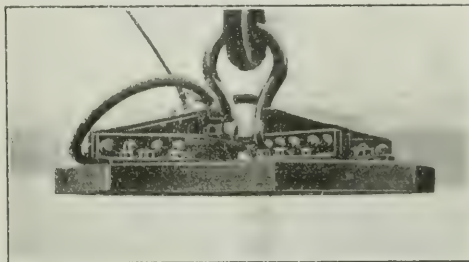


FIG. 2.—THE NEALE ELECTROMAGNET.

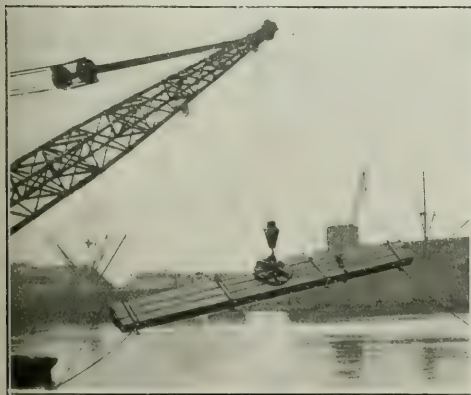


FIG. 1.—NEALE MAGNET LIFTING GIRDERS.

miscuously laid. As each of the objects had a considerable superficial area, the suction due to the presence of the mud added enormously to the work to be done by the magnet in the initial effort to lift the pieces to be "salvaged."

Without entering into constructional details, it may be stated that the Neale electromagnet has been so designed as to ensure the maximum pull on the object to be salvaged with the minimum weight of magnet and least expenditure of power.

To attain these desiderata it is essential to have the flux density in the iron as high as possible, and also to have a large area of pole face, both of which are ingeniously provided for in this magnet.

For purposes of description we may compare the magnet to an octagonal surface-plate, dimensioned as before stated and having at its centre a hollow with a radius of 6 in. The exciting winding is wound in

to the general construction being simplified, and the weights of copper and steel being greatly reduced.

In a report comparing the efficiency of a Neale magnet with one of the ordinary stock type, it is stated that only 1 kW was absorbed by the former as against 8 kW by the stock type in performing a given task.

The weight of the Neale magnet was 7 cwt., as against 55 cwt. for the stock type, the lift in each case being identical, viz., two 12 in. by 12 in. by $\frac{3}{4}$ in. girders, weighing approximately 5,500 lb. The ratio of efficiency—weight \times consumption of power—between the Neale and the stock magnet was 440 to 7, in this particular instance.

In the report upon a test recently carried out at the Faraday House testing laboratories, it is stated that for the purpose of the test a Neale magnet was placed in a tank of water, opposite a suitably stiffened $\frac{3}{8}$ in. mild steel plate, representing the side of a ship, and placed at an angle of about 30 deg. to the vertical, a projecting plate at the top representing a joint in the ship's side.

With a current of 9.3 amps. at 95.5 volts, the magnet slipped on the plate at $2\frac{1}{4}$ tons. When it reached the projecting plate, the pull was increased until the magnet became detached, at a load of $6\frac{1}{4}$ tons. With 17 amps. at 200 volts, slipping occurred at 3 tons, and the magnet could not be detached at $9\frac{1}{4}$ tons, the maximum load which could be applied. On dropping the current to 14 amps. at a pressure of 165 volts the magnet came off at a pull of $8\frac{1}{2}$ tons.

Similar tests with a gap between the magnet and the plate made by inserting about $\frac{3}{8}$ in. of cardboard gave the following results: With a current of 9.5 amps. at a pressure of 100 volts, the magnet slipped at a pull of $1\frac{1}{4}$ tons, and came away at 2 tons, while with a current of 18 amps., at a pressure of 200 volts, the magnet slipped at 4 tons, and came away at about $4\frac{1}{2}$ tons. With double the gap mentioned and with a current of

9.5 amps. at a pressure of 101 volts, slipping took place at 12 cwt. and detachment at 15 cwt. On increasing the voltage to 200 and the current to 17 amps., slipping occurred at 2½ tons, at which stress the magnet also came away.

The invention which, it is gratifying to know, is British both in its inception and development, would appear to have an almost unlimited field of usefulness before it, particularly for holding work during a machining operation. It can also be used for the recovery of anchors and chain cables, the varied loading and unloading of steel sections from rolling mills to railways, and thence to ships' holds, the discharging of metallic ores, the lifting of machinery, even when encased in wood, and the recovery of some of the many thousands of tons of metal forming part of the war wrecks sunk around the coasts of the United Kingdom, many of which have been dispersed by explosions in order to remove obstructions to shipping.

The makers of the apparatus are the Neale Magnet Construction Co., Ltd.

THE ALLOCATION OF BOILER-HOUSE WORKING COSTS IN REDUCING STEAM-ENGINE PLANTS.

By T. E. HOUGHTON, B.Eng., Assoc. M. Inst. C.E.

IN many industries there is a simultaneous demand for electrical energy and low-pressure steam for heating purposes. This problem is usually solved by the installation of a back-pressure or reducing prime mover which exhausts into the low-pressure heating system instead of the more usual condenser. Considerable economy results from the use of such plant since, in addition to the energy generated, low-pressure steam is obtained which would otherwise have to be supplied

resulting in an increased running cost, and the generating plant should thus be charged with some portion of the steam-raising cost. The method, however, is open to criticism on account of its empirical nature, and the author, therefore, suggests that the following reasoning gives the correct proportion of the boiler house working costs, which should be allocated to power generation and low-pressure heating respectively.

It is assumed that the boiler pressure is 175 lb. per sq. in. absolute, and the exhaust pressure—i.e., the low-pressure heating pressure—is 18 lb. per sq. in. absolute. Under these conditions the available heat according to the Rankine cycle is 170 B.th.u. per lb. of steam.

If the plant were put down for power generation only, it would, in general, exhaust into a condenser for efficient working. Assuming the maximum economical vacuum for reciprocating engines—26 in. Hg (bar 30 in.)—the available heat from 175 lb. per sq. in. absolute is then 295 B.th.u. per lb. In both cases the "Rankine efficiency" would be the same, and, therefore, the steam consumption condensing, and hence the fuel consumption would be $170/295 = 0.575$ times the consumption of the back-pressure engine.

Further, if the boiler plant was only required for generating low-pressure steam, less heat per lb. of steam would be supplied by the fuel than in the case of the high-pressure boilers. Assuming the feed temperature in both cases to be 92 deg. F., the heat in the steam would be:—

(a) 1,135 B.th.u. per lb. for the h.p. boilers (175 lb./sq. in. abs.).

(b) 1,094 B.th.u. per lb. for the l.p. boilers (18 lb. sq. in. abs.).

Thus, for l.p. heating only the fuel consumption would be $1,094/1,135 = 0.965$ times the consumption when generating h.p. steam. Evidently, then, if separate plant were installed for power and heating purposes, the fuel consumption under the best conditions would be $0.965 + 0.575 = 1.540$ times the consumption of a reducing plant supplying power and l.p. steam.

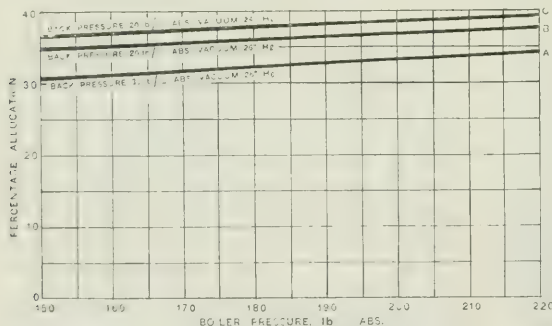


FIG. 1.—PERCENTAGE ALLOCATION OF STEAM-RAISING COST TO POWER GENERATION FOR RECIPROCATING ENGINES.

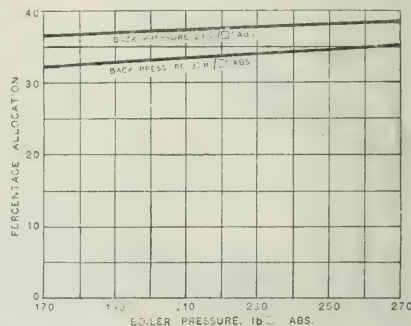


FIG. 2.—PERCENTAGE ALLOCATION OF STEAM-RAISING COST TO POWER GENERATION FOR REDUCING TURBINES.

from a separate plant, and it is obvious that the efficiency of the reducing plant will be higher than the combined efficiency of separate generating and heating installations.

Much doubt, however, appears to exist as to the correct method of allocating the boiler house working costs of such plant. Some engineers maintain that the whole of the steam-raising cost should be charged to the low-pressure heating system, the argument being that the boiler plant would be in use whether the generating plant existed or not and, therefore, the energy is obtained at the expense of engine-room charges only. Others affirm that a proportion of the steam-raising charges should be borne by the engine room, an arbitrary rule often used being 25 per cent. of the total boiler house running costs to be charged to power generation.

The latter method is undoubtedly the more correct of the two since, as power is required, the boiler plant works at a higher pressure than it otherwise would do,

Hence, the proportions of fuel consumption due to (1) power generation $= 0.575/1.540 = 37.4$ per cent. of the total, and (2) l.p. heating $= 0.965/1.540 = 62.6$ per cent. of the total.

Taking labour, water, and other charges *pro rata*, with a plant working to the above conditions, 37.4 per cent. of the steam raising cost should be charged to power generation and 62.6 per cent. to low-pressure heating. This proportion will, of course, vary with different plant, depending upon the pressures, and the curves A and B in fig. 1 have been drawn to illustrate this variation with boiler pressures of from 155 to 215 lb. per sq. in. absolute, assuming vacuum and feed temperature as above. From these it will be seen that the proportions do not vary very much, the range for power generation being only from 31 per cent. to 37.5 per cent.

In the case of reducing turbines it should be remembered that the vacuum is usually higher than that for reciprocating engines and, in addition, the steam is

invariably superheated. The effect of this is to slightly alter the proportions and the curves in fig. 2 have, therefore, been drawn for turbine plant for 28 in. Hg vacuum and 200 deg. F. superheat, the boiler pressures being taken from 175 to 265 lb. per sq. in. absolute and back pressures of 20 and 30 lb. per sq. in. absolute.

In this case it will be seen that the proportion chargeable to the engine room varies from 32.5 per cent. to 38.8 per cent., which is not very different from the previous case, so that, in general, reasonable figures to use are 37.5 per cent. and 62.5 per cent. for the proportions of steam-raising cost chargeable to power generation and low-pressure heating respectively.

In some instances it may be argued that it would not be possible to work up to the economical vacuum, and so the above figures would not hold. This is true, but it is an easy matter to determine the correct proportions and, in any case, they will not be found very different from the given figures, the engine-room figure increasing slightly with falling vacuum. To illustrate this, curve c, fig. 1, has been drawn for 20 lb. per sq. in. absolute back pressure and a 24-in. Hg vacuum, and it will be seen that there is only a 1.75 per cent. variation from the corresponding curve b for a 26-in. vacuum.

A HIGH-FREQUENCY INDUCTION FURNACE.

The Ajax-Northrup high-frequency induction furnace, which has been described in our pages in its earlier forms, is being developed by the Ajax Electrothermic Corporation in the United States, and particulars of a "Ten-inch conical pouring furnace" were given in *Chemical and Metallurgical Engineering*, Vol. 24, No. 7. Current for this furnace is supplied by a standard 20-kW converter set at about 15,000 cycles per second; this set is entirely static, and works with alternating current at 220 volts, 60 cycles, raising the pressure to 6,600 volts. The equipment comprises condensers, a transformer, and a discharge gap, by which the output can be regulated.

The furnace is shown in cross-section in fig. 1; it consists essentially of a crucible and a coil, with a small amount of electrical and heat insulation between them. The conical coil ranges in diameter from $4\frac{1}{2}$ to $10\frac{1}{2}$ in., and is $10\frac{1}{2}$ in. high; it is made of 37 turns of $\frac{3}{8}$ -in. copper tubing, flattened and wound on edge, through which cooling water passes. Inside the coil is a layer of micanite about $\frac{1}{4}$ in. thick, and between this and the crucible is a $\frac{1}{2}$ -in. space filled with a powdered heat insulator. The crucible holds from 50 to 60 lb. of metal of the density of steel, and will melt that weight of any metal of high specific resistance which melts under 1,200 deg.

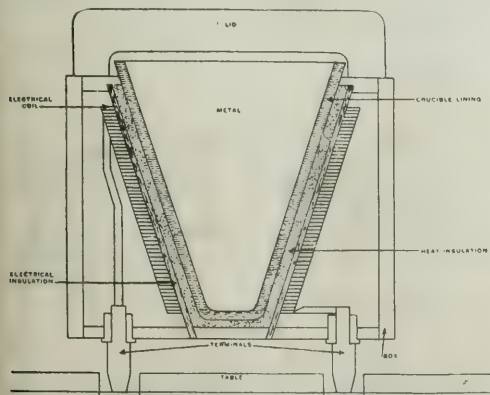


FIG. 1.—AJAX-NORTHROP HIGH-FREQUENCY INDUCTION FURNACE; VERTICAL SECTION.

C. Metals which require higher temperatures are dealt with in smaller quantities. The metals are put into the crucible in the form of turnings or chips, but not fine powder. Owing to the addition of hysteresis to eddy currents, magnetic metals are heated with special facility. The molten metal is automatically stirred, rising high in the centre and descending at the circumference, under the action of electromagnetic forces. Very homogeneous alloys result, a matter of great value in many applications.

In pouring the melt, the crucible is lifted off the asbestos-board table on which it rests, and is then entirely disconnected from the electrical circuits. On replacing it, the terminals

make contact with terminal plates sunk in the table top, as shown in the figure.

An actual test shows that 50 lb. of the metal of which castings for type-writer frames are made was melted in two hours 20 minutes with an average input of 17.55 kw. The metal is non-magnetic. Metals of high conductivity are not so readily dealt with in a crucible of non-conducting material; a crucible of moulded carbon or graphite is substituted, or fitted into the former, and the heat generated in the walls of the crucible melts the metal. A furnace of the size illustrated, with a carbon crucible, will melt 85 lb. of copper per hour.

Amongst the advantages claimed for this type of furnace are the following:—

The exterior is always at room temperature. As soon as the metal becomes molten it is actively stirred automatically.

Contaminating gases and carbon can be excluded from the metal.

The mass is heated uniformly throughout.

A temperature of 1,800 deg. C. may be attained.

Control of the temperature is perfect.

Crucibles for different metals can be inserted in the same furnace.

The component parts are readily interchangeable, but the essential parts suffer little wear, and the whole structure is simple and inexpensive.

INDUSTRIAL RESEARCH.

THE Quarterly Progress Report recently issued by the BRITISH ELECTRICAL AND ALLIED RESEARCH ASSOCIATION contains particulars of the scope and progress of several important researches which this body is carrying out.

Since the publication of the last report, work has been extended by the formation of new sections to deal with certain matters too big for subordinate classification. The work of the Joint Committee on *Dielectric Losses*, for instance, has so developed in extent as to demand independent treatment. The new Section to deal with this will conduct researches in the fundamental properties of insulating materials; immediate attention will be given to the question of thermal resistivity, on which but few experimental data are at present available.

Preliminary tests on *Fibrous Insulating Materials* (Section A) have revealed wide differences in the manufacture of both treated and untreated fabrics. These are under investigation, with the co-operation of manufacturers; at the same time the requirements of the users of treated fabrics are being considered as a basis for the purposes of standardisation. A similar policy is being pursued with treated papers. Specifications for fibres and boards are now drafted and under test prior to publication.

Work in Section B (*Composite Insulating Materials*), extending over twelve months, has emphasised the difficulty of dealing with materials of this class, owing to their wide variations in properties. The results of this work are now to hand, and methods for bringing them into perspective have been developed.

Of the extensive programme of research on *Insulating Porcelain* (Section C), based on preliminary researches by Messrs. Langton and Harris, much yet remains to be done. Included in this are researches on insulation resistance, improvement of surface, dielectric strength, and uniformity of vitrification.

Two reports by the Committee of Section D (*Mica*) are in course of preparation. The first is based on collected data on the use of mica and micanite for commutators; the abrasive hardness of these materials is, however, still under consideration. The second report deals with the use of mica in condensers.

Under Section E (*Insulating Oils*), a preliminary specification has been drawn up, and is in the hands of the British Engineering Standards Association for its consideration. There are extensive researches in hand on thermal transference coefficients, vapour pressure, thermal conductivity, and the action of catalysts. Samples of oils subjected to severe arc discharges in oil circuit-breakers have yielded data under the spectroscopic and the ultramicroscope; these results will be valuable later in developing the research programme.

In Section F (*Conductors*), researches have included further tests on the heating of buried cables and tests on overhead wires. The results of the former are to hand, and will receive immediate consideration; other recent work on this subject, published elsewhere, is receiving attention. The tests on overhead wires have involved the provision of special apparatus for testing long lengths, under conditions corresponding to service conditions; this is now ready, and results are expected shortly.

The Committee of Section G (*Control Apparatus*) has been able to collect valuable data from power plant engineers and others. The voluminous material, collected from all sources, on the phenomena of switching and arcing, has required careful reconsideration before it could be reduced to a *memorandum*, but new methods of attack have been developed as a result. Large scale tests, with the practical co-operation of power station engineers, have now been arranged. The Newcastle Electric Supply Co. has promised plant in the autumn for short-circuit tests on existing oil switches, and for the general study of the phenomena of circuit breaking.

Tests on *Mining Switchgear* have been arranged with the Home Office. These are to include studies of the magnitude

and relief of pressures set up by arcs in switch cases and by gas explosions. The Committee is also collecting data and samples of British standard ordinary-duty fusible cut-outs, preliminary to tests on heavy-duty fuses. Power plant engineers have been invited to co-operate in collecting data and in experimental work on d.c. circuit-breakers. A comprehensive programme of researches on the resistivity of joints and contracts is now in hand, and data are being obtained from existing plant showing results now obtainable under service conditions. Temperature rise is also under consideration.

The Committee on Corrosion Researches (Section H) is reviewing the phenomena of corrosion, with special reference to the corrosion of condensers.

Two new Committees (Sections J and K) have been set up since the publication of the last report. The first will deal with researches on turbines and turbine blading; it will co-operate with the Institution of Mechanical Engineers in the research on turbine nozzles being carried out at Manchester University. Section K will deal with the whole question of the manufacture of insulating materials with a synthetic resin base; special attention is being given to the production of these materials in this country.

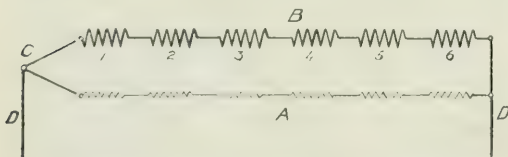
CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

A Motor Problem.

Would you or any of your readers kindly help me in the following case?—

A few days ago I was called to see a small motor which has been erected to drive some cleaning machines in a shop. This motor has never worked since installed. I examined the system, and found it was a single-phase, 230-volt, 25-cycle supply. I then examined the motor, but could find no maker's name on it, and no output plate (absolutely no information). Next, I took the motor adrift, and found it was a single-phase, 0.5 h.p. one with two distinct windings, a running winding and a starting winding, each consisting of six coils. I reassembled everything, put fuses in, and started up. I found the rotor would rotate, but very slowly; and the motor took from 8 to 9 amps., so obviously I could leave current on but a short time, in case of burning the coils out. Now I thought it possible that some of the coils were wrongly connected, so I had the machine removed to my workshop. There I disconnected the coils and tested each separately, and found them perfect. I then traced the way they were connected



Squirrel-cage rotor; running winding consists of 6 coils, each coil occupying 4 slots; starting winding also consists of 6 coils, each occupying 2 slots. In the figure the currents circulate upwards in coils 1, 3, and 5, and downwards in 2, 4, and 6.

A = starting winding. B = running winding. C = starting switch.
D D = supply mains.

and found them as shown in the accompanying diagram. The starting winding was purposely left disconnected, so I am dealing only with the running winding (being a small motor it can always be started by hand). The diagram shows the coils as they were originally connected; the current would produce poles N.S. N.S. (i.e., assuming d.c. was passed through). Are these connections correct for single-phase motors? For the sake of experiment I have connected the coils up all sorts of ways imaginable, but with worse results than I obtained originally. Is it possible that this motor was designed to run on a 50 or 60-cycle system, or some circuit with a higher periodicity than 25? I may say I examined the rotor and found it correct. The bearings are of the ball-bearing type. How am I to get this motor working and on a 25-cycle supply?

D. T. Davies.

Portsmouth, South Wales.
August 22nd, 1921.

The Electrical Trades Union and Non-union Labour.

With regard to "Fair Play's" letter in last week's issue, he states that the E.T.U. is flooded with all sorts of intruders, &c., and although not in the E.T.U. myself (I should be one of the so-called intruders, as I have never been apprenticed), I should be quite confident to back myself against any ap-

prentice or improver of my age, where practical and theoretical d.c. work as a whole is concerned.

I may say that there seems to be more prejudice against a man who has not "served his time" than non-union men, but I feel sure that if a trade test were given before a man could join the union, there would still be men in it who had never been apprenticed.

As regards wiring, I have done at least a dozen installation jobs, on my own, and never quoted less than 33s. a point, when I know that union men, on their own, have been quoting from 15s. to 35s. a point; and I may add that I have not had a job turned down yet, nor any delay when putting in the supply, as they have other methods here of trying to equash non-union men who are canvassing for work.

L. H. Edwards.

Bristol.

August 20th, 1921.

Overhead Transmission Costs.

In your current issue you quote estimates made in the U.S.A. for three lengths of transmission lines for the New England Power Co.

6 miles cost £1,200 per mile.
9.5 miles cost £1,500 per mile.
21 miles cost £1,600 per mile.

If the original is accurately printed, there is only sufficient weight allowed in the six-mile line for one and a-half lengths of No. 2 B. & S. conductor; "19,800 lb. at 17 cents" being only half enough for the work specified.

The right of way is narrower, and insulators and telephone equipment cheaper per mile.

In the *Electrical World*, May 7th, 1921, p. 1,048, Mr. Ashworth, engineer, Utah P. & L. Co., criticised the absence from the estimates of the New England Power Co. of any expense for surveying for a line which involved very considerable expense for clearing a right of way. These errors are worthy of correction.

Theodore Stevens.

London.

August 24th, 1921.

Carpets and the Electric Suction Cleaner.

If a "last word" is permissible as a comment on the correspondence evoked by the recent article on "Carpets and Vacuum Cleaners," may I ask why so much emphasis is laid by the correspondents on the necessity for powerful suction?

Do the manufacturers of vacuum cleaners imply that the carpets and rugs in an ordinary everyday household have in the past been allowed to get into such a condition of dirt and grime that they need really drastic treatment to clean them? or do they anticipate only a "spring-cleaning" use of the vacuum cleaner? In either of these cases powerful suction would be necessary, but since most women buy vacuum cleaners with the idea of using them at least once a week, the stress might with advantage be laid on simple construction and easy manipulation rather than on powerful suction.

Mary Gwynne Howell.

London, S.W.,

August 29th, 1921.

Accumulator Froth.

In answer to "Curious" in your issue of August 26th, I should like to point out that "frothing" only occurs in accumulators by certain makers. In a nut-shell, the reason is inferior quality celluloid.

As a manufacturer for the past 12 years of celluloid cases, and also of the complete accumulator, I can truthfully say that I have never seen or heard of one of my make frothing.

A. E. Frost.

London, N.

August 23th, 1921.

Trade Terms and Direct Trading.

It has come to my knowledge that private firms are receiving as favourable terms (re lamps) as the contractors, who are tied down by certain rules of the E.L.M.A. with regard to retail prices, and also what make of lamp to sell, and I think it is unfair for private customers to be able to inform me that they can get better terms from the manufacturers than we contractors can give them.

I should like the opinion of other contractors on this matter. I myself have had large orders cancelled through customers of mine getting better terms from the E.L.M.A.

I think it is time that contractors took this matter up. I also think that all "ring" lamps should be ordered through local contractors.

If this unfair business continues I shall be obliged to push the imported lamp.

Half What?

August 24th, 1921.

Country House Lighting Sets.

An article on "Automatic Lighting Sets" is long overdue, and the contribution of Mr. H. K. Taunton is acceptable. At the same time, it is a pity Mr. Taunton has dealt with this admittedly important development in rather incomplete fashion; certainly one is afraid that "in sailing through the Straits of Messina," so to speak, there is trouble both at Scylla and at Charybdis!

In dealing with the various points Mr. Taunton raises, it may, in the first place, be said that, so far as the number of seriously competing lighting plants is concerned, these amount to some 30-odd makes, a list of which is enclosed for information. The case of the full-automatic set is clearly stated, but one may question if damnation has not been ladled out excessively. Certainly this class of plant may be expected to improve in construction and performance in the course of time, though the difficulties are obvious. Even so, it is likely that semi-automatic sets will always hold the market in this line of business, for precisely the reasons Mr. Taunton sets forward in his third from last paragraph. With regard to the size of these plants, $\frac{1}{2}$ kW is not the favourite size, this being 1 kW or over.

By anyone engaged in this business—and one supposes this to include practically all electrical contractors—the plant so enthusiastically described by Mr. Taunton will be at once recognised, and while, on patriotic grounds, no one can cavil at the support given to any British plant, yet, on general technical and commercial grounds, there is much to be said for many non-British plants. Mr. Taunton's remark to the effect that "the average Englishman likes plenty of metal for his money, even if this results in a white elephant," is hardly flattering to the average Englishman; and if "a widely advertised American set, which has a cylinder of the size of a half-pint tumbler, and can deal with 50-light installations," meets buyers' requirements, and a very large number of such equipments are sold, then the case appears to be one where the proof of the pudding is in the eating thereof, and there would appear to be evidence that the average Englishman seeks "performance" first and "scrap-iron" value at a later date. Above all, Mr. Taunton's remark that the average American set is built for only a short period of service is to be seriously challenged, and one would be glad of a detailed statement. It may also be said that one British lighting-plant manufacturer is known to have recently turned out three different models in almost as many months.

As regards the matter of American batteries, one can hardly agree with Mr. Taunton's conclusion so far as the question of "standard" is concerned. The fact that British makers rate their batteries differently to the Americans, and that, in consequence, there is some degree of reserve in the case of the British battery is, of course, to the advantage of the purchaser, but this does not necessarily imply faulty description on the part of the American makers. In any event, Mr. Taunton's remark as to certain of such batteries being rated on "ignition capacity" can, one believes, be suitably ignored. The whole situation here appears to be one for battery makers' own consideration when viewing the competition they are meeting.

Turning to the question of 32-volt accessories, experience goes to show that these are not too difficult to obtain, and a list of such suppliers can be furnished if necessary. To secure 25- or 50-volt apparatus seems more difficult. With regard to lamps, Association firms are supplying them, and no shortage has been known to the present day. The point of low voltage entailing increased wiring cost is hardly to be taken seriously, unless comparison is made with standard systems of 110 volts and upwards. As against any such increase in cost, the fact that 32-volt systems or thereabouts are infinitely safer to the public, in the way of freedom from shock and general safety, cannot be ignored. Also, 16-cell batteries are about the limit so far as the question of voltage drop from "full charge" to an "empty" is concerned, and the connecting of such a battery as a "block" without end-cells, makes the simplest form of equipment for non-technical owners to handle.

In the case of the "Ford-Rolls-Royce" comparison mentioned by Mr. Taunton, the position is not at all clear. In the first place, such small sets are intended primarily for generating electricity and not for driving saws, churns, cutters, &c., direct. To drive such appliances from the generating set itself is poor engineering practice; moreover, it is more often than not a very difficult matter to reconcile the best position for the generating set with that most suitable for pumping or the driving of the farm appliances in question. Again, every country resident does not have accessories grouped together, and considerable lengths of line shafting would be required under such a scheme. Far better is it to have separate motors or a portable motor, though, of course, this increases the cost of the installation. It is also to be observed that farm appliances are not constantly in use, so that a material wastage of power is likely to result in adopting the system mentioned by Mr. Taunton.

With regard to Mr. Taunton's penultimate paragraph as to the ideal set, it may be said that under (a) there is such a set on the market, (b) ditto, (c) a simple, though expensive, matter to safely arrange. At the same time, the question of leaving any set to its own devices for months at a time is too exaggerated for consideration; moreover, one questions whether this is required. Mr. Taunton appears to forget that a reasonable amount of "service" is implied and is included

in the sale of these plants. Experience goes to show that for the first two months or so the average country owner takes great care in maintaining; during the second two or three months rather less attention is given to the equipment; finally many owners appear to decide that the plant needs no further care in a general way. This is really the "secret" of the semi-automatic plant, as it calls for human attention at regular intervals, and the equipment benefits accordingly. If the plant is not properly maintained and periodically inspected trouble is bound to develop with even the best of sets, whether they be full- or semi-automatic.

Mr. Atkinson's letter on this subject in your issue of August 19th may also be referred to, and here there is evidently a misconception. In the course of selling well over 1,200 plants of this description, it has been found that the average installation is certainly not more than about 40 lights, with a little power load, such as iron, sweeper, fire-log sawing, churning, and possibly some pumping duty. In fact, it is for a recognised average duty that the particular lighting plant with which the writer is connected is specially built. One agrees that the average owner often adds to his installation in the course of time, but not to the extent implied by Mr. Atkinson—in fact, only two cases are known where the plant was overloaded, one being an error at the commencement and the other a case where it was recognised as being a temporary measure till a larger plant on order was obtained. For large establishments, institutions, &c., it is the practice to install two, three, or more plants, which may be worked in parallel or separately. A number of such installations are actually in existence.

With regard to the point Mr. Atkinson raises as to whether semi-automatic sets have been installed for a sufficient number of years for a satisfactory estimate of their reliability to be formed, it may be said that such plants have been on the market for at least the past ten years, and that there is a real history behind this development; moreover, one looks for considerable future development in this particular line of industry.

Marshall Tate.

London, W.C.
August 24th, 1921.

The E.P.E.A. Schedule and Economy Stunts.

What good does Mr. Jones hope to achieve by rattling the sabre?

If he imagines he can maintain the drooping spirits of his Association and, likewise, ensure a steady flow of subscriptions by shouting "We whacked 'em at Dover and Perth,"—Well good luck to him.

But has he won? Did he win at Stalybridge? When reading his bragging letter, one is forced to the conviction that the victory he is so bombastic about is merely of an evanescent nature, and soon things will find their own level.

There is the law of Supply and Demand, which will dictate to Mr. Jones what schedule he must adopt, even as it has done to the miners.

As to all that piffle of "resisting by every means in its power," what is power in the commercial sense? It is money, and the power of any trade union is the measure of its solvency.

If the E.P.E.A. called all its members out to-morrow (that is, supposing they all came out!!!), the E.P.E.A. would be "busted" financially, and its members glad to get back as volt boys, and Mr. Jones knows it. That is why he shouts Dover! Perth!—Beware!

If unions like the A.E.U. of many years' standing, and backed up by powerful finances, accept reductions as a logical consequence, it should be evident to Mr. Jones that sooner or later his weak Association must be submerged by powerful municipalities.

There are always plenty of good engineers ready to fill a station at a low wage, hundreds in fact. There are many engineers, chief assistants among others, who threatened to plunge towns into darkness not so very long ago. What is their position to-day? The various committees have granted their demands temporarily, but they hold them in such disgust and contempt, that when the chief's post becomes vacant, they will be passed over, and dismissed on the first opportunity, and they have to thank their indefatigable secretary for landing them in such a hole.

Anti Bunkum.

August 27th, 1921.

Foreign Competition.

The wails of the British manufacturer at the sad sight of contracts going abroad are particularly interesting when one studies his terrific energy in going after business offered him.

My firm advertised in the REVIEW a week or two ago for starters for single-phase motors that it wishes to run in conjunction with its machines, and for which it does not want to pay fancy prices.

Net result: three replies from foreigners and one offer of second-hand oil switches from an English firm.

W. A. C. Phillpot.

London.

August 26th, 1921.

Oil Consumption and Prices.

I have held over my reply to Mr. S. H. Fowles's letter in your issue of August 12th, until I had an opportunity of hearing from the engineer in question. He sends me the following:—

Capacity of alternator 1,000 kW.
Total running hours=98.6 per cent. of possible per annum.
Energy supplied, exclusive of station auxiliaries, 2,666,000 units for year 1920.

Temperature of bearings of turbo. set, 148/150 deg. F.
Lubricating oil used per annum for turbo. and auxiliaries, 350 gallons.

No attempt is made to attain economy records as regards oil consumption. The safety of the collieries depends upon the electrical plant, therefore reliability and continuity of service is more desirable than the saving of lubricating oil. No old or filtered oil is used in connection with the plant, all reclaimed oil is used for the rough machinery outside the station. The oil cabinets are under the care of the power station attendants, and oil is not doled out to them.

In addition to oil, 28 lb. of grease lubricant are used per annum for the circulating pump thrust bearing. This constitutes, with the oil, the whole of the lubricant used.

Mr. Fowles inquires how the 1,000-kW set can show a lower oil consumption than the 48,000-kW station. In this instance it is done by Mr. Fowles assuming that the turbine in question runs at full load for 98 per cent. of the time. As the number of kWh generated is now given, he will be able to correct his figures, and will obtain a value of about 0.00013 gal. per kWh generated. This figure, dealing as it does with a station using only new oil, is of interest as it shows up clearly the economies which Mr. Fowles has succeeded in obtaining.

I am obliged to him for calling my attention to the article on fuel and costs in *Gas and Oil Power*, and also wish to thank Messrs. G. B. Petter and Robert Scott for their useful contributions to the discussion.

E. F. Butler.

London,
August 27th, 1921.

Testing and Repairing Magnets.

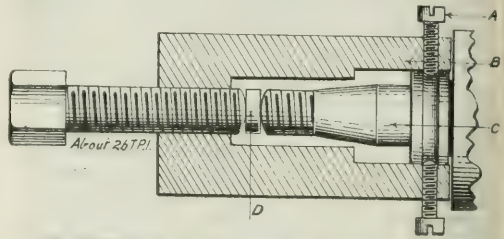
Having followed with interest the letters under the above heading that have appeared in your recent issues, and as part answer to "Mag's" letter in your issue of August 26th, we should like to state that we have had a race puller in use in our workshop for a considerable period.

That this pattern is infallible we can guarantee, and if it is a "trade secret," then we can only imagine that that portion of the trade who do not know its construction, must be lacking in ingenuity, as it resembles in principle the well-known wheel puller.

We enclose a sketch for the benefit of interested readers, and may add that the only "secret" embodied is that the bore must exactly fit the walls of the inner race, otherwise it is impossible to obtain screws sufficiently strong to withstand the strain to which they are subjected.

We may add that this puller has never yet failed us except on a starting motor with a very long shaft, and in this case it is cheaper from a business point of view to crack the inner race (not by the Service method), and replace.

We have had difficulty at times in removing an outer thrust race, as we find that some of these, instead of being a fit, in the mechanical sense of the word, have apparently been forced home with something akin to a hydraulic press.



A, eight hardened steel screws; B, piece of mild steel shafting; C, magnet spindle; D, brass or copper buffer.

BALL RACE PULLER.
(Not to scale.)

We should be pleased to hear of a simple method of testing a condenser *in situ* and without disconnection of the primary which is, of course, virtually, in shunt.

Taylor & Briggs.

Derby,
August 27th, 1921.

LEGAL.

EMBEZZLEMENT OF "OUTING" FUNDS.

At Ealing Police Court on August 24th, Ernest Mowbray Walker, described as an electrical engineer, was charged with having embezzled the sum of £500, this being money deposited with him on account of contributions to an "Outing Fund" by employees of the Underground Railways. A police officer, giving evidence, said that prisoner rang him up and told him that he (prisoner) had used the money, and asked to be arrested. The defendant said that he had given part of the money to friends and had squandered the remainder. He thought that he might be able to get some of the money back. He was remanded on bail.

TRAMCAR DRIVER ASSAULTED.

At the Bolton Police Court last week, Jas. O'Donnell, Howe Bridge, Geo. Smith, Westleigh, and Edward Heaton, Westhoughton, were summoned for assaulting a tramcar driver with the object of taking the car beyond its destination late one evening.

The magistrates considered it a very serious offence to attack a public official whilst executing his duty, and fined the defendants the maximum penalty of £5, and ordered them to pay £1 costs.

BUSINESS NOTES.

Bankruptcy Proceedings.—T. HYDE, electrician, 180, London Road, Croydon.—The first meeting of creditors was held on August 26th at 132, York Road, S.E. 1. The statement of affairs showed liabilities £635, while assets were estimated to realise £172, from which £30 had to be deducted in respect of preferential claims, leaving net assets of £142, or a deficiency of £494. Debtor attributed his position to losses in trading consequent upon general trade depression, loss of staff, and restrictions relating to light and heating during the war. It appeared that he commenced business in 1895 at his present address with £50 capital. In 1904 he added the business of an electrical engineer. Until 1911 his takings averaged about £800 a year, but they subsequently decreased. Early in 1914 he realised that his profits were not sufficient to cover his household and personal expenses. From 1916 no profits were earned and debtor had since been subjected to pressure by his creditors. At the date of the receiving order four creditors for about £207 had obtained judgments against him, and an execution having been levied on his effects, he filed his petition. The only book of account produced was one containing records of his transactions with his credit customers. He became aware of his position in 1914. The case being a summary one, the matter was left with the Official Receiver as trustee of the estate. The following are creditors:—

A. Turner & Co.	39	Heath & Co.	6
Edison Swan, Ltd.	174	C. Johnson	5
General Electric Co.	20	Stella Lamp Co.	5
W. Hall	25	Wharworth Lamp Co.	8
A. Taylor	130	Bankers	95
Baxter & Cauter	5	Mrs. Davies	100

A. C. A. WAMPAGE, electrical engineer, Formby Lodge, Seabrook Road, Hythe.—Last day for proofs for dividend September 10th. Trustee, Mr. J. O. Morris, Official Receiver's Office, 68a, Castle Street, Canterbury.

A. R. MCGOERT, electrical engineer, 45, Thrumpton Lane, East Retford. First and final dividend of 5s. 9d. in the £, payable at the Official Receiver's Office, Lincoln.

Company Liquidations.—HUDSON'S ELECTRICAL ENGINEERING Co., LTD.—A meeting of creditors was held in Leeds on August 29th, when the following statement of affairs was submitted: Liabilities £5,642; net assets £2,056; deficiency, as regards creditors, £3,586; share capital issued £1,000. The net assets represent approximately 7s. 3½d. in the £ on the claims to unsecured creditors. The total deficiency of £4,586 is accounted for by the loss on trading, depreciation in stock-in-trade, motor lorry, fixtures and fittings, goodwill, and preliminary expenses written off, reserve on book debts, and a very heavy discount on a debenture taken in satisfaction of a trading debt. It was decided to appoint a committee of inspection to confer with and advise the liquidator appointed by the company in the voluntary liquidation and to investigate the statement of affairs and general position of the company.

ARC & GENERAL EQUIPMENT, LTD.—Winding up voluntarily. Liquidator, Mr. F. A. Gillies, 37, Brown Street, Manchester. Meeting of creditors, September 5th, at Manchester.

MALAGA ELECTRICITY Co., LTD.—Winding up voluntarily. Liquidator, Mr. F. C. Allwork, 39, Coleman Street, E.C.2. Meeting of creditors, September 15th.

Trade Announcements.—THE ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHAHLEROI has now opened its own offices at 56, Victoria Street, London, S.W. 1, under the management of Mr. John H. Bunting, who will handle the whole of the company's British and Colonial business. The various works of the A.C.E.C. are all located within Belgian territory which was occupied by the enemy throughout the war, and owing to the company's anti-German attitude, the works were taken over and were used exclusively for German purposes for more than two years before the armistice. The Germans removed the company's machinery and equipment, which, after the cessation of hostilities, had to be recovered, repaired, and in many cases renewed or replaced, before the firm was in a position to resume its normal pre-war activities. We understand that the company is to-day the largest electrical manufacturing concern in Belgium, that it employs nearly 5,000 people, and that it is in a better position than ever before to supply all classes of electrical machinery, La Cour motor converters, rotary converters, turbo-alternators, transformers, switchgear, electric winders, pumps, traction equipment, cranes, railway signalling apparatus, and paper and rubber insulated cables.

THE JACKSON ELECTRIC STOVE CO., LTD., has appointed as its agent for the whole of Scotland Mr. H. L. Kirby Johnson, of 68, Gordon Road, Glasgow. A range of samples and small stocks will be held at this address for Scottish clients. It has also appointed as its agent for the Midlands Mr. Kenneth Hoggan, of Needleless Alley, New Street, Birmingham. He likewise will hold a range of samples and small stocks.

MR. C. B. MAURICE has joined the board of directors of Messrs. Catchpole & Maurice, Ltd., whilst continuing to act as the London agent for Messrs. Crumore & Co., Ltd., Birmingham, and Messrs. W. H. Cheadle & Waltho, Ltd., Wolverhampton; the address is Albion House, 59-61, New Oxford Street, W.C. 1. Telephone: Museum 3942.

MESSRS. HARWELL, LTD., of 2, Bayley Street, Tottenham Court Road, London, W.C. 1, inform us they are the sole agents in this country for the "Usines Diélectriques," Delle, Territoire de Belfort, France, manufacturers of micanite, amberite, oil silk, paper and sheets, tapes and cloths, all classes of insulating varnishes, and also commutator rings, presspahn and bakelite material.

THE LONDON ELECTRIC FIRM, Brighton Road, Croydon, informs us that the telephone number for its stall and exhibit at the Shipping Exhibition at Olympia will be Hammersmith 2148.

MESSRS. CHARLES CHURCHILL & Co., of Leonard Street, London, E.C., have been recently appointed sole agents for Great Britain for the National Acme Company, of Cleveland, Ohio, U.S.A., which manufactures Grindley automatics, Acme automatics, and numerous auxiliary machines. This department is under the supervision of Mr. C. W. Simpson at Manchester. He has for many years been associated with the Grindley and Acme products. A stock of spare parts will be held.

MESSRS. BAXENDALE & Co., LTD., 3, St. Andrew's Square, Edinburgh, have removed to Grassmarket, Edinburgh. The telephone numbers remain the same.

Catalogues and Lists.—MESSRS. ALAND & Co., 203, Great Dover Street, S.E. 1.—List No. 45, giving illustrated details and prices of exhausters and blowers of widely varying sizes.

THE DUSSEK BYRMEN Co., Empress Wharf, Bromley-by-Bow, E. 3.—An illustrated treatise upon the manufactures of the electrical department, dealing principally with "Trinitite" joint-box compound.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, E.C. 2.—A blotter advertising "Henley" "sticky" tape; also List W.L. 2, an illustrated and priced catalogue of "Isco" loop-in cut-outs for house services.

MESSRS. J. A. CRABTREE & Co., LTD., Rushall Street, Walsall.—A number of illustrated and priced leaflets dealing with "Crabtree" quick "make" and "break" switches.

MESSRS. A. FORT & Co., 51, Whitfield Street, Tottenham Court Road, W. 1.—An illustrated and priced catalogue of electrically-driven gramophones in various styles and periods.

THE BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, E.C. 4.—An illustrated and priced leaflet describing "X-ray Scoopette" fittings for show-case and window lighting.

THE FALKIRK IRON CO., LTD., Falkirk.—Leaflet No. 261, dealing with the "Falco" electric wash boiler. Illustrated and priced.

THE EDISON SWAN ELECTRIC CO., LTD., Ponders End, Middlesex.—List No. W.W. 232, an illustrated and priced publication dealing very fully with the "Ediswan" house wiring system described in our issue of July 22nd last.

MESSRS. HERBERT MORRIS, LTD., Loughborough.—Book 97, illustrating and describing hand-operated cranes.

MR. GEORGE ELLISON, Perry Barr, Birmingham.—List No. 320 (76 pp.), giving very full particulars and diagrams of drum type motor control gear (hand-operated) for d.c. and a.c. working.

THE KEY ENGINEERING CO., LTD., 4, Queen Victoria Street, E.C. 4.—A well-illustrated booklet dealing with "Key" fibre conduit and troughing, giving views of installations and particulars of tests.

MESSRS. HIGGS BROS., Sand Pits, Birmingham.—Monthly Magazine, Vol. III, No. 6, September, 1921, containing stock lists of a.c. and d.c. motors, d.c. dynamos, notes on starting gear, and humorous items.

MESSRS. PHILLIPS & TURNER, 115, Edmund Street, Birmingham.—Three illustrated lists of ceiling fittings, including plates, bowl rings, and chains.

THE BRITISH ALUMINIUM CO., LTD., 109, Queen Victoria Street, E.C. 4.—A set of five booklets giving "Hints on Working Aluminium." A great deal of valuable information of a varied nature is contained in these booklets. They deal respectively with: "Aluminium Ingots," "Sheet," "Circles," "Tubes," and "Sections." Tables of weights, sizes, &c., are embodied in the publications.

THE "ATLANTA" ELECTRICAL CO., 11, Hanway Place, N. 1.—An illustrated pamphlet dealing with a wide selection of electrical signs. Priced.

Forthcoming Exhibitions.—The following exhibitions are being organized:—

LONDON.—September 7th to 28th, Shipping, Engineering and Machinery Exhibition; September 12th to 16th, International Dental Exhibition; October 14th to 22nd, Commercial Motor Exhibition; November 4th to 12th, Passenger Motor Exhibition; November 17th to 25th, Public Works, Roads and Transport Exhibition; March 1st to 26th, 1922, Ideal Home Exhibition.

CARDIFF.—May to October, 1922, Welsh National Exhibition. GLASGOW.—September 15th to October 8th, Ideal Home Exhibition; November 1st to 19th, Shipbuilding, Engineering, and Electrical Exhibition.

BRUSSELS (Belgium).—April, 1923, Commercial Fair.

LYONS (France).—October 1st to 15th, Metallurgy, Machinery, and Industrial Fair. (Paris).—November 12th to 27th, International Aviation Exhibition; March 1st to 15th, 1922, Spring Fair.

BUKAREST (Rumania).—Samples Fair and Rumanian Exhibition.

BARCELONA (Spain).—March 15th to 25th, 1922, Samples Fair. UNITED STATES (New York).—January 15th to 25th, 1922, General Merchandise Fair.

A Reuter message states that the International Samples Fair which was to have been held in Trieste this month has been postponed until next year.

The Welsh National Exhibition.—We have received from the secretary of the above exhibition, 4, Mount Stuart Square, Cardiff, a copy of an advance prospectus. Mr. Lloyd George has accepted the presidency of the exhibition, which is to be of ambitious proportions, covering an area of 60 or 70 acres. The names of many representative Welshmen appear in the list of officers and committee. The exhibition is to be arranged in seven sections: Education, mining, health, housing, agriculture, fine art, history, and music. It is stated that ample provision will be made for the supply of power for exhibits of machinery in motion and for lighting, and no profit will be made from this source. Machinery will play a prominent part in the exposition.

For Sale.—Assets Auctions Co., Ltd., will sell by auction on September 7th, at 119-121, Newington Causeway, S.E., electrical stores, including fuseboards, switches, cable, wire, &c.

By direction of the Disposal and Liquidation Commission, Messrs. Fuller, Horsey, Sons & Cassell will sell by auction on September 6th, at the Military Railway Wharf, Purfleet, plant and machinery including electric generating sets, motors, &c., and on September 20th, chemical plant and machinery at the Grilo-oleum Works, East Greenwich, S.E.; on September 14th, 15th, and 16th, at the Central Stores Depot, No. 83, Georgetown, near Glasgow, Mr. H. Marshall will offer by auction engineering and electrical plant, machine tools, &c., for particulars, &c. (See our advertisement pages to-day.)

According to a Central News correspondent, the Disposal Board has decided to put up for sale within the next fortnight the huge stocks of machine tools and electric plant which are lying at the munition towns of Gretna, Georgetown, and Irvine, and at the experimental station on the Gareloch, valued at some millions sterling.

Copper and Lead Prices.—Messrs. F. Smith & Co. report, August 30th.—Copper (electrolytic) bars, £72 10s., 10s. decrease; electrolytic sheets, no change; electrolytic wire rods, £88, 20s. decrease; ditto H.C. wire 1½d., 1/16d. decrease.

Messrs. James & Shakespear report, August 31st.—Copper bars (best selected), ditto sheet, ditto rod, no change; English pig lead, no change.

Battery Contracts.—Edinburgh Corporation has placed an order with Messrs. Fritchett & Gold and E.P.S. Co., Ltd., for two batteries, each consisting of 120 cells having a capacity of 2,640 ampere-hours at the 10-hour rate of discharge. These batteries will be installed at the new power station which the Corporation is putting down at Westbank, Portobello, and will be able to supply 500 kW for three-quarters of an hour in an emergency.

In 1900 Messrs. Fritchett & Gold supplied a battery to the Macdonald Road station of the Edinburgh Corporation, and this battery is still giving useful service.

The New Spanish Tariff.—The British Chamber of Commerce for Spain has called attention to the new Spanish Customs tariff, which imposes a duty on 1,425 articles compared with 748 in the old tariff, and urges that manufacturers and others should lose no time in petitioning against the tariff, the latest date for doing which is September 8th.

Industrial Conciliation.—"It is largely because of the mutual growing respect of the two sides of industry that recent wage cuts have been accompanied by so few strikes," declared Mr. A. H. Paterson, general secretary of the National Alliance of Employers and Employed, in a recent interview. During July, he pointed out, there were 94 industrial disputes, compared with 265 in the corresponding month of last year, and reports received by the National Alliance showed that the spirit of goodwill and conciliation was becoming more manifest in industry. "There is," he added, "a growing sense of sympathy, of understanding, and of the desire to understand by a large number on both sides. Now is the time, while there is an atmosphere of sympathy and understanding, for leaders of trade unionism and of employers to join together to concert preventive measures against future strife. Good trade brings strikes or threats of strikes. Get the right feeling now, and when a boom comes in a particular trade employers will be able to make it clear that their first thought is of benefiting their workers. The moment you move first towards giving workers the advantage of increased prosperity you kill strikes."—*Daily Telegraph*.

Book Notices.—"The Decimal Educator," Vol. IV, No. 13, September, 1921. London: The Decimal Association. Price 6d.—In addition to the secretary's quarterly report, and the usual among a number of useful and interesting notes, is a reprinted article on "The Metric System in an American Workshop," by Theodore H. Miller. The author's experience of twelve years of the metric system is that it is an economical measure, reducing the number of errors in interpreting drawings and in making calculations.

"The Indian Importer and Exporter," Vol. I, No. 1, August, 1921 (80 pp.). London: The Pioneer and Civil and Military Gazette, Ltd. Monthly, 10s. per annum, post free.—This new journal will prove a valuable aid to those engaged in general trade with India, as it deals with many important and varied subjects.

"Science Abstracts," Vol. XXIV, Part 7, Sections A "Physics," and B "Electrical Engineering," London: E. and F. N. Spon, Ltd. Price 2s. 6d. per section.

Reported German Commercial Intrigues in Italy.—A Rome paper has published a report, said to have been sent to the German Government by the Commercial Attaché at the German Embassy in Rome, which lays stress on the German effort after the Armistice to recapture the Italian markets from France, Great Britain and the United States. In order to create a political atmosphere favourable to Germany the report suggests the exploiting of the discontent of the Italian people with the Entente Powers, and says it is necessary to aggravate this discontent by economic action. "With this object," the report continues, "we must establish economic ties and interests with Italy, such as will compel her always to support our policy. Above all, it is necessary to organise a systematic export service of German goods into Italy, and even at a lower cost than that of production. We shall thus gain the sympathy of the Italian consumer, and at the same time render it impossible for Italian industry to continue its activities. A crisis will thus be brought about which will leave Italy in the throes of constant agitation, and make us the master of commerce in the peninsula. It will also allow us to buy up Italian concerns at very low prices.

The report proceeds to point out how German industry can be developed in Italy by taking over various Italian concerns. It shows how the Siemens firm is endeavouring to absorb the Fiat Company by a Stinnes-Fiat combine, and by the acquisition by the Deutsche Bank, which it says is interested in Siemens, of shares in possession of the Banca Commerciale Italiana.

The alleged report next speaks of the necessity of preventing Italy from securing a privileged position in Yugoslavia and the East, and announces that steps have been taken to secure German participation in certain Italian firms, and for the return by Italy of vessels of the German Levant Line.

"The products of the Allgemeine Electricitaets Gesellschaft," continues the alleged report, "have killed the manufacture of electrical plant in Italy, but the German firms must understand the necessity for their branches to be known under Italian names."

The Consortium of Chemical Products of Berlin, the Deutsche Bank and the Disconto Gesellschaft have opened negotiations with Italian groups.

The report concludes by urging that the German-Italian Union shall constantly make its influence felt, and that an Information Office shall be established at the German Consulate in Milan to report on the industrial situation, and to add to the difficulties in labour troubles.

The German Embassy at Rome has emphatically denied that such a report was made. The *Idea Nazionale*, however, says it has sure proof of the authenticity of the document.—*Reuter's Trade Service* (Rome).

A Switch's Action "Filmed."—To enable the action of their quick "make" and "break" tumbler switches to be studied, Messrs. J. A. Crabtree & Co., Ltd., Walsall, have recently had a switch photographed by an "ultra-rapid" kinema camera. The film was taken at a speed of 200 exposures per second, the actual period of each exposure being .0011 sec. The throw-over of the switch was so rapid that there was only one exposure between the commencement of the movement and complete contact.

Electrical Demonstration at Bournemouth.—Referring to the note in our last issue, Mr. E. Brontman, of 139, Bournemouth Road, Parkstone, who is organising the demonstration that is to take place next month, informs us that there is still room for further exhibits, and he invites manufacturers and wholesale firms to participate. According to the local Press, his electrical showrooms contain an extraordinary variety of devices for use in the all-electric home.

Trade with Denmark.—It is reported that a large party of Danish electrical experts will visit this country during September, and make a tour of British works.

Cricket Match.—In a cricket match between teams representing the Barrow-in-Furness Corporation tramway men and the local police, last week, the tramway men badly beat the guardians of law and order, scoring 84 runs against the meagre score of 18 by the police.

Power House Equipment Required for Canada.—The Department of Overseas Trade is informed that a power house is to be erected for the Normal School and Institute of Technology, Calgary, Canada, and it is proposed to install a steam-driven generating plant. The boilers have been already purchased, but specifications for the remainder of the plant are not yet prepared. British firms interested should send literature, &c., to the Provincial Architect, Department of Public Works, Alberta.

Stoker Contracts.—Among the contracts recently carried out by MESSRS. E. BENNIS & Co., LTD., are the following for electricity works:—

Wallasey Borough electricity station, Liscard.—Relinking two Babcock & Wilcox chain grates.

Peterborough Corporation electricity works (per Spearing Boiler Co., Ltd.).—Two chain grate stokers for Spearing water-tube boilers.

Cardiff Corporation Electricity Department, Roath power station.—One complete ash-handling plant.

The general contracts include coal and ash-handling plant for mills at Warsaw, and sprinkler stokers and compressed-air furnaces for shipment to Japan.

The Kiewa Hydro-electric Scheme.—His Majesty's Trade Commissioner in Australia (Mr. S. W. B. McGregor) has forwarded a copy of the Report on the Kiewa Hydro-electric Scheme by the Electricity Commissioners of Victoria, which includes the report and estimates of the scheme by Mr. A. G. M. Nichell, M.C.B., their consulting hydraulic engineer. The reports may be consulted by United Kingdom firms interested on application at the Inquiry Room of the Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W.1.

Henley's Wiring System.—CORRECTION.—Messrs. W. T. Henley's Telegraph Works Co., Ltd., ask us to correct an error which they made in their advertisement in our issue of August 26th, in that they referred to Witley Court as "recently the seat of the Earl of Durham," when in fact the reference should have been to the Earl of Dudley. This mansion, which was illustrated, was for over 300 years the seat of the Earls of Dudley, but last year it was acquired by Sir Herbert Smith.

Annual Outings.—The first annual outing of PENROSE LIFTS, LTD., formerly the lift department of Messrs. A. W. Penrose & Co., Ltd., was held on Saturday, August 20th. The party journeyed by road to Brighton, and lunch was served at the Devon Restaurant. The toast of "The Firm" was proposed by Mr. W. E. Johnson, who said that most of the employes who were transferred from the old company had a sentimental attachment to the Penrose Lift, and had confidence that the new firm would have a successful future. Mr. F. E. S. Lindley, in replying, said that the difficulties had been got through so far successfully, and the difficulties would disappear in the near future.

The offices and works of MESSRS. J. H. TUCKER & Co., LTD., Birmingham, will be closed on Saturday, September 3rd, for the annual outing.

Chemical Industry Wages.—As a result of the conciliation efforts of the Ministry of Labour at Manchester on August 26th, the threatened stoppage of work in the chemical industry was averted, and the notices were withdrawn. It is understood that the terms of settlement provide for 13d. reduction from August 1st, with another reduction of 3d. per hour from October 1st, as against 2d. per hour proposed. The settlement also provides for the stabilisation of wages until the end of the year.—*Daily Telegraph*.

Swiss Production.—The Dutch Consul at Zurich reports that Swiss glow lamp makers and electrical contractors complain of an increasing scarcity of orders, and makers of porcelain for electrical purposes have been compelled further to reduce their production.

Proposed Amalgamation of Transport and General Workers.—The Executive Council of the National Transport Workers' Federation has passed a resolution welcoming the scheme of a Transport and General Workers' Union, and urges all the unions affected to consider the necessity of strengthening the Labour movement by a further consolidation of forces inside the new organisation. The executive is to instruct a special sub-committee to open negotiations with the executive committees of the affiliated unions to consider all necessary means of securing the best and strongest organisation of the men employed in all forms of transport.—*The Times*.

Australian System of Surtaxes.—It is reported that the Australian Parliament is considering the adoption of a system of surtaxes to be levied on goods coming from countries where the rate of exchange is low, on the ground that these countries—France, for example—pay their workers in depreciated money, and can consequently produce at a cheaper rate than can Australian firms. The *Journée Industrielle* understands that the nations interested will protest against the allegation on which the Bill is based.—*Reuter's Trade Service* (Paris).

The Rumanian Market.—Rumania offers a market for British goods in very many lines, states the Commercial Secretary to H.M. Legation at Bucharest in his recent report on the economic conditions in Rumania. The following are among those of most importance: Electric dynamos and motors, fans, lamps, &c., gas and oil engines, pumps, iron pipes and tubes, belting, and rubber goods (machinery).

Social.—On Saturday, August 20th, the chairman and directors of MESSRS. RAWLINGS BROS., LTD., and the RAWLINGS CO., LTD., gave a garden party and fête to the members of their staff. The opportunity was taken to present a silver salver and other presents to Mr. and Mrs. J. J. Rawlings as mementos of their silver wedding. The directors also made presents to employees of 20 years' standing. Sports were held during the afternoon in which a large number of people took part; prizes were presented to the winners by the donor, Mr. J. J. Rawlings. There were several amusing side shows run by members of the staff, the proceeds being given to the Rawcester Benevolent Fund.

The fifth annual horticultural show and sports of the Bradford Corporation Tramway Employees' Social and Athletic Society were held on two days recently, and were quite successful, alike on the exhibiting, sporting, and attendance sides. The horticultural exhibits were rather fewer in number than last year, but the quality was distinctly good. The sports prizes were presented by the wife of Mr. R. W. Wilkinson, the general manager. The tramway band provided music.

On Saturday afternoon, the 27th inst., the staff, employees and friends of the County of London Electric Supply Co.'s Horticultural and Social Society held their fifth annual exhibition of vegetables, flowers, and fruit at "Oaklands," Cavendish Road, Clapham Park, S.W. Although exhibits were fewer in number, the quality was quite up to the usual standard. A magnificent exhibit of both fruit and vegetables was made by Sir Frederick Hall, M.P., D.S.O. Lady Hall kindly presented the prizes. Witty speeches were made by Sir Frederick Hall and by Sir Harry Renwick, K.B.E., and Mr. A. E. Bacon. Features of the afternoon were a wireless demonstration kindly arranged by Mr. T. D. Dallas, M.I.E.E., and sports arranged by a member of the Society. The proceedings were carried on until dusk, when dancing took place to the accompaniment of a band. All the exhibits were presented to local hospitals.

Lamp Taxation in Germany.—The German Government has introduced a Bill for increasing the tax on lamps. If passed, the new taxes, which are given below, will come into force on October 1st:—

	Carbon filament lamps.	Metal filament lamps, Nernst lamps and other types.
	Tax per unit in marks.	Tax per unit in marks.
1. Up to 15 watts	0.20	0.40
2. Over 15 and up to 20 watts	0.40	0.80
3. Over 20 to 60 watts	0.80	1.60
4. Over 60 to 100 watts		
5. Over 100 to 200 watts	2.00	4.00

In the case of carbon filament lamps of a higher consumption than 200 watts, an additional tax of 1 mark is to be paid for each further 100 watts, or portion of 100 watts. Arc lamp carbons made of pure carbon, are to be taxed at 2.40 marks per kilogramme, and those formed of carbon and admixtures at 4 marks per kilogramme. The tax on burners for mercury vapour and similar lamps up to 100 watts is 4 marks each, and for those of further consumption, an addition of 4 marks is made for each further 100 watts or portion of 100 watts.

Incandescent gas mantles are to be subject to a tax of 0.40 mark each.

German-Italian Commercial Agreement.—The *Lokalanzeiger* states that the German-Italian Commercial Agreement was signed at Berlin on August 29th.—*Reuter's Trade Service* (Berlin).

Lead Market Report.—Messrs. J. Forster & Co. report that the closing prices on August 26th, were £23 7s. 6d. for August, and £23 15s. for November, against £23 7s. 6d. and £22 17s. 6d. respectively, at the end of last week.

The market has been 7s. 6d. lower than these figures, £23 being due for August on the 23rd and 24th, and 25th, and as low as £22 7s. 6d. for November on the 24th.

Business on the Metal Exchange has been on a somewhat larger scale, about 2,500 tons changing hands, but there is little speculative interest shown in lead, and what there is, is on the "bear" side. Delays in shipment of lead, against July contracts, both from Spain and America, obliged sellers to deliver wharf lead against July contracts, with a consequent large reduction in stocks here, and a corresponding increase

of lead available for August contracts, which perhaps accounts for the easy conditions on the market last week. At the same time, there is no surplus foreign lead about, and the prospects for September arrivals are much on the short side.

Consumers have shown no disposition to buy beyond immediate requirements, and export business is very slack.

Encouraging Electric Foundries in Brazil.—A project is under the consideration of the Chamber to grant a subsidy of 200 contos of reis (nominally £10,000) to each of the first three electric foundries to be established in Brazil.—*Financial Times*.

Inquiry.—The present address of the firm trading under the name of O. G. & Co., Ltd., Birmingham and London, is required.

National Food Exhibition.—The above exhibition, which is to be held at Olympia in September, 1922, will present an opportunity to manufacturers of electrical cooking apparatus and utensils, dairy machinery, refrigerating plant, &c., to exhibit and extend the use of electricity in this most important direction.

Unemployment in South Africa.—Owing to the prevailing lack of employment even mechanics and better-class workers, including a number of skilled men, are accepting relief work. While this is to a certain extent due to the general depression, the position is largely caused by an influx of men from overseas, owing to the bad state of the engineering trade in Great Britain. A thousand unemployed have registered in the town. Unemployment is also rife in Cape Town and other large centres in the Cape Province.—*Reuter's Trade Service* (Johannesburg).

Canadian Preferential Tariff for West Indies.—The Canadian preferential tariff in favour of the West Indian Islands becomes effective on September 1st by proclamation.—*Reuter's Trade Service* (Ottawa).

New Spanish Companies.—The Hidroelctrica del Maestrazgo is the title of a Spanish company formed at Tortosa (Calle de Cervantes 14) for developing certain waterfalls for the generation of electric current to supply a number of towns in the provinces of Tarragona and Castellon. The capital of the company is 500,000 pesetas.

The Asociacion de Productores y Distribuidores de Electricidad has been formed in Spain to vindicate the rights of the producers and distributors of electrical energy against the arbitrary action of the Government and Government officials. Acts complained of are the imposition of heavy fines for slight faults of supply, exaction of the deposit of heavy guarantees for the discharge of fines, maintenance of the price of energy at pre-war rates, variation of terms of granted concessions, the incidence of the new customs duties, and penalties exacted for importing machinery not made in Spain, ignoring the national importance of the electrical industry, and other matters. Señor Urrantia is the spokesman in a vigorous campaign which has been begun.

New French Companies.—The Forges et Ateliers de Constructions Electriques de Jeumont is a company recently constituted at Paris (75, Boulevard Haussmann) with a capital of 80,000,000 fr., to take over certain assets of two other companies, namely the Société des Ateliers de Constructions Electriques du Nord et de l'Est and the Société des Forges et Ateliers de la Longueville. Of the 320,000 250-fr. shares of the new company 160,000 are allotted to the former, and 160,000 to the latter, in consideration of their assets, the balance of 10,000 shares being subscribed in cash.

At Grenoble has been formed the Société d'Etudes des Chutes de la Moyenne-Isère, with a capital of 160,000 fr., with the object of acquiring existing rights for creating falls on the Middle Isère between the Saint Gervais bridge and the confluence of the Arly. Four hundred founders' shares and 400 250-fr. shares, fully paid, are allotted to the former owners of the rights, the remaining 240 shares being subscribed in cash.

The Société d'Electricité de Surgères, Agrefeuille et Eten-sions has been formed at Surgères (Charente Inférieure) with a capital of 1,000,000 fr. (raisable to 3,000,000 fr. by simple decision of the Council), with the object of the generation, purchase, sale, transformation, and transport of energy in all its forms, and accessory applications.

With a capital of 500,000 fr., subscribed in cash, has been formed the Electricité Asea at Paris (114, Boulevard Haussmann) for the manufacture, purchase, and sale of electric apparatus and material of all kinds.

Trieste Samples Fair.—The authorities of the annual Trieste Samples Fair, which was to open on September 11th, having invited H.M. Government to form a British propaganda and information bureau at the Fair, a stand was placed at the disposal of the British Consul-General free of charge, and the organisation of the bureau was commenced. Owing to the postponement of the Fair to May, 1922, the arrangements have been suspended for the present.

The Export Credits Scheme.—The Board of Trade has added Italy and Portugal (including Portuguese Colonies) to the list of countries included in the new export credits scheme. Inquiries in this connection should be addressed to the Director of the Export Credits Department, 73, Basinghall Street, London, E.C.2, from whom forms of application can be obtained.

LIGHTING AND POWER NOTES.

Aslington (Northumberland).—PROTEST AGAINST LIGHTING AND POWER MONOPOLY.—Representatives of the district are petitioning the Ministry of Health to investigate a proposal of the local council to enter into a 10-years' agreement for public lighting by electricity on the ground that it is creating an unnecessary monopoly.—*The Times*.

Belfast.—CONSULTANTS' REPORT.—At the monthly meeting of the Corporation on August 2nd, it was stated that the consulting engineers, Messrs. Preece, Cardew & Rider, desired to withdraw for the present their report dated June 7th on the financial position of the electricity undertaking as it is likely to be when the first section of the Harbour Power Station is completed. A resolution was, however, adopted to the effect that each member of the Council be furnished with a copy of the report. These copies were received by the members, together with the agenda for the meeting on September 1st. Councillor Alexander gave notice that he intended to move:—"That in view of the very grave state of the city's electricity undertaking, the Corporation forthwith dispenses with the services of their consultants, and that the opinion of senior counsel be taken as to their responsibility and the responsibility of Sir John Snell in the matter."

Bradford.—MOTORS AND RATES.—Despite the understood rule that tenants' fixtures are not included in the valuation of premises for rating, it appears that electric motors in Bradford industrial establishments are liable to assessment, even though most of them are tenants' fixtures, as distinct from big permanent plant like steam power machinery. The local custom in valuation of business premises has been to include only such machinery as would pass with the freehold.

One firm has been advised to give the Corporation notice to remove a 15-h.p. motor. Therefore, the immediate result of insistence on the small amount to be yielded by this rating, is that the city loses £7 10s. per annum for hire of the motor and the revenue from the electricity which would have been consumed.

Canada.—HAMILTON (ONT.).—Every house in the city of Hamilton, Ontario, is to be equipped with electricity for heating and cooking. This decision has been reached by a commission which has been studying the scheme for some time. Electricity sufficient for cooking, and for heating and lighting a six-roomed house will cost about 14s. a month, the commission estimates, apart from the initial wiring expense of about £50.—*Daily Express*.

Chester.—JOINT DISTRIBUTING AUTHORITY.—The Chester Rural District Council has authorised its Electricity Committee to confer with the Chester Corporation electrical engineer, on the question of the formation of a joint distributing authority. It was explained that the Chester Corporation hoped to obtain electricity supplies from H.M. Factory at Queensferry in November, when it would be in a position to supply all the requirements of the city and the district. It was stated that the cost of cables, &c., where laid in the Rural Council's area, would fall on that Council whose idea was that the scheme should be self-supporting.

Continental.—FRANCE.—The strikes at Strasburg, affecting mainly metallurgists and electricians, are having far-reaching results. The town is entirely deprived of ordinary lighting, only the central streets being lit up by searchlights and a few powerful acetylene lamps. The inhabitants were considerably astonished to see the first tramcar which was run after the electrician's strike began; it was drawn by a railway engine of a type used on light railways. A skeleton tramway service is now being run in this manner.

Although the workers in the gas and electricity works at Strasburg and also in ten factories have come out, the metallurgists' strike in the Lower Rhine area is not complete. Of 46 works, 22 are now working, the reduced wages having been accepted. In two of the most important metallurgical works in Strasburg, work has been partially resumed.—*Reuter's Trade Service* (Paris).

AUSTRIA.—The City of Vienna, in conjunction with a banking syndicate, is forming a company with a capital of 1,000 million crowns to develop a water power near Vienna sufficient to supply the city with electricity. The cost of construction will be covered by an issue of bonds aggregating 10 milliards of crowns, about one-third of which will be issued in the first five years.—*Reuter's Trade Service* (Vienna).

London.—On August 24th, the employees of the Warraway municipal electricity works, came out on strike, depriving the city of light and power. The municipal employees had already been on strike two days, causing a breakdown of transport. It was reported that the gas workers had also ceased work.

Lyver.—THE FIRE STATION STRIKE.—An outbreak of fire, believed to have been caused by a spark, occurred at the Corporation power station early on August 24th.

Flame burst out of the wooden roof of the boiler house at the rear of the station. There was for a time danger to the generating plant, but the fire brigade, which promptly arrived and set the automatic water control, and there was no danger of the electric works. A first estimate puts the damage at several hundred pounds.

Crief.—ELECTRICITY SCHEME.—Mr. J. E. Macewan, consulting engineer, Glasgow, recommends the Town Council to institute an electricity supply, and to install Diesel oil engines. The estimated expenditure, including expenses in connection with the obtaining of an order and installation of plant is £15,650. The yearly outlays are estimated as follows: Standing charges, £2,223, and running expenses £1,656, a total of £3,879. The estimated revenue is £4,275.

Haslingden.—LOAN SANCTIONED.—The Corporation has received the sanction of the Electricity Commissioners, to the borrowing of £10,000 for electricity purposes, made up as follows: Mains and services, £7,000; sub-stations, £3,000.

Haworth (Yorks.).—SUPPLY PROBLEM.—At an inquiry in 1915, the Council objected to inclusion in the Keighley supply scheme, preferring to promote an order separately for its own area. Nothing has yet been heard of this order, and the district is not included amongst the other urban districts in which Keighley has obtained power to supply.

Leek (Staffs.).—LOAN.—The Urban Council is seeking sanction to borrow £18,500 for the provision of additional plant at the electricity works.

Matlock.—WATER POWER.—Some time ago a letter was read at a Council meeting from Mr. D. Palmer Pearson suggesting that electricity for the district could be secured from turbines placed in the Derwent, and he gave the locality as the Colingwood stream, at the northern end of Matlock Dale.

On August 23rd, the Council considered the report of the engineers, Messrs. Grime & Frith, of Manchester, and it was explained that the engineers, on their inspection of the district, visited the High Tor Works, and it was there shown that the works could take the whole flow of the Derwent at its present level.—*Sheffield Daily Telegraph*.

Morecambe.—LOAN SANCTIONED.—Sanction has been received from the Electricity Commissioners to borrow £6,000 for the purchase of mains and meters for the electric light undertaking.

Oldham.—YEAR'S WORKING.—The report of the borough electrical engineer (Mr. E. L. Ogden), for the year ended March 25th last, shows that the total revenue of the electricity undertaking was £146,846, as compared with £119,865 in the preceding year. Working expenses amounted to £117,326, as against £79,139, leaving a gross balance of £29,520 (£40,426). After adding a balance of £10,774 from the previous year's accounts and paying capital charges, &c., a credit balance of £3,386 remained. The large increase in working expenses is due to the increased cost of fuel and labour, and to a larger expenditure upon repairs, maintenance and renewals. The total number of units sold was 18,340,242 as against 16,693,515 in 1919-20. The maximum load rose from 9,232 kW to 10,996 kW.

South Africa.—JOHANNESBURG.—The municipality proposes to call for tenders for two new boilers costing £20,000; a converting plant to cost £12,000; and other plant. There is also a proposal to construct a large new generating station making provision for future extensions, as the town grows, up to an approximate total of 54,000 kW. Machinery and plant estimated to cost £119,551 is urgently needed to equip the power station for the next two years. The Tramway and Lighting Committee recommends the Council to apply to the Administration for authority to borrow £119,551.

GRAHAMSTOWN.—The City Council has adopted a scheme for the electric lighting of the district, involving an expenditure of £65,000.

Southport.—EXTENSION OF SUPPLY.—The Corporation is applying to the Electricity Commissioners for an order to supply electricity to that part of the Kew district within the jurisdiction of the West Lancashire Rural District Council.

South Shields.—YEAR'S WORKING.—The report upon the Corporation electricity supply department (engineer, Mr. E. Moxon) for the year ended March 31st last records a total revenue of £93,066, as compared with £66,377 in the preceding year. Working expenses amounted to £57,655, as against £43,438, leaving a gross profit of £35,411 (£23,239). The net result, after payment of all capital charges, &c., was a profit of £10,218, comparing very favourably with a profit of £3,514 in 1919-20. The number of units sold rose from 6,962,929 to 7,955,693, and the average price obtained per unit from 2.19d. to 2.69d.

PROPOSED PRICE REDUCTION.—Owing to the satisfactory surplus obtained during the past year, and also to the fact that the engineer considers that the highest level of working costs has been reached, the Electricity Committee recommends a substantial reduction in charges, to take effect at once.

Teignmouth.—ELECTRIC LIGHTING.—At a meeting of the Chamber of Commerce reference was made to the question of electric lighting for the town, and opinions were expressed that Dr. Parry's proposal to erect three miles of overhead cable in two years was insufficient.

Wakefield.—EXTENSION OF SUPPLY.—The City Council has decided to make application to the Electricity Commissioners for power to supply electricity to the parish of Lupset.

TRAMWAY AND RAILWAY NOTES.

Bolton.—MARKET SIDING.—Negotiations have been completed for the construction of a tramway siding at the south end of the wholesale market, to serve as a terminus for the Daubhill and Deane route, so as to relieve the congestion of traffic in Great Moor Street.

Birkenhead.—YEAR'S WORKING.—The annual report of the manager of the borough tramways and motors department (Mr. Cyril Clarke), for the year ended March 31st, 1921, records that the revenue of the tramways amounted to £152,304, as compared with £148,179 in 1919-20. Working expenses absorbed £116,060, as against £100,476, leaving a gross surplus of £36,244 (£47,703). The net result, after payment of interest, sinking fund contribution, and income tax, was a profit of £4,033, a considerable decline from last year's balance of £16,104. The number of passengers carried and car-miles run were almost the same as in the previous year, but there was a slight decline in the number of passengers and a small increase in the number of car miles.

RESULT OF FARE INCREASE.—The Tramway Committee's report upon the result of the increased fares during the first week of their operation shows that compared with the corresponding week last year there was a decline of over 88,000 in the number of passengers and a reduction of £142 in the receipts. Compared with the previous week, the falling-off in the number of passengers was 22,500.

Canada.—TORONTO.—The *Times* Toronto correspondent states that the tramways were to pass into the possession of the municipality on September 1st. It was announced that the fares would be increased.

Chile.—RAILWAY ELECTRIFICATION.—The Government has decided to take up a loan of £2,700,000 for the purpose of electrifying 200 kilometres of railway between Santiago and Valparaiso.—*Reuter's Trade Service* (Santiago de Chile).

Gateshead.—COLLISION.—On August 24th a tramcar was proceeding up West Street, which is a steep gradient, when it was run into by a motor coach which was proceeding in the same direction. The two vehicles came into contact with considerable force, and as a result the motorman's platform and controlling mechanism of the tramcar were torn away. With nothing to check it, the car at once began to fall backward down the hill. Upon the same track another car was travelling in the same direction. The motorman of this car saw the collision, and at once realised that his car was in peril as the first tramcar backed down the hill. He at once applied his brakes to their full power, and held on to them until the first car dashed into his car and was brought to a standstill. None of the passengers were seriously injured.

Glasgow.—ENLARGED BORROWING POWERS REQUIRED.—With a view to meeting expenditure on tramway extensions, motor omnibuses, &c., the Tramway Committee has recommended the Town Council to increase the borrowing powers of the department to the extent of £600,000.

London.—FIRE.—On August 24th an L.C.C. tramcar, which was standing in the Brixton Road, suddenly burst into flames. It is reported that this happened immediately after the fixing of a collector shoe in changing from overhead to conduit working. The few occupants of the car escaped without injury.

DERAILMENT.—On August 25th, a London United Tramways car jumped the track at Shepherd's Bush. It crossed the road and mounted the pavement, being brought to a stop by some railings. Several passengers sustained shock and slight injuries.

COLLISION.—Another accident occurred at Greenwich on August 25th. A motor coach collided with an L.C.C. tramcar, and six persons, including the two drivers, were injured.

Manchester.—THREATENED STRIKE.—A serious position has arisen at Manchester on account of the employment of non-union labour—five men—in the tramway department. The trade union employees have ballot in favour of a stoppage during the next week-end if the men in question refuse to join the union or are not discharged.

Northampton.—EXTENSION OF TIME.—The Minister of Transport has further extended the time of the Northampton Corporation Act, 1911, for the construction of tramways until August, 1922.

Portrush.—GIANT'S CAUSEWAY LINE.—It is reported that the Portrush and Giant's Causeway Electric Tramway, a very early electric line, may be forced to close down owing to a combination of adverse circumstances.

Southport.—POWER FOR TRAMWAYS.—The alterations which have recently taken place at the Crowlands power station will, the Tramway Committee will be charged at the rate of 2d. per unit up to 100,000 units a year; 1½d. per unit for additional power up to 300,000 units a year; 1½d. for further supplies up to 500,000 units a year; and 1½d. for supplies above 500,000 units a year.

TELEGRAPH AND TELEPHONE NOTES.

Canada.—PROPOSED NEW WIRELESS STATION.—It is stated that the Department of Naval Affairs has in view the installation of a very powerful continuous-wave wireless station near Vancouver to undertake land work and to communicate with distant points up the coast, leaving the present station at Point Grey to handle shipping business only.—*Reuter's Trade Service* (Vancouver).

Electrical Storm.—The Cardiff telephone system was dislocated by an electrical storm early in the morning on August 24th. No calls to area subscribers could be put through. Trunk calls were received at the exchange, but could not be connected locally. After thirty minutes the service became normal again, says the *Daily Express*.

Russia.—TELEPHONE AND TELEGRAM FEES.—As from August 1st the following charges were to be made for telephones and telegrams: A single subscriber has to pay 350,000 roubles a year, while a "collective" telephone—that is, one installed in a large house and used by a number of persons—costs 500,000 roubles a year. The fee for three minutes' conversation on a long-distance or suburban telephone has been raised from 1,800 to 7,200 roubles. The installation of a new apparatus costs 500,000 roubles. The persons or organisations who have the right to possess and use telephones on these conditions are those who previously were allowed to have the telephone free of charge. The charges for telegrams are as follows: Local telegrams, 100 roubles a word; inter-urban telegrams, 500 roubles; and urgent telegrams, 3,000 roubles.—*Morning Post*.

Sweden.—SHIPS' WIRELESS INSTALLATIONS.—As a result of the British regulation which came in force last December requiring vessels of 1,600 tons or more plying to British ports to carry wireless installations, the wireless section of the Swedish Telegraphic Administration has been overwhelmed with orders for new wireless apparatus. About 200 ships are required as a result of this regulation to be fitted with wireless, and the installations are not yet entirely finished. Some of these would have been fitted without the special incentive of the British regulation. When Swedish shipping recovers from its present depression a further thirty will have to be fitted. In Göteborg harbour there are already two salvage vessels fitted with wireless apparatus; in Stockholm harbour there are three, and will shortly be four.—*Economic Review*.

Switzerland.—TEMPORARY WIRELESS STATION.—In order to facilitate the transmission of Press dispatches from Geneva during the discussion of the Silesian problem by the Council of the League of Nations and during the second assembly of the League, the Marconi Co. again erected in Switzerland, at the request of the Swiss Government, a temporary wireless station giving precedence to news messages. The transmitting station, which is at Borno, will be operated automatically at high speed and by distant control from a room adjacent to the Assembly Hall of the League in Geneva. Communication will be established with England and several other European countries. A staff of experts has been sent from London to conduct the service which opened on August 30th.

The Telegraph Service.—TELEGRAPHISTS' BONUS.—The daily Press announces that the Government has decided to appeal against Mr. Justice Darling's decision on the question of the payment of a bonus to General Post Office telegraphists who enlisted in the Royal Engineers. Mr. R. T. Sutton, along with many others, joined the signal section of the R.E. under contract with the Government that he should receive on return from the war full civil pay. He did not, however, receive the amount by which the civil pay was increased by awards (bonuses) during his military service, says the *Evening News*.

The Telephone Service.—SCARBOROUGH.—On Saturday afternoon the telephone exchange service was transferred from the old premises at Vernon Place corner to the General Post Office in Aberdeen Walk. The new switchboard is a common battery manual No. 10 of 2,000 subscribers capacity, although at present Scarborough has only 900 subscribers. Trunk calls will be dealt with direct by the exchange operators, and it is expected that before very long lines to Malton, Bridlington, Whitby, York, Middlesbrough, &c., which are at present trunk calls, will be worked merely as junction services.

HULL.—The Corporation telephone department experienced a loss of £13,279 on the year's operations.—*The Times*.

U.S.A.—NEW LONG ISLAND WIRELESS STATION. What is claimed to be the largest and most powerful radio plant in the world, the new central station of the Radio Corporation of America on Long Island, N.Y., will be formally opened for service in the latter part of August or early in September. Two of the wings or spokes of the wheel-like arrangement of the antenna towers, that has been described in our pages, are complete. Twelve steel towers, each 400 ft. high, compose the two wings or one operating unit. When the entire station is complete there will be twelve of these. The total distance between the first and twelfth towers of the complete unit is

approximately three miles. In the centre of these twelve towers is the central power house, which is now completed, and two of the 20-kW Alexanderson high frequency alternators have been installed and are ready for operation.

The receiving station destined to operate in connection with "Radio Central" is at Riverhead, L.I., about 17 miles away. This receiving centre is capable of intercepting six different messages simultaneously. The control system is so arranged that there are no actual receiving operators present. The aerials pick up the signals, special apparatus in turn directs these to a regular land wire, and finally the messages are received in New York City.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Australia.—MELBOURNE.—October 19th. Victorian Government Railways. Three-phase motors, starters, circuit breakers, and switches. Contract No. 34,181.*

Bristol.—September 16th. Electricity Department. One 500-kW rotary converter. (August 26th.)

Bulgaria.—September 19th. Supply of 2,000 telephones. Direction des Postes, Telegraphes et des Transports bulgares, Sofia.

Dorchester.—September 10th. Electricity Committee. Replating battery, &c. (August 26th.)

Eastbourne.—September 26th. Electricity Department. One water-tube boiler, fan and chimney, boiler-feed pump and piping; one 2,500-kW turbo-alternator with condensing plant and pipework. (See this issue.)

Halifax.—September 10th. Electricity Committee. Steelwork in connection with foundations for new turbine set at the electricity generating station.—Mr. A. C. Tipple, acting borough engineer, Crossley Street.

Horsham.—September 3rd. Electricity Department. One 3-crank, triple-expansion engine, coupled to a 300-kW d.c., 460/500-V generator, or alternatively, one 2-crank compound engine, coupled to generator as above. (August 19th.)

Ilford.—September 9th. Electricity Department. Air compressor, motor and starter. (August 19th.)

London.—FULHAM.—September 10th. Electricity Department. A.c. motor-driven centrifugal circulating pump with pipework and valves. (August 19th.)

H.M. Office of Works. September 16th. Supply of electrical and mechanical labour-in-daywork in the Cardiff district. (August 26th.)

BIRMINGHAM.—September 23rd. Board of Guardians. Six months' supply of electric lamps. Mr. H. Reeve, clerk to the Guardians, 283, Tooley Street, S.E.

Malta.—September 15th. Government of Malta. Single-phase a.c. meters. (August 19th.)

Manchester.—September 13th. Tramways Committee. Motors, controllers and trucks, &c. Mr. J. M. McElroy, general manager Corporation Tramways, 55, Piccadilly, Manchester.

New Zealand.—WELLINGTON.—September 27th. Public Works Tender Board. Six sets 3-phase, 50,000-V air-break switches for the Waikato electric power scheme.*

November 29th. Public Works Department. Mangahao electric power scheme: 3 water wheels, three 6,000-kVA and two 3,000-kVA a.c. generators, two 3-unit exciter sets, seven 4,000-kVA single-phase transformers, insulators, lightning arresters, switchboard, &c.*

October 15th. Corporation. Two water-tube boilers with feed-water heaters, superheaters, stokers, &c.; one 5,000-kW turbo-alternator with condensing plant. (See this issue.)

Uruguay.—September 19th. Board of State Electrical Stations. Generating plant for four electrical groups, consisting of a.c. and d.c. generators, Diesel engines, &c.*

South Africa.—JOHANNESBURG. November 7th. Rand Water Board. Two 350-kW steam-driven electrical generating sets, complete with switchboards and all accessories.*

West Ham.—September 8th. Board of Guardians. Three months' supply of electrical fittings. Mr. T. Smith, clerk to the Guardians, Union Road, Leytonstone.

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

FORTHCOMING EVENTS.

Institute of Marine Engineers.—Tuesday, September 6th. At the Institute, The Minerva, Tower Hill, E.C. At 6.30 p.m. Paper on "The Burning of Oil Fuel, and the arrangement of machinery necessary, together with observations and comments drawn from actual conditions," by Mr. A. Keens.

British Association for the Advancement of Science.—September 7th-14th. At Edinburgh. Eighty-ninth annual meeting.

Shipping, Engineering and Machinery Exhibition.—September 7th to 28th. At Olympia, W.

NOTES.

Appointments Vacant.—Associate Professor of Electrical Engineering (£3,800 per annum), for the New Provincial University of British Columbia; electrical engineer and manager (£800), for the Corporation of Southport Electricity Department.

Fatality.—Edward Braithwaite, electrician at the works of the Yorkshire Electric Power Co., was killed in the course of his work on August 26th. He was examining a defective lamp fitting on the top of the ash tip at the Thornhill works, when the tip man heard him call out and saw him clinging to the electric wires. When he succeeded in pulling him off the wires to the ground, Braithwaite was unconscious, and artificial respiration methods failed to have effect.

Educational.—Advanced evening technological courses have been arranged in electrical, civil and mechanical engineering at Leeds University, commencing on September 12th. Certificates of attendance for four sessions at courses in mathematics, mechanics and machine drawing, or evidence of similar work elsewhere, are required. In the absence of such evidence there is an entrance examination, but students of 22 years of age and over may be admitted without examination at the discretion of the head of the department.

Heat-resisting Glass.—The Montreal convention of the Society for Chemical Research, which was opened on August 29th by Sir William Pope, is being attended by noted chemists of Great Britain, Canada, and the United States. Among the scientific papers to be presented is one dealing with a new glass, which, the inventor claims, admits unlimited light while eliminating all heat rays.—*Daily Express*.

Seeing Through Criminals.—The *Daily Mail* recently recorded the strange case of a woman who, by means of X-rays, was discovered to have swallowed two stolen rings. This journal also recalls another instance in which the interior of a criminal was examined by the agency of the rays; in this case it was a Berlin burglar who had swallowed a bunch of skeleton keys. Radiology is likely to become an unpopular science to members of this industry.

Turbine Locomotives.—The *Dagens Nyheter* learns that the Ljungstrom Steam Turbine Co. has built a new type of locomotive from a Swedish invention which is now being tested by the State Railways. The chief innovation in the new locomotive is that reciprocating machinery has been replaced by a steam turbine. The locomotive is also equipped with a condenser and other appliances for economising fuel. Another turbine locomotive is being tested in Switzerland.—*Reuter's Trade Service* (Stockholm). It will be remembered that rumour has it that a similar type of locomotive has also been built in this country.

Institution Notes.—ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—On August 24th the members of the Midland Branch of the Association paid a visit to the works of the General Electric Co., Ltd., at Witton. After inspecting the various departments, where the manufacture of motors and generators was in progress, the visitors were entertained to luncheon at the Imperial Hotel, Birmingham, by Mr. T. Evan Davies, general manager of the works.

INSTITUTION OF MINING ENGINEERS.—The offices of the Institution have been removed from 39, Victoria Street, Westminster, to Cleveland House, 225, City Road, London, E.C.1. Tel. No.: Clerkenwell 3670; tel. add.: Instimimi, London.

Use of Electricity in Scottish Coking Seams.—The referee appointed to arbitrate in the case mentioned in our issue of July 22nd last, p. 123 (Mr. John Gemmell), states with regard to the use of electrical plant at Auchengie Colliery, Arthurlie, that if used in the coking coal seam at or within 50 yards of the face for any purpose (other than that of shot-firing or of obtaining light by means of electric safety lamps) it would on account of the risk of explosion of gas be dangerous to life.

Bolshevist Dreams.—"Our dreams are of establishing the most modern system of electrification for our entire industry and agriculture, if possible with the United States' assistance," M. Chicherin, Soviet Russia's Foreign Minister, is reported to have remarked recently in an interview with a United Press of America reporter.

"We intend to establish powerful electrical centres all over Russia, utilising the natural power available locally—coal in the Don region and certain parts of Siberia, naphtha in the southern districts, and water power wherever possible. We are prepared to give concessionaires every possible guarantee of protection."

Electric Wiring at the Royal Albert Docks.—Another example of the increasing use of c.t.s. cables is provided by the new Royal Albert Dock, which was recently opened by H.M. the King. This magnificent dock, constructed by the Port of London Authority, is equipped with the most up-to-date travelling electrical cranes, and for the trailing cables c.t.s. is used exclusively. The same type of cable is also used wherever cables have to cross the water, as in feeding island jetties. The latter each carry four 3-ton travelling cranes. Each crane has a range of travel of 150 ft., and the cable is led over a series of pulleys, as shown in the accompanying illustration. C.t.s. cable is, of course, a type which lends itself, particularly to such conditions as these. On the dock side there are a number of 25-ton cranes which are similarly fed by c.t.s. cables. The examples of wiring at these new docks demonstrate the manner in which the c.t.s. cables are run,

three years, will be appointed by the Committee as stewards to each factory to exercise control, but their functions will be determined by regulations which are to be issued. They will be empowered to furnish the Committee with information relating to the costs of raw materials and production, administrative and production methods—but not trade secrets—wages, profits, and the constitution of capital. Two employers' representatives and one of the Supreme Labour Council will have the right to attend and speak at the meetings of the Control Committee, they will have no vote, but will have power to demand entry of their remarks in the minutes, and to prohibit the publication in the reports, or even entries in the minutes, of information calculated to prejudice the interests of the industries.

A Board of nine employers' representatives is to be elected every three years under special regulations to negotiate with the Control Committee for the purpose of compelling individual manufacturers to carry out the provisions of the Act. The Control Committee will be entitled to attend and speak—but not vote—at the meetings of the Board, and at least once a year the employers' representatives and the Control Committees are to meet to consider improved methods of working the industry, means of increasing production, and to settle any disputes.

Special regulations to govern the hire and dismissal of workmen are to be framed, and employment bureaux, composed of representatives of the Control Committee and the employers, are to be established to register and engage persons seeking work. The dismissal of employees is to be governed by rules, and in the event of staff reduction, before any hands are dismissed, the hours of work are to be reduced to a minimum of 36 per week, with a proportionate reduction of wages, after which preference in the retention of hands is to be given to the oldest workmen, and those having large families.

If circumstances so require, more than one Control Committee can be appointed for one industry; the expenses of such committees are to be borne in equal shares by the men and employers; all disputes must be settled by arbitration; and, finally, penalties may be imposed for breaches of the Act, and of the regulations relating thereto.

New Bearing Material.—A new bearing material called Genelite, recently developed in the research laboratory of the General Electric Co. (U.S.A.), has given remarkable results in a series of tests made to determine its performance, both when lubricated and self-lubricating.

It consists of a mechanical mixture of a high-grade "synthetic" bronze, and graphite, the latter amounting to about 40 per cent. by volume of the whole mass. Since the material cannot be melted and poured into moulds like ordinary metals, its formation into bearings is accomplished by a special process. It is made from the oxides of tin, lead, and copper (mixed in the proportions to form a high-grade bronze) plus graphite, all the ingredients being in a finely divided state. Graphite is added in sufficient excess quantity to reduce the oxides to the metals and still leave the required content in the finished material. The oxides are partly reduced by heating the mixture, after which it is still in powdered form, but is then pressed as nearly as possible to the required shape in massive metal moulds.

In the pressed form it is still too brittle to stand handling, so it is given a final heat-treatment which reduces and sinters the metals together into a homogeneous bronze, holding the graphite uniformly distributed throughout the mass. The baking fixes the graphite so securely within the mass that it cannot be separated or washed out, even if the metal is lubricated. The material has the general appearance and body of bronze, but the characteristics are different. It does not machine readily by ordinary methods, but can easily be ground, which has been found to be the best method of handling it in production. Neither has it the physical characteristics of bronze, having very low tensile strength, but being able to withstand high compressive strains.

Another marked difference is its porosity, it being able to absorb as much as 2½ per cent. by weight of oil. This feature is made use of in some of the high-speed applications where oil is applied to the outside of the bushing and carried to the bearing surface by capillary attraction.

A bearing made from this material never seizes or "freezes" as these expressions are commonly understood. The metal of the shaft and bearing never flow and weld together as a result of bearing friction. If the Genelite bearing sticks, owing to having been fitted too close, examination will show that no damage has been done, either to the bearing or the shaft, and they can be reassembled after the bearing has been ground down to proper size.

Genelite is useful where lubrication is either poor or neglected altogether owing to the inaccessibility of the bearing.—*Chem. and Met. Engineering.*

Church Telephones.—The deaf of the province having formed themselves into a mutual aid association, which has submitted a request to the ecclesiastical authorities for more religious facilities, special churches for the deaf are to be built in the Province of Hanover. They will be provided with a telephone transmitter, into which the preacher directs his voice, together with from 50 to 100 receivers to be worn on the worshippers' heads.



C.T.S. CRANE CABLE.

in striking contrast to the extremely careful and elaborate manner in which it was found necessary to install the type of cable previously used. It should be mentioned that c.t.s. wire is run through the water without any external protection, and also underneath the floor of the jetty, feeding the various plug-connection boxes to which the c.t.s. trailing cables are attached.

Electric Ploughs in Russia.—At the Briansk works a new electrical plough has been prepared which on trial has yielded very satisfactory results. The plough has 16 shares—eight on each side. It will do a lot of work and will plough as deep as 14 in. The capacity of the implement is considerable, and it does not refuse virgin land or land that has not been ploughed for a long time. Twenty are being made at the Briansk works. It is the first such plough made in Russia, and it is hoped that it will be one of the chief features in the electrification of the country's agriculture.

Labour Control of Italian Industries.—The text of the much-talked-of Bill for the labour control of factories that was introduced in the Italian Chamber by Sr. Giolitti last month is now available, but in view of the resignation of his Cabinet, it remains to be seen what the fate of the Bill will be. The lengthy preamble explains the reasons for the introduction of the Bill, and states that the divergencies of the opinions of the General Confederations of Industry and Labour were too great to admit of agreement; therefore, each submitted a scheme to the Government which was thereby guided in drafting the Bill.

Concerning the substance of the Bill, provision is made for the control of ten industries, including the electrical, engineering, iron, steel, and chemical industries, by the workmen and the reasons for so doing are set out. State and municipal industries, those established for a period of less than four years, and factories employing less than 60 hands, are to be exempt from control. A Committee of Control will be elected every three years by the workers in each industry, and of its nine members six will be chosen by the workmen, and three by the technical, clerical, and managerial staffs.

Two or more workmen, who will also be elected every

Service v. Trouble.—Following a prize-winning suggestion in an employees' suggestion contest, the Oklahoma Gas & Electric Co., Oklahoma City, has issued orders that the former "trouble department" shall henceforth be known as the "service department." The line of reasoning followed by the company is that this department is the one charged with the duty of seeing that customers receive service at all times, and that in a great majority of cases the interruption is not due to trouble on the lines of the company. It is believed that the change of name will materially assist the company in its attempt to convince customers that the commodity furnished is primarily service and secondarily electricity. The policy of the company has been that the degree of satisfaction derived by individual customers is influenced by continuity and quality of service rather than by the mere use of the commercial product supplied. In selecting an employé to take charge of this work consideration was given to the personal qualities of diplomacy and energy, while thorough information concerning the functions of the various departments of the company was another decisive factor.—*Electrical World*.

Electric Vehicles in the U.S.A.—Notwithstanding the tremendous output of cheap petrol-driven passenger cars and trucks, which are sold at prices much below those charged for electrically-driven vehicles, the advantages for certain purposes of the electric car and the electric lorry are gradually being realised by an increasing number of firms and individuals. Electric passenger cars are slowly making headway in the larger American cities among doctors, travellers, and others who are largely occupied in making frequent calls within a restricted area; they are also used as auxiliary cars by wealthy people who find them easy to drive and, therefore, very convenient in emergencies. Many manufacturers and department stores are using small electric trucks in increasing numbers; most of these firms formerly used gasoline-propelled vehicles exclusively, and it was only after proving the superiority of electrically-driven trucks for short hauls that the change was made.

No official figures are published showing the number of electric vehicles in use in the United States, but there were 3,142 in operation in New York City in March, 1921, as compared with 2,495 in 1913. The increase may not appear to be large, but allowance should be made for the extremely keen competition provided by the innumerable types of cheap petrol-driven vehicles now on the American market. A wholesale baker, who has several branches in New York, Buffalo, and other Eastern cities, owns more than a thousand small electric trucks, while several department stores in New York City each have 100 or more in operation. The New York Post Office recently authorised the expenditure of 50,000 dollars for the purpose of testing electric trucks in the transportation of mail matter. Comparisons will then be made with the records of petrol trucks used on the same routes and carrying similar loads.

Detroit is said to possess the best electric taxi-cab service in the United States, and quite a number of these public vehicles are in operation in other western cities, but they have not yet appeared on the streets of New York. An exhibit of electrically-operated trucks will be a feature of the New York Electrical Show, which is to be held in the Grand Central Palace from September 28th to October 7th.—*Reuter's Trade Service* (New York).

Rearing Chickens Electrically.—Labour-saving devices on the farm are among the most important contributions which electricity has made towards rural progress. At least 10,000 farms, says the New York *Sun*, will be supplied with electric light and power when the plant now being constructed by the Ontario Government is completed, and in this connection the following account which the *Journal of Electricity* gives of the practical elimination of all human labour, and the efficient accomplishment of a task that formerly could only be undertaken on a much smaller scale, and with infinite trouble, is therefore of interest. The chicken-brooding plant owned by Mr. J. W. Dobbins of Sebastopol, California, is said to be one of the largest and most modern in the world, and is so conveniently arranged that the services of only one man are required to raise and handle thousands of chickens. The electrical features of these modern chicken brooders have contributed so much to their success that a new field has been opened up for further practical application of electrical appliances. The large number of Mazda lamps together with the heaters and motors make up a combined load which is well worth while, and extends over a period of approximately nine months, beginning in the latter part of September and extending into June.

At the present time Mr. Dobbins has four brooder houses. One takes care of 4,000 chickens. The other three houses are each capable of handling 1,500 chickens.

The usual principle of brooders is to set the heater at a central point and place the chickens about it, or to set it in a long line brooder and have the chickens run in or out on one side. These methods, according to Mr. Dobbins, are unscientific in that they do not radiate the heat so as to cover all the chickens at one time with an even and uniform temperature. The new principle which he has worked out reverses this old method, and it completely surrounds the chickens with the heat.

All the brooders are constructed in a rectangular form, with a well hole in the centre, which is surrounded with a double

coil of hot water circulating pipes placed under a board covering all around it. Around the outside of the brooder is a fringed billiard cloth. The well has a cover which can be raised or lowered, and a ventilator in the apex controlled by a thermostat. When the chicks are put in at the start they are kept in the well space during the entire first day. The next day they are allowed a three-foot space all round the brooder, which is enlarged day by day as they grow older. The feeding during the first two days is done in the well. Each brooder has an independent hot water circulating system, heated by the latest 2-kW electrical heaters which have been developed by the Edison Electric Appliance Co. They are all equipped with thermostats which maintain a remarkable evenness of temperature in the brooders.

Putting the chicks to bed at night has always been a problem, but this difficulty has been overcome in a very novel and simple manner. Lights have been placed around the inside of each brooder well. When the time comes to put the chicks to bed, the attendant simply turns off all the lights except those in the brooder. Since chicks do not like to be running around in the dark they immediately flock into the brooder where the light is, and in a few minutes the lights can be turned out and all the chickens will be in the brooder. Each of the buildings is thoroughly lighted so that the houses can be brilliantly illuminated in the morning and late afternoon in order that the chicks can be kept busy 15 hours a day. There are 115 40-watt lights in the four buildings.

The drinking water is supplied by new principle fountains. They are designed to furnish fresh running water constantly, and at the same time are automatically self-cleaning. Each fountain is equipped with electric lights for night use. The lights illuminate the rippling surface of the water and the chicks will drink where otherwise they would not. Other conveniences, such as blinds for the windows, automatic feeders, and so forth, are all worked out so that the routine involves a minimum amount of time and labour.

The water supply is taken care of by a 5-h.p. motor controlled by a float switch. This automatically furnishes an abundance of water at all times. Another motor is used for the feed cutter. Vacuum cleaners are used to pick up all straw, dust and dry droppings. Each house is supplied with a stationary motor-driven spraying pump and whitewashing apparatus equipped with a sufficient length of hose to reach every crevice both inside and outside the building.

The electric control of the whole plant is most thorough and complete. All human agencies are eliminated wherever possible. An electric bell system is so arranged that an alarm is sounded if the heat or lighting fails at any time.

Offhand, one might think that this would be a very expensive system to operate, but such is not the case. Any other system would require more help in addition to the maintenance of some other class of heating and lighting. The plant has shown a remarkable record for percentage of chickens raised. It has been so satisfactory that the owner is planning another larger and more elaborate building. The electrical equipment and the circulating water system were furnished and installed by the J. L. Bone Co.

Carbon Monoxide in Gas.—The Departmental Committee appointed by the Board of Trade in January "to inquire into the question whether it is necessary or desirable to prescribe any limitations of the proportion of carbon monoxide which may be supplied in gas used for domestic purposes" has issued its report, which states that on the balance of advantage to the public, it is not necessary or desirable to prescribe any limitations of the proportion of carbon monoxide which may be supplied in gas used for domestic purposes. The Committee suggests that it should be made an offence to supply any gas for domestic purposes which does not possess the distinctive pungent smell of coal gas.—*The Times*.

Super-power Survey in the U.S.A.—The committee which has been organised to study the need or desirability of working toward a super-power transmission system in the north-west States has commenced operations, and data are to be compiled. It is not expected that steps towards actual construction will be taken for several years as the immediate needs of the territory are being satisfactorily taken care of by the existing organisations and transmission systems. Until the industrial expansion exceeds the capacities of the present systems and the available minor power sites are all developed there appears unlikely to be any economic pressure which will force the development of the major power sites at which energy can feasibly be developed only in large blocks. In this territory the primary basis for the development of a super-power transmission system is not the saving of fuel, but the expansion of industry and agriculture through the use of the large hydro-electric resources as yet virtually untouched.—*Electrical World*.

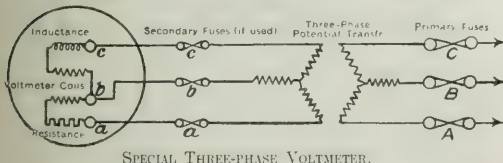
Colonial Research.—The Committee on Research in the Colonies, which was appointed by Lord Milner in November, 1920, reports that for the recruiting of scientific departments in the Colonies the Universities and allied institutions in this country can most usefully assist by encouraging post-graduate study and by providing facilities in their laboratories for the training of students in the principles and methods of independent research. For the adequate development of this post-graduate study all witnesses were of the opinion that the increase of research fellowships or studentships would be of prime importance.

Dransfield's Special Voltmeter.—With reference to the note in our August 19th issue on the subject of "Testing for Phase Sequence," the following brief description of a device (Patent No. 5,376/15), which was patented by Mr. H. S. Dransfield some years ago, might be of interest.

This instrument is designed for use on three-phase circuits, more particularly where potential transformers are used for the purpose of energising meters, instruments, relays, &c. In appearance it is exactly similar to an ordinary voltmeter, has the usual type of scale, and has three terminals marked A, B, C. It may be either of the moving-iron, induction or dynamometer pattern. It is provided internally with two magnetising coils, which act on the moving element, one coil being in series with an inductive resistance and the other with a non-inductive resistance. It is of simple construction and of the same reliability as an ordinary voltmeter, and only requires the same amount of current for its working. The accompanying diagram shows the connections as viewed from the front. In practice it is connected across the three secondary phases of the potential transformer, and it then performs the following functions:—

1. It indicates the voltage of the three phase circuits. 2. It indicates when a break occurs in the potential transformer, or its connections, and/or the failing of any of the fuses, whether it be a high or low pressure one. 3. It indicates which fuse has blown, or the particular phase in which the break may have occurred. 4. It indicates the direction of phase-rotation in the potential transformer secondary.

The indications are observed by means of special points marked (in colour) on the scale A, B, C and a, b, c. For example, in the event of a fuse failing on the high-pressure primary limb A of the potential transformer, the pointer of the instrument immediately falls from its normal reading to point A on the scale, i.e., approximately 70 per cent. of the normal reading. Similarly, in the case of a fuse a on the secondary side of the potential transformer, the pointer would fall to point a on the scale, i.e., approximately 50 per cent. of the normal reading; similarly, for faults on other phases the pointer will fall to other points, of great diversity, on the scale. In the event of the phases being in incorrect order, the instru-



ment will only read approximately 57 per cent. of the normal; this enables one to see at a glance if, for instance, in the case where two single-phase transformers are used in "open delta," they are incorrectly "paired," or if there should happen to be any cross connections in a three-phase potential transformer, or even if the high-pressure mains themselves have been incorrectly "phased out."

Undoubtedly these indications are most important where integrating watt-hour meters are used, as in the event of any of the above mentioned faults developing, the said meters would immediately become inaccurate, to a degree depending on so many factors (such as conditions of load, power-factor, &c.) that approximation and adjustment are difficult. This instrument in such a case gives a clear signal to an observer immediately on the fault taking place, thus enabling it to be rectified with the minimum of delay. It has also been found on several occasions that a prompt discovery of a faulty potential transformer winding has saved a complete "burn-out," and eventual "short."

It is, therefore, claimed that at a very slight extra cost, the instrument acts as a constant detector of faults that sooner or later are bound to occur, in addition to its duties as an ordinary voltmeter, which is an indispensable part of the equipment of switchboards and control gear of all descriptions; this has been fully borne out in practice, many of the instruments having given satisfactory service during the last six years.

Shop Photo-prints.—Why use the blueprint? Perhaps the experience of the writer, not on a large scale but on a scale big enough to give an idea of possibilities, would interest. The outfit includes a 4-plate camera and a simple enlarging apparatus adapted to use the camera as a projector. The plates cost a few pence a time; cheap bromide papers 12 in. by 8 in.—4d. or so. Adding cost of chemicals, each 12 in. by 8 in. print will be worth when finished about 6d. You cannot reckon the plate, for that will last till the job expires, maybe years hence, and dozens of prints have been made therefrom. With accurate focusing the 4-plate will enlarge to more than 12 in. by 8 in. if bigger prints are needed and give good enough results.

What do you save? Tracing, for the drawing need only be well pencilled in. Re-tracing, for the drawing need not be disturbed till you break the plate, provided you do not get a careless boy on the job; that is a matter of organisation only.

What do you get? Clear prints free from spatters' were hiding important figures perhaps, or making 3s into 5s and scripping work. Black lines on white, easier to read and less trying to the vision than white on a dirty brown or blue.

Consistent results can be obtained after a little experimentation, for all processes can be regulated by time and temperature methods. The aim should be to get the biggest possible contrast at all steps.—F. W. SHAW, in the *American Machinist*.

An Electric Vitreous Enamel Furnace.—A two-compartment electric furnace for baking vitreous enamel on resistance tubes has recently been installed at the Schenectady works of the General Electric Co.

The furnace is divided by a door which can be raised or lowered when a batch of tubes is to be transferred from one compartment to the other. These tubes consist of a grooved porcelain body, wound with resistance wire; the enamel is placed over this winding. The front compartment of the furnace is used as a pre-heater, where the tubes are held at a temperature of 570 deg. F. for six minutes. This is necessary, because if the body of the tube is subjected to too high an initial temperature, it will crack. The connected load on this compartment is 9 kW and the temperature is automatically controlled by means of a thermostat. When preheating is accomplished, the work is moved into the second or baking compartment by raising the door between the two compartments. In this compartment it is subjected to a temperature of 1,650 deg. F. for six minutes, emerging from it in a finished state. The connected load in the compartment is 24 kW, and the temperature is also automatically controlled by means of a thermostat.

This furnace has not only saved time and floor space, but has improved the quality of the finished product and has reduced the percentage of defective tubes from 20 per cent. to less than 1 per cent.

Some interesting comparisons have been obtained with this furnace and an oil-fired furnace which it replaced. Working on two different classes of material—viz., push buttons and resistance tubes—it was found that the kWh per lb. of push buttons was 1.87, and the cost per lb was \$0.023. For resistance tubes, the kWh per lb. was 0.541, and the cost per lb \$0.006. The cost per hour of operating the oil furnace was 72 cents, since it consumed 6 gallons of oil costing 12 cents per gallon. The cost over the same period with electric heat was 41 cents, or a saving of 31 cents per hour in favour of the electric. It is estimated that production has also been increased approximately 50 per cent.—*Chem. and Met. Engineering*.

Service Notes.—Commander H. E. H. Spencer-Cooper, M.V.O., has been appointed to the light cruiser *Raleigh*, flagship of the North America and West Indies Station, for wireless duties, on the Commander-in-Chief (Vice-Admiral Sir William Pagenham, K.C.B.) hoisting his flag. A commissioned or warrant electrician for service with the Australian Navy is required for a period of two years. The electrician so chosen will be in all respects in the same position as if serving in the Royal Navy, in which he will take his turn of promotion. Lieut. J. E. Parnall, from the Tyne Electrical Engineers, has been posted in the same rank to the Regimental list of the Territorial Reserve.

The Minister of Transport.—Sir Eric Geddis has left London for Scotland, and the consequent rearrangement of duties will, it is expected, lead soon to the appointment of Mr. Arthur Neal as Minister of Transport in succession to Sir Eric. Mr. Neal, who is nominally Parliamentary Secretary to the Ministry, is already virtually the Minister in charge. In time the Ministry is destined by the Government to become a department of the Board of Trade, but for the present its status as a Ministry is determined by Act of Parliament.

Radium in Czecho-Slovakia. In order to increase the annual output of radium in the country, which at present is only one gramme, the Czecho-Slovak Government has granted twelve million crowns for the technical improvement and enlargement of the mines. The annual output is expected as a result of these developments to reach four grammes, of which 1.3 grammes will be used for educational purposes and 0.8 gramme for medicinal purposes in Czecho-Slovakia itself. The remainder will be lent to foreign countries.—*Reuter's Trade Service* (Prague).

Defence of "Straphanging."—It is considered, states the *Morning Post*, that straphanging is a necessary evil in the present conditions of London traffic. It had been imagined that the time was approaching when there would be sufficient rolling stock to carry all passengers with comfort, but the authorities catering for this public need cannot fulfil this expectation, and are urging the necessity for permitting "straphanging" as a permanent feature of travel in London. The views of the traffic authorities were voiced by Messrs. H. E. Blain, A. L. C. Fell, and A. V. Mason on August 31st, when the Assistant Commissioner of Police received them at Scotland Yard. It was pointed out that congestion in some of the principal City streets would be still further increased by the abolition of "straphanging," and the public seriously inconvenienced. The Assistant Commissioner of Police promised that careful consideration would be given their representations.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

The marriage took place at Chapel Street Wesleyan Church, Luton, on August 22nd, of Mr. J. E. Burrows, technical representative of Gent & Co., Ltd., electrical engineers, of Leicester and London, and Miss Ida Maud Bennett, only daughter of Mrs. Bennett, of Napier Road, Luton.

Messrs. John Sterling & Co., of 66, Victoria Street, state that they are no longer acting as consulting engineers for the Bourne End & District Electricity Corporation.

Obituary.—We regret to learn of the death of Mr. Peter Cooper Hewitt, which occurred at Neuilly on August 25th. Mr. Hewitt was the son of A. S. Hewitt, a former mayor of New York, and a member of Congress; his mother was the daughter of Peter Cooper, a well-known American philanthropist. Peter Cooper Hewitt was educated at the Stevens Institute of Technology, Hoboken, and at Columbia University, and having inherited a large fortune from his parents, he devoted his life to scientific research in several directions, achieving an international reputation.

Although he was perhaps best known in Europe in connection with the development and application of mercury vapour apparatus—the Cooper Hewitt lamp and the arc rectifier for the conversion of alternating to direct current—for the manufacture and sale of which he founded, in collaboration with Mr. George Westinghouse, the Cooper Hewitt Electric Company of New York and the Hewitt Electric Company of London, yet he was a contributor to scientific discovery in a diversity of fields from wireless telegraphy and telephony, to a special process for the electrical welding of steel. In 1903 the degree of Honorary Doctor of Science was conferred on him by Columbia University. He was at the head of mining, railway, and philanthropic societies, and associated with many organisations for the encouragement of Art. He was only 60 years of age at the time of his death.

Mr. J. SWIFT.—The death has occurred at Helsby of Mr. Joseph Swift, one of the oldest employes of the British Insulated & Helsby Cables, Ltd., by whom he had been employed for 33 years, occupying the position of chief of the stores department.

Will.—The late Sir JAMES PENDER, chairman of the Aron Electricity Meter Co., Ltd., and of the Direct United States Cable Co., Ltd., and a director of the Electric Construction Co., the Globe Telegraph & Trust Co., and the Telegraph Construction & Maintenance Co., left £44,555.

NEW COMPANY REGISTERED.

Jones & Pordes, Ltd. (176,414).—Private company. Registered August 22nd, 1921. Capital, £1,000 in 41 shares. To adopt an agreement with A. E. Jones and M. Pordes, and to carry on the business of manufacturers of electrical batteries, accumulators, dry cells for bells and batteries, electric pocket lamp cases, lighters, and electric novelties of all kinds, motor and cycle accessories, metal press work, nickel platers and gliders, &c. The permanent directors are: A. E. Jones, Tavistock Residential Club, 38, Tavistock Square, W.C.; M. Pordes, 6, Stanley Road, Broadstairs. Qualification: £5. Secretary: M. Pordes. Registered office: 8, Crawford Passage, Farringdon Road, E.C.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Johnson & Phillips, Ltd.—Land registry charge on certain bonds and premises in Charlton, dated July 29th (supplemental) to trust deed dated July 1st, 1921, securing £350,000 first mortgage debenture stock). Trustees: Land Debenture Corporation, Ltd., and London General Investment Trust, Ltd.

McWhittaker, Ltd.—Debentures dated August 5th, 1921, to secure £400 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. McWhittaker, 48, Queensborough Terrace, Bayswater, W.

Morrell Export Co., Ltd.—Debenture dated August 17th, 1921, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. Green, M.P., The Knoll, Old Normanston, Derby.

Ely Gas & Electricity Co., Ltd.—Satisfaction to the extent of £500 on June 18th, 1921, of debentures dated October 1st, 1908, securing £1,000.

Malleable Fittings, Ltd.—Debenture dated July 28th, 1921, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. T. Forrester, 65, Stanley Road, Hammersmith.

British Illuminated Sign Co., Ltd.—Issue on August 17th, 1921, of £1,000 debentures, part of a series already registered.

Sloan Electrical Co., Ltd. (61,528).—Return dated August 17th, 1921. Capital, £60,000 in 41 shares (10,000 preference and 30,000 ordinary); 30,000 ordinary and 10,000 preference shares taken up; £28,500 paid; £31,500 considered as paid. Mortgages and charges: Nil.

South American Light & Power Co., Ltd. (74,446).—Return dated August 18th, 1921. Capital, £200,000 in 41 shares; 180,000 shares taken up; £130,097 paid; £49,903 considered as paid. Mortgages and charges: £196,460.

United Electric Tramways of Montevideo, Ltd. (80,456).—Return dated June 30th, 1921. Capital, £1,000,000 in 45 shares (100,000 preference and 100,000 ordinary); 100,000 preference shares taken up; £295,105 paid; £704,895 considered as paid. Mortgages and charges: £930,275.

Brush Electrical Engineering Co., Ltd. (29,533).—Return dated May 23rd, 1921. Capital, £600,000 in 41 shares; 458,000 shares taken up; £296,841 15s. paid; £161,175 considered as paid; £546 5s. remains in arrears. Mortgages and charges: £425,881 18s.

W. H. A. Robertson & Co., Ltd. (95,906).—Return dated June 6th, 1921. Capital, £36,000 in 41 shares (600 ordinary and 3,600 preference); 600 ordinary and 2,177 preference shares taken up; £25,626 paid; £10,374 considered as paid. Mortgages and charges: Nil.

British Electric Transformer Co., Ltd. (76,351c).—Return dated May 14th, 1921. Capital, £1,000,000 in 41 shares (300,000 preference and 700,000 ordinary); 300,000 preference and 325,000 ordinary shares taken up; £389,821 paid; £15,179 considered as paid. Mortgages and charges: Nil.

Ilfracombe Electric Light & Power Co., Ltd. (71,378).—Return dated June 27th, 1921. Capital, £15,000 in 45 shares; 77 shares taken up; £385 paid. Mortgages and charges: Nil.

United River Plate Telephone Co., Ltd. (23,654).—Return dated June 28th, 1921. Capital, £25,000,000 in 45 shares (324,000 ordinary, 40,000 preference, and 136,000 unissued); 324,000 ordinary and 40,000 preference shares taken up; £1,740,000 paid; £90,000 considered as paid. Mortgages and charges: £300,000.

British Mica Co., Ltd.—Mortgage dated July 30th, 1921, to secure £650, charged on 15, Cardington Road, Bedford. Holder: J. H. Howard, Clapham Park, Beds.

S. Gillatt & Co., Ltd.—Debenture dated July 17th, 1921, to secure £4,000, charged on company's undertaking and property, including uncalled capital. Holders: Albert Lee & Co., Ltd., 8 and 9, New Zealand Avenue, E.C.

Edison Swan Electric Co., Ltd.—Mortgage on certain lands and buildings in Windsor End and Winchmore Hill, dated August 24th, 1921, to secure all moneys due or to become due to company to Coutts & Co.

D. and J. Hill, Ltd.—Debenture dated July 25th, 1921, to secure £1,000, charged on the company's property, present and future, including uncalled capital. Holders: Smart Ad. Service Agency, Ltd., 3, Ave Maria Lane, E.C.

Rose Bros. Electrical Co., Ltd.—Particulars of £3,000 debentures authorised August 5th, 1921, whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

CITY NOTES.

Marconi's Wireless Telegraph Co., Ltd.

Senator G. Marconi presided at the annual general meeting at the Connaught Rooms, London, on August 24th. In dealing with the balance sheet, he said that the general reserve account figured at £4,001,368, which represented a very considerable increase in consequence of the premiums from shares having been transferred to that account. Having regard to the very large amount which now stood to the credit of this reserve account, they had not thought it necessary to make any provision for the big sum which they had invested in Russia, amounting to £375,000, but which they hoped they would not lose, nor in respect of the considerable advances which they had made to several of their associated companies during a time of great stress. They had every reason to hope that all these moneys would be not only recovered but productive of profitable results so soon as they might see the much hoped-for improvement in the trade of the world. Sundry debtors, debit balances and expenditure on foreign developments was some £564,250 more than it was in the preceding year, due to a number of matters which were under way, and from which results should be obtained in the future. Stock also showed an increase, amounting to some £165,000 in round figures, representing largely material which had not been invoiced at the end of the year. Approximately £51,000 had been added to freehold and leasehold property at home and abroad, and about £94,000 was expended during the year on long-distance stations and plant. Shares in associated companies and patents stood in the accounts as shown at their cost price. They were represented by £2,941,517, an increase of approximately £1,018,000 during the year. The shares were of a par value of £3,488,847, from which they hoped to see a steadily increasing revenue. Turning to the profit and loss account (which showed an actual balance for the year of £297,682), he said the balance of contracts and sales, traffic and trading accounts which represented the gross profit, was only £563,314, as compared with £946,997 in the preceding year, which in part accounted for the reduced profit, which was due to many circumstances. During 1920 they experienced a very serious depreciation in most foreign currencies, which had the effect very naturally of impeding the commerce of the world. The buying power of all Governments was greatly reduced, and nothing but what was immediately essential was contracted for. In the second place, the business which they did carry through in many countries showed substantially reduced profits in consequence of the fall in value of currencies, which were practically at their worst on December 31st last, when they closed their accounts for the year, but a substantial improvement had now taken place, and in the course of time they looked forward to further appreciation. There were also other disadvantages which their business had been under as a direct consequence of the war. It was for these reasons and others that the directors had resolved that it was best in the interests of the shareholders only to recommend a final dividend of 10 per cent. on the ordinary shares and 5 per cent. on the preference shares, carrying forward to the next account £820,567, and so preserve the cash resources of the company, which would enable them to take advantage of opportunities which might not recur. During the past twelve

months research, experimental work, and technical demonstrations represented an expenditure of approximately £84,000, plus a very substantial sum for patent fees. The nation had enjoyed the benefit of all this work and outlay year after year, but nothing yet had been received from the Government on the credit side of the account. All this was yet to come. They were doing their utmost to obtain settlements in respect of these matters, but they had to go by stages, and progress was extremely slow. Subject to satisfactory arrangements with the Post Office, they hoped, in the near future, to create telephonic services with several foreign countries, and provided they had the opportunity, as they hoped to have, of creating a wireless telegraphic service between here and Australia, it was quite within the realms of possibility that having the means of experimenting with their telegraphic stations they might thereafter supply Mr. Hughes with a telephonic means of communication with this country besides the direct wireless telegraphic service; but the one must exist before there was a possibility of the other. Considerable progress had been made in the perfecting of wireless telephones and the employment of them in aeroplanes plying between this country and the Continent. The whole of the British aeroplanes flying on the London-Paris route had been equipped with their system, and were giving most excellent service. There had been a certain amount of infringement of their patents in recent times which they had stopped in part and were taking steps to arrest entirely. They could not afford either the expenditure in research or patent fees and allow others to reap the benefits therefrom. Towards the end of last year they erected a temporary station in record time in Switzerland at Geneva for the purpose of conducting the Press service for the first Conference of the League of Nations. So satisfactory were the results of this demonstration that the Swiss Federal Government had granted to the company a concession for 25 years for the erection and maintenance of a wireless station in Switzerland to conduct international telegraph services. As that station could not be completed in time for the second meeting of the League of Nations to be held shortly the temporary station was being re-erected to conduct the Press service. The reasons advanced by the Swiss Government for granting that concession were that they had neither the knowledge nor the experience necessary to enable them to embark upon such an enterprise. They considered that by entrusting the work to a private organisation with full experience they would best serve the interests of their country. The company had taken over the administration of the postal and telegraph services, both wired and wireless, of the Republic of Peru; and in other countries in Europe and elsewhere they had a number of negotiations pending, and in some cases on the point of completion. In Canada they were looking forward to developments of an important nature.

Mr. Godfrey C. Isaacs seconded, and the resolution was carried unanimously.

A shareholder said that a few years ago they heard something of the Chinese business, but they had heard nothing of it that day. As he understood the matter, they were to have a monopoly of wireless telegraphy in China. The American Government stepped in and raised some objection to a monopoly to any other company. He would like to know what the position of this company was in China.

Mr. Godfrey C. Isaacs said they did enter into an agreement with the Chinese Government under which they agreed to join with them in the formation of a Charter in China for the conduct of wireless telegraphy work throughout China. The Chinese Government were to have half the interest in the company, and the company was to be given the other half for the benefit of its patents and its guidance and assistance in the work which was to be done. An American company subsequently obtained the right to construct a station in China. The company had protested, and the British Government had given it all the support possible. The matter had not been finally disposed of. But independently of that, the company was building three stations in China, the contract for which was entered into prior to the creation of the Chinese National Company.

Tyneside Tramways and Tramroads Co. The half-yearly meeting of the Tyneside Tramways and Tramroads Co. was held on August 30th at Newcastle-on-Tyne. Dr. J. T. Merz, who presided, said it was rather remarkable that they were able to pay a dividend at all. It was the smallest paid for some time, but considering the difficult times the company had gone through, the position was satisfactory. The reserve fund now stood at £38,898, which was less than the figure of 12 months ago. That was due to taking out of reserve some £2,000 for the improvement of the permanent way. This improvement was a special welding process which they were now carrying out. The decrease in the amount available for dividend was £3,209, which would be met by carrying to reserve £1,000 less, carrying forward £870 less, and paying £1,339 less in dividends. The report was adopted.

French Companies. *The Triphasé (Nord Lumière).*—The report stated that the rise in coal prices, raw materials, and wages which marked the year 1920 had weighed heavily on the task of balancing cost of working, maintenance and first establishment. In the department of the Seine negotiations with the communes were being continued, without, however, leading to satisfactory results. In Seine-et-Oise more had been achieved,

and the sanction of the Administration only was awaited. Various legal steps had, however, to be resorted to. After deductions for depreciation, the accounts for 1920 showed a profit of 2,091,708 fr., which, with the carry over of 1919, made a total of 2,844,926 fr., from which a dividend of 30 fr. per share was declared, payable from June 30th, less taxes.

Under the style of *Groupeement des Compagnies d'Energie Electrique et d'Eclairage du Nord et de l'Est* has been formed a combination with a capital of 1,000,000 fr. to issue bonds guaranteed by the annuities owed by the State for war damages. The offices are at 94, Rue St. Lazare, Paris, and the combination comprises some twenty companies spread over the districts which suffered most severely from the ravages of the war.

Compagnie Parisienne de Distribution d'Electricité.—At the last general meeting of the company it was stated that the number of subscribers had risen from 132,600 in January, 1914, to 240,720 in December, 1920; the kWh consumption from 76,000,000 to 191,000,000; the new connections from 1,143 km. at the end of 1913 to 1,285 km. at the end of 1920. The rise was still in progress in 1921. A programme of new works to a value of 300,000,000 fr. was under way, comprising enlargement of stations, increases in their power, and construction of a new sub-station on the left bank of the Seine. The profit and loss account showed a deficit on working of 12,903,510 fr., increased by financial charges to 22,279,128 fr. This had been covered by drafts from the special account and the interest account, so that the creditor balance, with the addition of the profits carried over from former years, amounted to 6,818,771 fr. The agreement with the City of Paris allowed of the distribution of the greater part of this among the shareholders, and a dividend of 6 per cent. was proposed, payable from July 1st at the rate of 13.50 fr. per nominative share and 11.75 fr. per share to bearer.

Spanish Company.

La Electrica Popular de Vigo y Redondela.—The report for the year 1920, presented at the meeting in March, referred to the increase of capital, sanctioned in the foregoing December, namely, 2,000,000 pesetas, in 1,000 shares of 500 pesetas each, of which 1,500 had been taken up at par. The issue was intended to defray the cost of enlarging the steam reserve stations. The acquisition of machinery for the service of the tramways, the carrying out of works at the Lerez Waterfall, and the unification of the voltages on the lines of transport and distribution networks. Of the works mentioned in the report for the foregoing year, the enlargement of the Central del Oeste had been completed, and the new 700-h.p. Diesel motor group had been installed. The cost of the latter, with accessories, &c., totalled 351,048.12 pesetas. The 625-kVA alternator for this group, up to the date of the report, had not, however, been delivered by the Swiss makers, the Maschinenfabrik Oerlikon. The debt of the municipality of Vigo at the end of 1920 totalled 454,111.92 pesetas, after payment during the year of 203,624.66 pesetas. The profit and loss account showed an available profit of 336,661.08 pesetas, allocated as follows:—10 per cent. to reserves; 5 per cent. to management; 5 per cent. for statutory services; 204,328.88 pesetas to sinking fund; and 65,000 pesetas for a dividend of 6.50 per cent on 1,000,000 pesetas of ordinary shares. Compared with the foregoing year, the gross profits had increased by 116,480.21 pesetas, the receipts by 151,176.45 pesetas, and the expenses by 965,806.87 pesetas.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148a:—

Canadian General Electric Company.—\$1,750,880 Common stock (and fractional certificates).

County of Southland Electric Power Board.—£750,000 Guaranteed Six per cent. Debentures (guaranteed by New Zealand Government), issued at 96 per cent., 16 per cent. paid, and fully paid after issue of allotment letters.

New Issues.—County of Southland Electric Power Board.—Letters of allotment in connection with the issue of £750,000 6 per cent. debentures were posted on August 26th. It was over-subscribed nearly five times. The scrip went to a premium of 1 on the issue price of 96. The loan is to provide funds for the erection and equipment of the electric power station, most of the plant for which has been or will be purchased in this country.

Debentures in respect of the City of Auckland 6½ per cent. electrical undertaking extensions loan will be ready for delivery in exchange for scrip or allotment letters on September 5th.

The Bank of New Zealand is authorised by the *Thames Valley Electric Power Board* to receive subscriptions for £360,000 6 per cent. loan in debentures to bearer of £100 each, at £96 per £100 debenture. The principal and interest are unconditionally guaranteed by the Government of New Zealand, and are free from all New Zealand taxes, present and future, unless held by persons domiciled in the Dominion of New Zealand. The loan is issued to provide further funds for the purchase and construction of electric works throughout the Board's area in the North Island. The list will close on or before September 5th.

Victoria Falls & Transvaal Power Co., Ltd.—Net earnings (including those of the Rand Mines Power Supply Co.) for the quarter ended June 30th amounted to £203,041, before providing for taxation.

STOCKS AND SHARES.

TUESDAY EVENING.

The state of Stock Exchange interest is shifting from the pivot of investment on to the more or less unsteady ground of speculation. For some reason difficult to define the attractions of speculation are making something of an appeal to those people who hitherto have been content to put money into purely gilt-edged stocks. Stock Exchange business has started, very faintly, to revive. Some people ironically attribute this to the fact of the holidays drawing to an end, involving the annual necessity for attempts to be made to replenish bank-balances depleted by hotel bills, &c. About the greater willingness on the part of the public to venture into speculative fields, there is no doubt. It remains to be seen whether the buying which is taking place in the speculative markets will be of much practical benefit to those who take an optimistic view in regard to the general settlement of world conditions and increase of trade. The austere will doubtless point to the fact that business is reviving but slowly, and that the United States, where activity is likely to make appearance first, does not report anything startling in the way of improved conditions.

The war is now over, officially speaking, and those who have pre-war obligations which are still open under the various measures of protection that came into force in August, 1914, are faced with the knowledge that they must liquidate, or shoulder, their responsibilities within the next twelve months. What effect this is likely to have upon markets in the Stock Exchange it is difficult to estimate. The pre-war account in stocks and shares has been closed down to the extent, probably, of 90 per cent., but the other 10 per cent. is a troublesome legacy, and its completion may give a certain amount of trouble that will find reflection in realisations of existing stocks and shares in order to wipe out the pre-war liabilities. So far as can be seen, the fact of a whole year being available for paying-off these old scores will enable operators, and other debtors, to make their arrangements without any unfavourable effect being exercised over Stock Exchange markets. We must expect to be told, a good many times within the next twelve months, that liquidation is the cause of what there may be of dulness and depression in markets, when no other reason is assignable for the heaviness.

The market in new issues is little affected by the prospect of further newcomers in the near future. The Southland (N.Z.) Electric Power 6 per cent. debenture stock, issued at 96 with the guarantee of the New Zealand Government, was promptly over-subscribed, and a premium of about a point became established at once. This is followed by the offer of £275,000 similar stock, also with the New Zealand guarantee, by the Thames Valley Electric Power Board. There was brisk demand for underwriting. The credit of New Zealand stands particularly high, so that any industrial company which is successful in obtaining the guarantee of the colony can be assured of a welcome in the money market. Indian industrials are a shade easier by reason of the riots that have broken out.

Metropolitan Electric 7½ per cent. debenture stock and North Metropolitan 7½ per cent. debentures are both 7½ premium. The Shropshire debenture, after being down to a small discount, is now 2 premium. General Electric 7 per cent. debenture stock is a good market at 95 buyers. There is on offer at the present time a small amount of Bournemouth & Poole Electricity 7½ per cent. seven-year notes at 101, free of stamp duty. Interest is payable on January 1st and July 1st, and the notes are redeemable in July, 1927, at par, or at any time after July next year by drawings at 102. The company's financial record for the past 10 years, and the fact that last year's profits would approximately cover the interest on the seven-year notes four times over, make these worth noticing by investors on a look-out for a security of this class.

Yorkshire Electric Power 5½ per cent. redeemable debenture stock is on offer at 85½, free of stamp, with interest payable April 1st and October 1st, the present price carrying half a year's dividend. The security, in this case also, is well covered.

The market for Home Railway stocks is generally better, but Undergrounds are hanging back in the improvement that has carried up prices of the steam issues. Central London Assented ordinary has fallen a couple of points. Metropolitan at 26 is 1 higher, and Underground Electric ordinary gained 1 at 24. City and South London Senior preferences at 57½ are up 2, the 1901 stock strengthened to 56 and the 1903 to 55. There has been a small inquiry for East London Prior Charge stocks without, however, having any quotable effect upon prices.

Foreign railway and tramway descriptions show comparatively little change. British Columbia Electric deferred is a point down, but the preference hardened to 60. In the Mexican group, Mexico Tramways 5 per cent. bonds at 58 are 3½ higher, in consequence of the payment of the March 1915 coupon, which, as already pointed out here, can be sold at a

substantially better price in the Stock Exchange than is paid by the bank over the counter. Mexican Light & Power bonds have gone back to 51½, interest in them having subsided now that the string of eleven coupons has been duly met. There has been some exchanging of these bonds by holders who have put the money into Mexico Tramway bonds, the latter having of course, some 6½ years' coupons still overdue.

Electricity Supply shares are firm, with a rise of 5s. to 6½ in St. James' and Pall Mall ordinary. The manufacturing group, however, continues dull. English Electric preference at 14s. shows a small fall, compensated by a recovery to 11s. in the company's ordinary shares. Metropolitan-Vickers fell 2s. 6d. to 1 11/16. Edisons are nominally 8s. 3d., though actually the price is not so good as this. It may be that the talk of apprehended German competition in this trade is being rather overdone. Cable manufacturing shares are inclined to be better, with Siemens 1/32 up at 23s. 13d. Cable stocks and shares are quietly good. Great Northerns at 24½ are 5s. higher. Globe preference rose to 9½, though the ordinary at 16½ are easier. Marconis at 1½ are better; the price is ex 2s. dividend deducted last week. Other shares in the Marconi group are holding their prices.

Armament and engineering varieties are generally steady. Vickers ordinary, and the company's tax-free preference, both spurred on a rumour to the effect that the company is on the point of concluding a satisfactory termination to its claim against the Government. Armstrongs have advanced upon reports that the prospect for work ahead of the company is decidedly good. Iron and steel shares are better. The rubber market continues heavy. Next week there will probably be published the official details respecting the Rubber Shareholders' Association, to which the support of proprietors in rubber-producing companies is being invited. But so far the negotiations have had no influence in helping the prices of rubber shares.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend		Price	Yield.	
	1919.	1920.	August 30.		
Brompton Ordinary ..	12	12	6	—	410 0 2
Charing Cross Ordinary ..	7	7	8	—	9 8 4
do. do. 4½ Pref. ..	44	44	8	—	7 4 4
Chelsea ..	4	4	82	—	9 4 8
City of London ..	18	14	17	—	10 3 0
do. do. 6 per cent. Pref. ..	8	6	68	—	9 5 6
County of London ..	8	8	68	—	7 7 4
do. do. 6 per cent. Pref. ..	6	6	66	—	10 12 0
Kensington Ordinary ..	7	9	44	—	7 10 0
London Electric ..	23	24	24	—	10 3 0
do. do. 6 per cent. Pref. ..	6	6	66	—	9 6 8
Metropolitan ..	6	7	83	—	7 16 0
do. 4½ per cent. Pref. ..	44	44	84	—	9 12 0
St. James' and Pall Mall ..	12	13	92	+ 2	10 13 2
South London ..	6	7	98	—	8 17 10
South Metropolitan Pref. ..	7	7	15/9	—	8 13 10
Westminster Ordinary ..	10	10	62	—	8 13 10
TELEGRAPHS AND TELEPHONS.					
Anglo-Am. Tel. Pref. ..	8	6	254	—	7 0 4
do. Def. ..	13	14	173	—	8 14 2
Chile Telephone ..	6	6	24	—	6 14 3
Cuba Sub. Ord. ..	7	7	74	—	9 6 8
Eastern Extension ..	10	10	163	—	8 2 0
Eastern Tel. Ord. ..	10	10	163	—	6 2 0
Globe Tel. and T. Ord. ..	10	10	163	—	6 0 4
do. do. Pref. ..	8	6	94	—	6 6 4
Great Northern Tel. ..	22	24	248	+ 2	9 16 8
Indo-European ..	10	10	80	—	8 6 8
Marconi ..	26	15	14	+ 16	8 0 0
Oriental Telephone Ord. ..	12	12	24	—	* 16 4
United R. Plate Tel. ..	8	8	60	—	* 10 4
West India and Panama ..	NH	NH	60	—	* 11 2
Western Telegraph ..	10	10	164	—	* 11 2
HOME RAILS.					
Central London Ord. Assented ..	4	4	174	+ 2	8 8 6
Metropolitan ..	13	14	26	+ 1	6 0 0
do. District ..	NH	NH	174	—	NH
Underground Electric Ordinary ..	NH	NH	24	—	NH
do. do. "A" ..	NH	NH	66	—	NH
do. do. Income ..	4	2	794	—	* 15 8
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams, First Pref. ..	64	124	92	—	10 0 0
do. do. 2nd Pref. ..	NH	54	24	—	10 0 0
do. do. 8½ Deb. ..	6	6	64	—	7 16 0
Brazil Tractions ..	NH	NH	28	—	NH
British Columbia Elec. Rly. Pfc. ..	5	5	60	+ 1	8 6 8
do. do. Preferred ..	5	5	50	—	* 11 2
do. do. Deferred ..	9	12 1/2	68	—	* 10 15 6
do. do. Deb. ..	42	42	604	—	7 2 10
Mexico Trams 5 per cent. Bonds ..	NH	NH	68	+ 34	NH
do. do. 6 per cent. Bonds ..	NH	NH	24	—	NH
Mexican Light Common ..	NH	NH	58	—	NH
do. Pref. ..	NH	NH	174	—	NH
do. 1st Bonds ..	NH	5	54	—	9 11 2
MANUFACTURING COMPANIES.					
Babcock & Wilcox ..	15	16	2	—	6 3 0
British Aluminium Ord. ..	10	10	176	—	11 8 6
British Insulated Ord. ..	15	15	1	—	9 12 0
Callenders ..	15	15	174	—	10 8 8
do. 6½ Pref. ..	64	64	176	—	7 8 7
Crompton Ord. ..	10	10	146	—	13 15 10
Edison-Swan ..	10	10	24	—	7 1 0
do. do. 5 per cent. Deb. ..	5	5	68	—	7 7 1
Electric Construction ..	10	10	169	—	11 18 10
English Electric ..	8	8	147	+ 64	14 13 2
do. Pref. ..	6	6	147	—	8 11 6
Gen. Elec. Pref. ..	64	64	176	—	7 13 0
do. Ord. ..	10	10	207	—	10 0 0
Hawley ..	15	15	1	—	15 0 0
do. 4½ Pref. ..	42	42	62	—	6 12 6
India-Rubber ..	10	8	174	—	—
Met. Vickers Pref. ..	8	8	14	—	9 9 4
Siemens Ord. ..	10	10	13	—	* 13 2
Telegraph Co. ..	20	20	24	—	* 14 1

* Dividends paid free of Income Tax.

A NOTE ON THE INTERCONNECTED-STAR METHOD OF CONNECTING THREE-PHASE TRANSFORMER WINDINGS.

By S. AUSTEN STIGANT, A.M.I.E.E., M.Am.I.E.E.

(Concluded from page 269.)

With the three-wire primary and four-wire secondary star/star connection the primary current corresponding to the secondary out-of-balance current flowing through any one phase of a four-wire system must flow through the primary windings of the remaining two phases, and as there are no balancing load ampere-turns on the secondary windings of these two phases the primary out-of-balance current acts wholly as magnetising current to such phases, with the result that the phase voltages of the two lightly loaded phases increase considerably, the phase voltage of the heavier loaded phase correspondingly drops, and the position of the neutral is considerably deflected. The angular distances between the phase voltages also become unbalanced. A delta connected secondary does not improve the conditions.

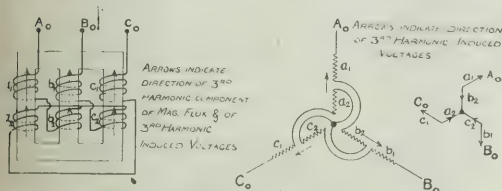


FIG. 3.—NEUTRALISING EFFECT OF THIRD HARMONIC VOLTAGES.

If, however, the secondary winding is connected up in the interconnected star manner in which the winding on each limb is split up into two halves, the half of the winding on one limb being electrically connected in series with the half of the winding on another limb, any out-of-balance current flowing through one of the interconnected secondary phases is balanced by a corresponding primary current flowing through each of the two primary phase windings, the interconnected secondaries of which carry the out-of-balance current. As a consequence, the primary out-of-balance current has a perfectly free path through the two windings affected and the two-line wires, and the neutral is only slightly disturbed on account of the voltage drop due to the out-of-balance current. As with the delta/star arrangement there is no choking effect.

These remarks apply equally well to three-phase transformers and three-phase banks of single-phase transformers.

4. *Harmonics.*—It is generally known that on account of the variations in permeability with changes in magnetic density in the transformer iron, and also on account of the shape of the hysteresis loop, the m.m.f., and consequently the magnetising current wave form required to produce a sine wave of induction in the magnetic circuit will contain a third harmonic; if the third harmonic is absent from the wave of magnetising current it will be present in the induction wave, and, therefore, in the induced voltage waves.

As with a symmetrical star connected generator the third harmonic and its multiples are eliminated from the terminal voltages, it follows that they also will not appear in the applied line (or phase) voltages of the delta connected primary of a transformer, but third harmonics will appear in the wave of the magnetising current. Such a delta winding provides a closed short circuit path for the circulation of the triple frequency component of the magnetising current, and there exists no third harmonic voltage to neutral on the secondary star connected windings. Looking at it from another point of view, the triple frequency current circulating round the primary delta, supplies the third harmonic component of the magnetising current so that the wave of induction,

and consequently the induced voltage waves are sinusoidal, and no third harmonic voltages exist.

Third harmonic voltages of any appreciable magnitude can only occur in single-phase transformers (core and shell type), and in three-phase shell-type transformers, as in each of these types the magnetic core presents a completely closed path to the third harmonic flux. They cannot be of any serious value in the usual construction of three-phase core-type transformers having three limbs, whatever the connection, as the resulting triple frequency flux instantaneously flows in the same direction in each limb, and so must take the return path through the air (or oil) and tank, this path being of very high reluctance.

When changing to a star connected primary, it is not permissible to retain the star connection on the secondary side, nor is a delta secondary desirable, as a neutral point is usually required for giving a four-wire supply or for earthing purposes. Both of these requirements, of course, can be obtained by artificial means, but it is better to incorporate them with the transformer secondary winding if possible.

By using an interconnected-star winding on the secondary side of the transformer the third harmonic voltages which are induced in the same direction in each half of the windings on each limb are eliminated from lines to neutral by opposition, as shown in fig. 3.

This, therefore, becomes an important feature *per se*, when dealing with single-phase shell and core-type transformers and three-phase shell-type transformers, but not so to any practical extent in the case of three-phase core-type transformers. It does, however, give an advantage even with the latter type, but is not a decisive factor in the selection of the interconnected star secondary.

5. *Availability of neutral point.*—As stated earlier, one of the chief features of the delta/star connection is that the neutral point on the secondary star connected side is available either for supplying a three-phase four-wire load or for earthing purposes. On the primary side, if a system requires earthing, this is usually done at the generator or by the creation of an artificial

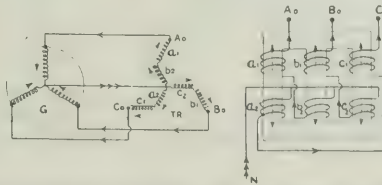


FIG. 4.—PATHS OF THIRD HARMONIC CURRENTS WITH INTERCONNECTED STAR TRANSFORMER PRIMARY WINDING AND FOURTH WIRE BETWEEN GENERATOR AND TRANSFORMER NEUTRALS.

neutral point. With the star/interconnected-star connection a neutral point is available on both primary and secondary sides of the transformer, so that one still has the same facilities on the secondary side, with additional provision on the primary side for earthing if desired. This may at times be a very useful feature.

If the primary winding is connected in the interconnected-star manner and supplied direct from the generator, the generator and primary neutral points should not be connected together, either *via* earth or direct by a fourth wire. If the neutrals are joined a third harmonic current may flow in the fourth wire resultant from third harmonic voltages in the source of supply, and due to the splitting and interconnection of the transformer primary windings, the third harmonic exciting ampere turns, and consequently the induced e.m.f. is

in the halves of the windings on each limb of the transformer neutralise each other, thereby providing a low impedance path (virtually a short circuit, so far as transformer reactance is concerned) for the flow of third harmonic currents. Such currents would only be limited in magnitude by the impedance of the generator winding and by the resistance of the connecting cables and transformer windings, and they would reach such large values in practice as seriously to overload the transformer and generator windings. Fig. 4 shows the paths of the third harmonic currents, and in both sketches the opposition of third harmonic exciting ampere turns in the halves of the windings on each limb of the transformer will be seen.

In conclusion, it may be interesting to show how the pressure distribution varies in the interconnected windings at different parts of each cycle. Fig. 5 shows this distribution during one complete cycle at intervals of

REVIEWS.

Factory Administration and Cost Accounts. By EDWARD T. EMMERT. Pages xx+311; 12 diagrams. London: Longmans, Green & Co. Price 45s. net.

The author is to be congratulated on not allowing this work to remain *in statu quo*. The book comprises seven main sections, and each section is further sub-divided; there are numerous diagrams, tables, and 166 specimen forms.

The author states in the preface that industrial conditions have permanently changed to such an extent as to induce him to start entirely afresh, on the foundation of his previous work (7th Reprint, *Factory Administration and Accounts*, first published April, 1914) to re-organise and re-write the whole book from beginning to end.

The work appropriately opens with a diagram of staff organisation and functions, and throughout the book a system of cross references is adopted, so that once the reader has found his particular subject through the index, he is automatically referred by marginal page references to other pages bearing on the same subject.

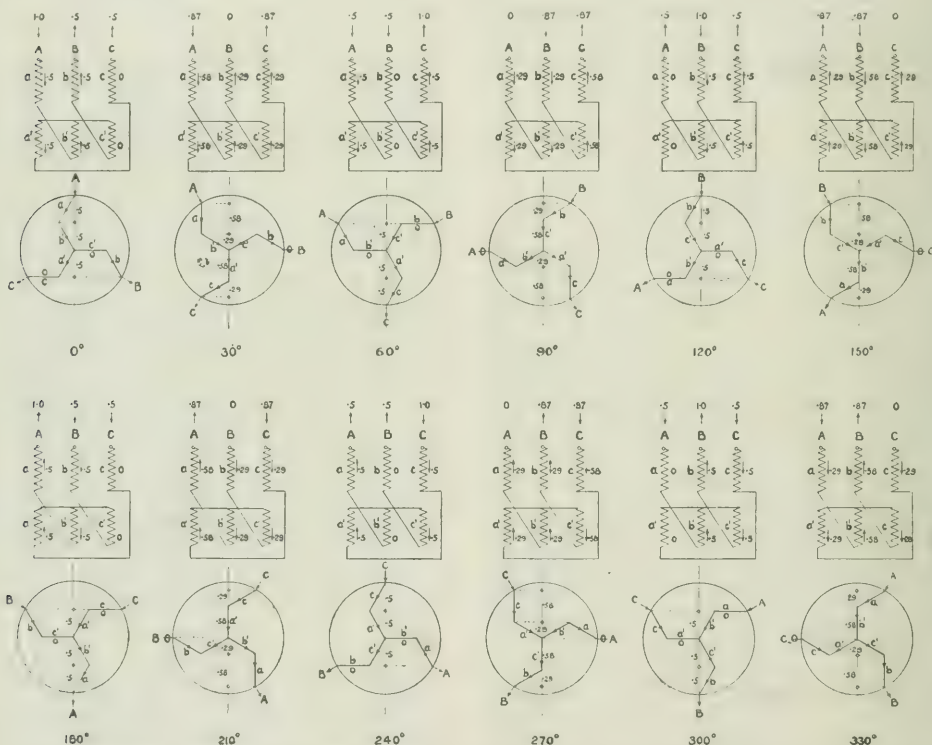


FIG. 5.—PRESSURE DISTRIBUTION IN INTERCONNECTED STAR THREE-PHASE WINDING DURING ONE COMPLETE CYCLE AT INTERVALS OF 30 ELECTRICAL DEG.

30 electrical degrees. The distribution at 360 degrees is, of course, the same as at 0 degree. The figure shows the winding diagrams with relative directions and instantaneous values of the voltages in each half-winding and in the lines, and also the corresponding positions of the vectors. The vector diagrams also show the distribution of voltage in the windings, together with their instantaneous values which are obtained by projection on to the vertical line passing through the centre of each diagram.

An American Copper Research Association.—Producers, manufacturers, and selling agents of copper and brass and their products in the United States, have recently formed a Copper and Brass Research Association. The principal object of the organisation appears to be not research, in the generally accepted meaning of the term, but to interest and educate the public in the advantages of the substitution of copper and brass for many purposes for which other materials are used at present. The head of the Association is Mr. R. L. Agassiz, of the U. S. Copper Export Association.

Section 1, "General Administration," illustrates lucidly manufacturing policy, and the conclusions arrived at, taking into consideration the altered conditions of industry since the pre-war state, form an interesting and valuable treatise on the facts. The choice of manufacturing policy, production efficiency, and programme is discussed in some detail; the author's comments upon staff-organisation and control, and the principles propounded, are both logical and a valuable commentary on modern administration methods. The sub-section on "Sales Management and Estimates" will at once appeal to the sales manager; the subject is dealt with in a general manner. No industry in particular is described, and the principles could be adopted in any industry, either large or small. "Correspondence" forms an important section, dealing with general responsibility and routine, filing systems, and internal correspondence, and the recommendations if carried out would obviate many of the slipshod methods very often employed in some otherwise highly organised works.

Under "Insurance," not only is the question of fire insurance dealt with, but also insurance against loss of profits through fire, a contingency that has probably not received the consideration it merits. Workmen's compensation, plant insurance, superannuation funds coupled with life insurance, sinking-fund policies, fidelity guarantee, and goods in transit are also dealt with. This section concludes with routine organisation, that is, duties of a regular nature that are re-

quisite for administrative and commercial purposes. Section 2, "Production Control," comments admirably on the selection of a factory site, availability of labour, power supply, transport, &c., and contains instructive diagrams of lay-out of administrative buildings; it also describes the general arrangement of a factory, factory construction, lighting, heating and ventilation, and plant lay-out. A sub-section deals with the organisation of pattern stores and records. "Production, estimating, rate-fixing," gives an interesting account of the important process of fixing job rates, suggestions re piece work and premium systems, and manufacturing operations. "Tools and Gauges," "Production Regulation," and "Foremanship and Inspection" are fully covered.

Section 3, on "Labour Administration," deals with a subject of the first importance, and the author has spared no effort to make a concise exposition of the matter. He states that of the most important official reports in this connection, two are of outstanding value, viz., the Memorandum issued by the Garton Foundation in October, 1916, and the reports of the Whitley Committee, issued in March, 1917, and copies of these reports are given, together with the functions of Works Committees, &c. A sub-section on "Government Regulations" refers to certain Acts which have an intimate relation to labour administration. "Trade Union Agreements" comments on collective bargaining, and gives specimens of various agreements between federations and unions.

"Working Conditions," "Principles of Remuneration," "Selection and Training of Workers," and "Works Regulations" form the subjects of other sub-sections.

Section 4, "Material Control," is a practical and careful analysis of the principles relating to purchasing, and contains interesting sub-sections on the principles of "Stores Organisation," "Warehouse Organisation," and "Dispatch."

Sections 5 and 6, "Administrative Records" and "Cost Accounts," cover in a most thorough manner all matters relating to works accounting, and conclude with an interesting chapter on "Cost Returns."

In Section 7, "Specimen Forms," the author deals with this subject with his usual distinctness, and makes specific recommendations for universal application under all conditions. Cross references are given to all those pages where forms have been indicated as having some interest or application.

Under "Departmental Application of Specimen Forms" the various forms are scheduled and illustrated, and are grouped under the headings of officials and departments likely to be interested.

There are one hundred and sixty-six forms illustrated, dealing thoroughly with the complete business organisation of an undertaking, and covering practically every departmental requisite. The forms are notable for their lucidity and utility, and no pains have apparently been spared in order to make them complete.

The work concludes with a comprehensive general index and a glossary appendix on the various principles dealt with; as the author states, some are admittedly old and well known, but their interpretation requires modernising, which is, in fact, the key-note of this interesting book. The work is of general excellence, dealing with the subjects in a practical manner, and it is a valuable book of reference to all interested in present-day problems of management.

Elements of Radiotelegraphy. By E. W. STONE. Pages viii+268; 153 figs. London: Crosby Lockwood & Son. Price 16s. 6d. net.

This work is essentially an elementary book for students commencing the study of wireless telegraphy. The author states that it had its origin in lectures given to radio classes for men in the American Navy, and considers that it may be found useful for instruction purposes generally. There are some 267 pages with well-prepared illustrations of which the clearness and detail leave little to be desired.

A noteworthy feature of the book is the description given of high-power Poulsen arc transmitting stations and plant used. Much of the more general information given is, however, of a disappointing character. Many of the usual fallacies which are handed on from text-book to text-book are repeated, whilst also errors, inaccuracies and unscientific explanations are much too prevalent. As examples the following may be quoted. The plain aerial transmitter is credited with being only able to give out highly damped waves, and that because the spark gap is included in the antenna circuit of the transmitter. The same reasoning should preclude the formation of prolonged oscillations in a Leyden jar discharge seeing that the spark gap is there, also, in the discharge circuit. The fact is, of course, that the damping can be made just as large or as small as we please, depending on the capacity of the aerial among other factors; the presence of the spark gap in the system being a matter of relatively small moment. In Article 105 the electrical resistance of the air or other gases is said to depend on the degree of compression, this being followed by a statement that when the molecules are not free to move about, no conduction can occur. In Articles 330 and 331, the fallacy of the high-resistance and therefore practically untunable coherer receiver is repeated. The fact is that the coherer is quite a sharply tunable receiver, and is normally an insulating device except in bad or wrongly treated specimens. The diagrams of connections given in Chapter X are nearly all incorrect and practically unworkable. The action

of the Pedersen ticker used for continuous-wave reception is not clearly or completely explained, nor is that of the rotating or slipping contact device.

Advertising the Technical Product. By CLIFFORD ALEXANDER SLOAN and JAMES DAVID MOONEY. 1 pp. x+355. New York: McGraw-Hill Book Co., Inc. 1920. Price 30s. net.

The authors of this exciting book expressly state in their preface that they do not pretend, either to write a manual upon advertising methods, or to cover the whole subject of advertising the technical product. They believe that the science and art of advertising is, generally speaking, well understood, so that a manual is hardly necessary. In spite, however, of the numerous invitations to "learn to write advertisements," and the glowing prospects held out of the wealth to be gained thereby, and notwithstanding the undeniable advances lately made in advertising practice, both from the scientific and the artistic point of view, there is still much to be done in the direction of adapting particular advertisements to particular products or markets. Dedicating their book "To the man who pays the advertising bills, the manufacturer of technical products," the authors, whose experience and knowledge of their subject is considerable, attempt (successfully, in our opinion) to show how technical advertising may be made better, more attractive, and more efficient in the obtaining of business.

In such a country as America, where distances are very long, and railway journeys frequently occupy several days, the cost of sending travelling representatives to make the product known, and to do the spade work as well as collect the results, is obviously much more serious than it is here, where distances are so much shorter. This, we think, is one of the chief reasons why advertising has progressed to so great an extent in the United States. Some developments of American advertising do not commend themselves—perhaps we should write, do not yet commend themselves—to the unreserved admiration of our British readers; but no doubt this was true 20 years ago, when the positions were relatively the same. The great weight of advertisements carried by American technical journals seems to show that manufacturers feel they cannot afford to discontinue their insertions, but there is now, and has been for some few years, a considerable amount of advertising. Newspapers announce: "You will find many novelties among the advertisements in to-day's paper." Popular papers state that if the goods advertised in their columns fail to give satisfaction, either the advertiser will give back the money paid for them, or the proprietors will do so, and (presumably) will not accept advertisements for such goods from the defaulting advertiser. So we have reached a point where the advertisement is admittedly likely to be overlooked, unless those to whom it is addressed voluntarily assist with their goodwill.

This being so, it is of enormous importance to be sure that the advertisements are directed to the right end. How often do we find the whole purport of the message to be taken up—we had almost written "obscured"—with information about the goods themselves, when what really interests the prospective user is: what they will do in his service, and the manner in which they can be adapted to further his ends, by cheapening his costs and increasing his output, and in consequence augmenting his profits in a geometrical ratio.

We have called this an exciting book. If to be continually tickled by a new point of interest; if to be led almost breathlessly onward to the development of a point of view as unexpected as it is important; if to have new aspects of the subject suddenly revealed; if to find one's own views, which have perhaps been suspected, even by oneself, of unorthodoxy, confirmed for novel reasons, and yet again to find a pet theory knocked into the middle of next week—if these characteristics, which might almost describe a successful detective story, are those of an exciting book, then that distinction is merited in this case.

Not only do we find much that is of interest concerning the bringing of technical products in a suitable way before the favourable notice of the prospective purchaser, but there are many useful hints on the essential characteristics of house journals, both public and private. It is necessary to keep the staff and workpeople apprised of how they can best advance their employers' interests, but this can be done in a right way, as well as in many wrong ways. Our readers do not need to be told that we have rather a high opinion of human nature; and for this reason we think it offensive for an employer, whether firm or individual, to tell his staff to "get an hour's earlier start to-morrow morning," to "do it now," to "make one more call to-day than yesterday." The natural instinct of mankind is to give a square deal, and this instinct is strengthened, in the great majority of cases, during the process of coming to years of maturity. It is the unnatural who cheat and defraud, and the very existence of criminal courts and prisons is a symptom that the person who operates against the recognised natural principle is abnormal, and must be put outside the pale of ordinary society. Those whose interests are bound up together should work together. It is the business of the leaders, not to insist upon this necessity, but to show how it may best be accomplished.

We commend this book to all, whatever their state of education in matters pertaining to advertising, who have at heart the advancement of our engineering industry.

FUTURE PROSPECTS IN HUNGARY AND POLAND.

HUNGARY'S principal asset is her capacity to produce food-stuffs. Other sources of natural wealth, such as oil, may possibly be discovered, but this is uncertain. Coal there is, but with the exception of that mined at Pécs (at present under the occupation of the Serbs, Croats, and Slovenes) of poor quality and insufficient. There are possibilities of obtaining power by hydraulic means, but these, again, have not been developed.

A few good harvests, together with sound financial economy, should, according to a recent report by the British Commercial Commissioner,* place Hungary in a fair way to recover her balance, always provided that the essential factors of internal as well as external peace are assured, and an unrestricted market with the neighbouring States is mutually arranged.

The coalfields yield but a poor quality of brown coal, similar to lignite, which therefore cannot be used for gasworks, foundries, domestic purposes, or express trains, without an admixture of better class material. Last year's production amounted to nearly five million tons, equal to 78 per cent. of the 1913 output. The annual requirements are estimated at 7,500,000 tons.

Certain raw materials which were available to Hungary before the war are now cut off, and unless supplies are obtainable from neighbouring States without restriction, Hungarian industries will be in serious jeopardy.

Apart from the question of the rate of exchange, demand in Hungary is keen, and if British firms were willing to do business on consignment to first-class houses, a very fair trade would ensue. British houses have always had an excellent reputation in Hungary, but competition is likely to be keen in the future, especially from Germany. Machinery, hardware, small tools, and iron-mill products are some of the main branches which will have to be taken into account, and in order to secure a market, apart from such credit facilities as may be granted, the selection of good agents is a matter of utmost importance. Budapest, owing to its position on the Danube, will in all likelihood become a centre for transit trade eastwards. A large stock of goods of various categories could be warehoused or bonded for transit purposes as well as for local sale.

No electrification of the State Railways has as yet taken place, although its desirability appears to be generally accepted, but it is proposed to electrify an experimental line of 49 km. from Kelenfold-Adony and Prisztaszabolcs, with a generating station at Budajök, near Budapest. This station is complete with a 4,000-h.p. installation, and one electric locomotive is under construction at the Ganz-Danubius works at Budapest. The system will be single-phase with overhead wire, and the local brown coal will be used for power generation. If good results are obtained, it is proposed to electrify about 1,400 km. of line.

Tramcars and trams in Budapest and other towns are in need of thorough overhauling.

In connection with a scheme to build a commercial harbour on the island of Coepel, south of Budapest, it has been proposed to take advantage of the 4½ metre fall of the river during its 60 km. run, and by building a lock at the northern end and one at the southern end of the so-called Soroksar arm of the river, to develop some 7,000 h.p. Foreign capital is also needed for this scheme, but although both British and French firms have examined the proposition, no definite offer has yet been made.

A preliminary concession has been obtained by a firm of Swiss engineers to harness a branch of the river near Pressburg (Bratislava) and Győr. This, if undertaken, would yield between 20,000 and 15,000 h.p. according to the state of the river, and would be of great value to the industrial town of Győr. A third river power scheme is proposed in the neighbourhood of Vác.

As soon as financial conditions permit, telegraphic and telephone lines will need to be set in order as, owing to the war, many of them are still sadly in need of repair.

Amidst a turmoil of internal and external political struggles Poland has been striving bravely to reconstruct her economic life. The turning point would come, it was believed, when the plebiscite in Upper Silesia was taken. Yet that event is over and uncertainty still prevails.

Poland reckoned to lay a strong foundation again for her manufacturing industry with raw materials from Upper Silesia if that territory became an integral part of the new State. The Commercial Secretary to H.M. Legation at Warsaw dwells upon this factor in Poland's future in the report which has been recently issued by the Department of Overseas Trade.

Whatever Poland may ultimately gain from Upper Silesia, she will certainly make a big bid for trade with Russia and other countries in Europe in the products of her textile and engineering industries.

The character of the latter is local and interests Great Britain only in so far as it will be possible in the future to purchase in the United Kingdom machinery for the extension of the existing plant and the erection of new ones. Before the war nearly all the machinery required in the metallurgical and engineering industries was imported exclusively from Germany.

Exact statistics have not yet been compiled, but the following figures give an idea of the present position of the industry:—

1. Number of rolling mills, foundries, &c., employing more than 20 workmen in operation at the end of 1920, 325; of these, 237 belonged to the Polish Metallurgical Association.
2. Number of workmen employed in 1920, 27,000; in 1913, 54,000.

The Starachowice Metallurgical Co. has entered into an agreement with the Creusot-Schneider Co. and Messrs. Vickers for the development of the company on a larger scale and the erection of munition works.

Electrical Engineering Industry.

In spite of the difficulties in obtaining metals and other materials necessary for this industry, various enterprising capitalists started factories for the manufacture of indispensable articles. Local factories are now able to supply insulated wire of small diameter, switches, safety appliances, insulating tubes with accessories, electrotechnical porcelain, electric lamps, &c. All these articles are of good quality, and, although the output does not cover local requirements, the industry is developing satisfactorily, and improvements are made in manufacturing.

Owing to the depreciation of the Polish mark there is no competition in this class of goods at the present moment, but there is no doubt that, as soon as the exchange improves, the Germans will throw on the Polish market their manufactures, of which they hold large stocks, and which were imported in large quantities by Poland before the war.

The import trade is not likely to increase until conditions become more normal, the currency appreciates, and the buying power of the country is larger.

It is readily admitted that Poland will become a buyer of foreign goods in the future not only for her own needs but as a middleman for the Russian market. The Poles have an extensive and accurate knowledge of Russia, and should play an important part in the commercial and industrial regeneration of that country. German competition is likely to be very keen in this part of the world, as, having lost important colonial markets, she will probably devote special attention to the capturing of Polish trade. It is therefore essential not to consider the Polish market as a buyer of goods to be utilised only in Poland—the scope is much larger.

German and other competition was not felt much during 1920; as regards the former, this was perhaps due to the enforcement of special regulations by which the export from Germany to Poland of a large number of articles was prohibited by law, but such goods as have been offered are cheaper than British-made goods.

With a view to competing successfully, it will be necessary for British traders, in the first instance, to adapt their goods to local requirements, to appoint local representatives of a good standing, with a thorough knowledge of the country, and to sell goods on credit, as soon as local conditions will justify the granting of it. In some branches it will be indispensable to keep stocks of goods in Poland to enable quick delivery with a view to overcoming the advantage which Germany, Czecho-Slovakia, or German Austria possess, owing to their more favourable geographical positions.

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The Water Power Resources Committee, it is added, recommended that a technical commission of inquiry should be constituted, but, in view of the financial stringency, it was decided not to establish a commission at present. The recommendation will be further considered when conditions are more nearly normal. In the meantime the Board, in conjunction with other Government Departments, proposes to collect such information and data concerning the Severn as may become available, with a view to its possible future utilisation.—*The Times*.

* H.M. Stationery Office, 1s. 6d.

† H.M. Stationery Office, 2s.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Reflector for Show-case Lighting.

The "X-ray Scoopette" fitting sold by the BRITISH-THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, E.C.4, has been designed to meet the demand for a neat and effective lighting unit suitable for use in show-cases and shop windows which cannot be lighted from the top. The fitting consists of a "Scoopette" reflector (which is corrugated as shown

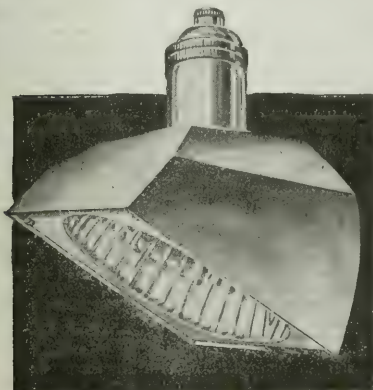


FIG. 1.—"X-RAY SCOOPETTE" FITTING.

in the illustration, fig. 1), a polished nickel or Florentine bronze casing and a bayonet-type lamp-holder. Two forms of casing, rectangular or elliptical, can be supplied—the former is illustrated. Special brackets have been designed for fixing these fittings to a wall or woodwork.

A Lamp-locking Device.

A new type of lamp-locking device has recently been placed upon the market by The HEIGHT ENGINEERING CO., 33, Bridge Street, Manchester. As will be seen from the illustration (fig. 2), this consists of a brass cover which fits over the collar of the lamp, the shade resting on the top of the cover. Normally a locking nut is screwed down on to the top of the

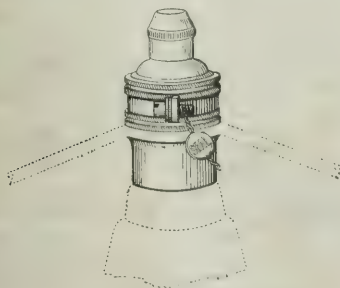


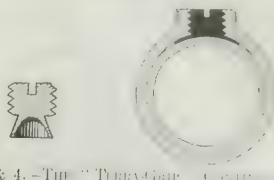
FIG. 2.—LAMP-LOCKING DEVICE.

shade, leaving a space on the screwed top. This is covered by a ring which can be slipped on to prevent the nut being turned to release the pressure holding the lamp on to the bayonet contacts. The ring is locked by a nut and screw and through the latter is drilled a hole for a sealing wire. The width of the ring can be varied for different types of lamp holders.

The "Terra-Grip" Continuity System.

A system has been introduced by SIMPLEX CONDUITS, LTD., Birmingham, to provide a cheap means of effecting ample and permanent electrical conductivity in light gauge unscrewed conduit installations. Each outlet of every fitting has a drilled and tapped boss for housing a steel screw of the formation shown in fig. 3. After the conduit is inserted into the outlet of the fitting, the screw is driven home, and, by virtue of its structure, the cup-shaped nose of the screw on making contact with the conduit expands, as shown in fig. 4. In expand-

ing, the enamel is automatically scraped off the contact, thus ensuring continuity. Further, the expansion of the cup-shaped nose automatically locks the screw in position, thus guarding against loosening under vibration. Conductivity tests on "Terra-Grip" junctions have been carried out by the



FIGS. 3 & 4.—THE "TERRA-GRIP" CONTINUITY SYSTEM.

Electrical Engineering Department of the University of Birmingham, by measuring the potential drop in millivolts across a number of "Terra-Grip" junctions in series. Currents up to 40 amperes were passed through the conduit and junctions, and the average resistance per junction was found to be only .0003 ohm.

A Tramcar Tire Heater.

A device (of Swiss manufacture) for heating tramcar tires, preparatory to fixing them on the wheels, which is being put on the British market by the EQUIPMENT & ENGINEERING CO., 2 & 3, Norfolk Street, Strand, W.C.2, is a distinct improvement upon the types of heaters usually employed at tramway depôts and repair shops. As will be seen from the illustration (fig. 5), the device is a very simple one, consisting of a transformer with a removable yoke which permits of the placing of the tire in the magnetic field to form a closed secondary. The tire is placed upon a bed of insulating

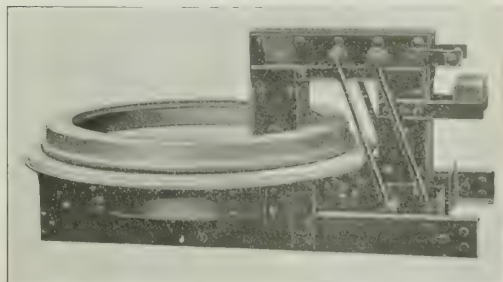


FIG. 5.—TRAMCAR TIRE HEATER.

material, and heats up very quickly. The yoke of the transformer slides in a guide, and is moved by means of a handle. The power required is about 25 kVA, and the desired temperature is reached in from 15 to 30 minutes, depending principally upon the size of the tire being heated. The apparatus weighs about 9 cwt. The only drawback to its use is the fact that an a.c. supply is not usual in tramway depôts, and of course this would involve the installation of the necessary plant.

We may mention that this appears to be an improvement upon a similar device made by the Oerlikon Co., of Switzerland, described in our issue of September 24th, 1915, p. 303.

The "Universal" Electric Range.

A distinct advance in electric cooker construction is apparent in the "Universal" range, recently placed on the British market by MESSRS L. G. HAWKINS & CO., 116, Charing Cross Road, W.C.2. This cooker is shown in fig. 6. The first point which strikes those who have to do cooking is the height of the appliance which does away with the stooping necessary in the case of most cookers, whether electric or otherwise. The overall height is 61 in. In appearance the range is very neat, and the floor space it occupies very small, being only 27 in. by 29 in. The oven is of rigid construction and heat-insulated by means of high-grade "Santotherm" block which will not deteriorate with long service or under high temperatures. The lining is of "aluminised" sheet steel. The oven equipment consists of a broiling rack, two heavy wire racks, and drip pans. The amount of heat is adjustable through a large range, as there are two elements, each with a three-

heat control. There are three hot plates containing very simple but efficient elements, simply connected to the cables upon the under-side of the bottom steel casing. Each of the hot plates consists of an insulating block, an asbestos pad, and the top plate containing the element. These hot plates are also connected with three-heat switches. In addition, there is also a shelf which embodies a hot plate. The switches for these heating elements are

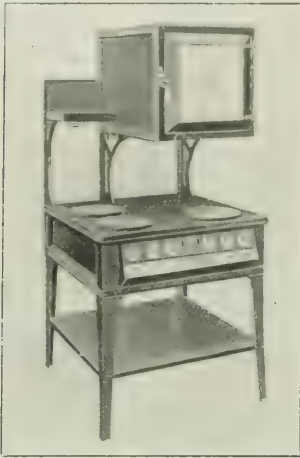


FIG. 6.—THE "UNIVERSAL" ELECTRIC RANGE.

arranged on the front board, and their construction is such that it can be seen at a glance which elements are "on" and which "off." The total (full-heat) loading is 7,660 watts, the oven taking a maximum of 3,500 watts. The range is made by Messrs. Landers, Frary & Clark, of New Britain (Conn.), U.S.A.

THE INTERNATIONAL TRAMWAY AND LIGHT RAILWAY ASSOCIATION.

FIRST ANNUAL CONGRESS.

THE International Tramway and Light Railway Association was founded in Nuremberg in November last. The greater part of the membership is German or Austrian, practically all the undertakings in the two countries having given the Association their support. The number of representatives of other countries is 72, made up as follows: Denmark, four; Holland, sixteen; Italy, one; Jugo-Slavia, two; Norway, six; Poland, two; Rumania, three; Spain, one; Sweden, six; Finland, one; Switzerland, twelve; Czechoslovakia, nine; and Hungary, nine. It will be noticed that of the nations of the *Entente* only Italy has a representative. The membership is apparently not confined to traction undertakings or their representatives, for in the list given by *The Electric Railway and Tramway Journal*, from which this information is taken, the names of companies which are concerned only indirectly with the industry appear.

The first annual congress took place in Vienna on May 30th and following days, under the presidency of Herr Ludwig Spängler, director of the Vienna municipal tramways. About 350 delegates attended, and the day prior to the opening was devoted to a reception and sightseeing in Vienna. Among the visitors were official representatives of the Austrian, Dutch, Swedish, and Hungarian Governments. In replying to a number of addresses of welcome, the president stated that the membership already exceeded 450.

During the first day's proceedings President Engineer Dr. Exner (Vienna) discussed the relations between transport and experiments. He began with a reference to the year 1840, which saw the birth of the first large railway in Belgium, described the various stages of development of technical appliances and experimental work as the traffic increased, and mentioned the obstacles which had to be overcome in effecting satisfactory arrangements.

Director Dipl.-Engineer van Putten (Amsterdam) spoke of the many difficulties which had had to be overcome in the construction of the Amsterdam tramways. The reclaimed land was below sea level and of a gravelly nature. The tramway track had to be laid on concrete topped with asphalt. Of the present 115 km. of track, 74 km. was laid on concrete. The extended area presented difficult problems for the tramways, and especially in respect of the intercommunal tramways. At present, although Amsterdam had 700,000 inhabitants, it had only about 19 km. of tramway lines, on which about 1,200,000 passengers were carried yearly.

The eight car depots and repair works of the tramways were all built on piled foundations—in fact most of the buildings in Holland were built on wooden piles. These piles often had a length of 13 metres and in some cases as much as 25 metres. These facts showed clearly that the cost of the foundation of any building in Holland must amount to 10 or 15 per cent. of the total cost of the structure.

Prof. Dr. Helm, dealing with the German light railways and tramways, said that at the end of 1916 (when the last statistics were published), the mileage was about 12,000 km. In the case of tramways, the metre gauge predominated, then came the standard tramway gauge, which was followed by the 75-cm. gauge. Other gauges were very little used. In the light railways the standard gauge predominated. The small increase in the length of the lines with other than standard gauge was almost exclusively due to the extension of the existing lines, and not to the building of new lines. Owing to the war, the formerly favourable economic position of the light railways and tramways had been greatly affected. Many had had to be closed down, and on others the traffic had had to be greatly reduced. The higher prices often made it impossible to maintain the lines and the rolling stock in proper order. This would require at least 2.35 milliard gold marks, of which 1.5 milliard gold marks would be required for the tramways. In Germany the State had attempted to support the lines which were in financial straits, but this attempt must be considered as a failure, as the 100,000,000 marks allotted was quite out of proportion to the requirements. Moreover, these contributions meant a complete sacrifice of independent working. It would be much more to the point to release the railways from compliance with agreements and Acts which were passed when the conditions were entirely different. Many economies could be effected in the working; thus, for instance, a series of experiments was being carried out with the object of reducing the quantity of the rolling stock required and its wear. The tapping of new sources of revenue was absolutely essential. Such new sources could be found in an extension of the goods traffic on tramways, in the storing of goods on railway land at the receiving or shipping station, but chiefly, however, in advertising.

Director Norregard (Copenhagen) gave an account of the history and development of the Copenhagen tramways. He said that it was in the year 1863 that the first horsed tramway line was put into operation. In the course of the next year or so no fewer than ten other tramway lines were built by private companies. In the latter part of the nineties, however, these little tramways were amalgamated by two large private companies, and the tramways were electrified. Meanwhile the oldest line had been acquired by English capitalists and was under English control, although the electrification had been carried out by German firms with German capital. In 1911 the Copenhagen Tramways Co.'s large undertaking was purchased by the municipality, and now all the systems were municipally-owned and operated. The total length of tramways was 91.6 km., and the rolling stock comprised 426 motor cars and 440 trailers. The tendency to travel by tramcar had increased rapidly in recent years. Increased fares, due to adverse economic conditions, had not given a satisfactory balance between revenue and expenditure, and severe economies in working were necessary.

Director Hultmann (Malmö) said that it was impossible to secure satisfactory results by further increasing fares; attention must be paid to economies in staff and in new purchases. He advocated an extended use of trailer cars and the introduction of the one-man car, which was becoming common in America. The Malmö Tramway Co. had been experimenting with a car of this type so designed as to allow passengers to enter and leave the car at the same time. It was, as yet, too early to pronounce a judgment on the merits or demerits of this arrangement, as the period of experiment had not yet closed.

The session then closed, and in the afternoon visits were paid to the Mejdling Works and to the Favoriten station of the municipal tramways.

On the second day, Directors Barth and Falkenburg dealt very fully with the Christiania tramways and light railways. The former said that in 1917 a prize was offered for the best scheme of co-ordination and organisation of the traffic facilities in the city and its suburbs. Thirteen projects—two of them foreign—were presented. The speaker described the successful plan, the main principle of which was to run cars from east to west, and to lay down in the centre of the city as many tracks as were necessary to avoid the delaying of passing cars. Outside the centre, the lines are carried as far as possible radially to the limit of the populated area and beyond, the terminal stations all being designed as loops. Between the residential quarters and the business part there will later be a ring line. Another outer ring will also be built. There will be branch lines to the harbour and railway stations for goods traffic. Altogether the scheme provides for 60 km. of new suburban lines and 34 km. of new city lines, estimated to cost, without rolling stock, at present prices, 160,000,000 kr. This scheme is being actively proceeded with. Director Falkenburg outlined the present position of the Christiania system. There were two companies serving the city, and the total route length of both was 36.3 km. There were 155 motor cars and 150 trailers each carrying from 52 to 68 passengers. In 1919 over 90 million passengers had been carried, as compared with 37 million in 1913, showing the

enormous growth of traffic which had taken place in recent years. The speaker gave statistics which showed that the cost of material and labour had risen to from four to six times the 1913 figures. The fares had necessarily been increased considerably.

Chief Engineer Tramm (Berlin) then dealt with the psycho-technical test of the fitness of motorists. He said it was necessary to test the sight (long or short sightedness, quickness, colour blindness), the hearing (sharpness of hearing, ability to locate sounds), general state of nerves and other movements such as trembling, &c., arm rotation, manipulation of the driving apparatus, staying power of the driver, attentiveness and presence of mind. With the test of fitness went hand in hand the training on the Taylor method, and the activity was regulated in accordance with given principles. It went without saying that in testing for fitness the humane point of view must not be lost sight of. The speaker described briefly, with the aid of slides, the testing and training methods applied in the case of over 2,000 employees, as well as the results obtained. He mentioned that out of 100 candidates medically passed, 20 to 30 per cent. had to be rejected after the test of fitness. The psycho-technical test of the fitness of drivers was an extraordinarily efficacious means for ensuring safe and economic working, as had been proved by experience on the Berlin tramways.

Director Lehmann (Cologne) laid down the broad lines for the amalgamation of transport undertakings in large German cities. He described the reasons that had led to the splitting of transport undertakings in these cities, the results being a number of independent transport undertakings, want of a general plan for the whole of the city, great variety of technical equipment, great difference in rates, and frequently want of facilities for quick, direct, efficient, and cheap traveling. Amalgamation of transport undertakings must be considered as the only remedy. The object of the amalgamation of transport undertakings would be to lay down a joint plan for the traffic, to improve the existing traffic connection, and to equalise and to reduce the rates as far as possible. Amalgamation ought to be dealt with by the municipalities to which the necessary powers would be transferred, and their task should be facilitated by the unification of State examiners and inspectors, and by suitable legislation. The amalgamated transport undertakings should be owned chiefly by municipalities, but worked privately.

Engineer van Nes (Vienna) dealt with automatic converter stations for electric railways, and with mercury rectifiers. He gave a general description of the object and arrangement of automatic converter stations with single-armature converters in America, and of automatic converter stations on the Brown-Boveri system. He also dealt with the successful converter station at Riehen, near Basle, for the Basle-Lörrach tramways. The mercury rectifier, its construction and use, were described with the assistance of a number of slides, and converter stations with distant control from a central station, and automatic rectifier stations, were also described.

On the third day Dr. Mattersdorf (Hamburg) dealt with the standardisation of equipment, and spoke of the work of the Union of German Tramways, Light Railways and Private Railways in this direction. Among the subjects dealt with by this union were voltage, motors, controllers, interior wiring, mechanical parts, collectors and rails. As regarded controllers, 18 positions with four different connections had been standardised. Four standard sections of grooved rails had been approved, and six sections of headed rails. Dr. Mattersdorf also spoke on "service," and emphasised the need for centralised management and careful supervision and upkeep. He recommended the formation of a special commission to deal with these problems.

Director Tobias (Budapest) described the experience gained on the Budapest tramways in the use of ball and roller bearings. His conclusions were that properly designed ball and roller armature bearings were superior to armature bearings with sliding friction as regarded reliability of working, and that considerable economies could be effected in lubricating material, as well as in the cost and attendance and upkeep of the bearings and of the motors, such economies soon paying for the cost of purchase, in addition to the interest, even in the case of bearings subsequently put in.

Director Albert (Crefeld) and Director Loercher (Stuttgart) also testified to the advantages gained by the use of correctly designed ball and roller bearings.

Engineer Stehr (Vienna) gave statistics and general information about high-pressure direct current, about speed regulation by shunting, and about power and converter stations. He concluded by describing the possibilities of the use of high-pressure direct current for light railways.

Engineer Findeis (Vienna) dealt with railless systems, and considered this a cheap means of locomotion for districts with small traffic. With the assistance of slides he gave particulars of the various constructions of current collectors, such as the Schiemann, the Kohler, &c., of the construction of the cars, of the possibilities of electric overhead lines, and described some existing lines and their results.

In conclusion of the day's proceedings, officers and council for 1921 and 1922 were elected.

On May 30th, the members visited the principal depot of the Vienna municipal tramways, and inspected the various departments, shops, and products of that large establishment. They saw about 450 cars in the sheds, besides rail-cars, snow-

ploughs, and other service vehicles, &c. Later the members were the guests of the City of Vienna, and were welcomed by Bürgermeister Reumann in the Magistrates' Sessions Hall.

On Tuesday afternoon, June 1st, a visit was paid to the brown coal depot at Zillingdorf and the new power station at Epenfurt of the Vienna Electricity Department, as well as to the electricity works of the Southern Railway Co.; and on the following day the visitors inspected the modern works of the A.E.G. Union Co., and the railless trolley installation between Potzleindorf and Salmansdorf.

The next congress of the Association is to be held in Budapest.

SIGNALLING BY INVISIBLE RAYS.

SELECTIVE TRANSMISSION AND DETECTION OF ULTRA-VIOLET RADIATIONS.

Very little regarding the origin or detail of the invention which enabled signalling to be carried out by means of invisible rays during the later period of the late European war has been so far available. A recent issue from the U.S.A. Patent Office, however, "let the cat out of the bag" for, according to the *Electrical World*, the invention is claimed by Dr. Louis Bell and Mr. Norman Marshall, of Boston, who are reported to have attacked the problem many months before America entered the conflict, and to have achieved success following a brilliant series of research investigations.

The peculiarity of the system described is that it utilises not the radiations of very short wave lengths known academically as the ultra-violet, but rather a part of the spectrum to which relatively very little attention has been paid—that portion which lies between the extreme visible violet and the point at which radiation is strongly absorbed by glass. Very powerful radiation in this region, which roughly lies between 400 μ and 350 μ , can be obtained from divers sources like the carbon, mercury, and magnetite arcs, but—what is here of great importance—the incandescent lamp, particularly hard pushed, yields very excellent results. Rays in this region are of extremely low visibility, so low as to be virtually invisible under all working conditions, and yet they have the power of exciting the "chemical eye" of fluorescence with somewhat astonishing efficiency.

Perhaps the most remarkable thing about the system is the extremely small quantity of energy required to operate it, less than 20 watts total output being ample for ordinary front-line work and 100 watts or so for distance signalling. Bearing in mind the fact that even this small amount of energy is filtered through half an inch of dark glass, the extraordinary sensitiveness of a properly organised "chemical eye" becomes strikingly evident. The retina itself, for visible rays, responds to amounts of energy so small as to be hardly imaginable, but the photochemical process of fluorescence, if photochemical it be, seems not to fall far behind.

All previous efforts to signal by normally invisible rays had attempted to use either the extreme ultra-violet or infra-red rays in the belief that the former were so quickly absorbed by the atmosphere, and so difficult to obtain in quantity as to be impracticable for portable service, and even less attainable in suitable transmitting apparatus. Moreover, every previous attempt to utilise ultra-violet light rays had involved the use of quartz apparatus which was utterly impracticable for production in quantity as required for military use. Therefore, Messrs. Bell & Marshall turned to the region just beyond the visible spectrum and instead of working with quartz lenses, the experimenters used ordinary Mangin mirrors, which by tradition were entirely incapable of dealing with the ultra-violet rays without vital absorption for the region now used (400 μ to 350 μ). The Mangin mirror proved excellent for the work, and it was found possible to obtain a powerful beam in this part of the spectrum from an ordinary gas-filled lamp of the type used for automobile headlamps.

A suitable screen to cut out the visible spectrum gave the investigators a large amount of trouble, owing to the fact that nearly everything in the way of an absorbing medium is permeable to the red of the spectrum, of low visibility by day but conspicuous by night. The problem was to leave the nearer part of the ultra-violet and to transmit it with considerable freedom. Traditional screens failed utterly. Messrs. Bell and Marshall tested virtually the entire range of dyed films and liquid absorbing media, literally in hundreds of combinations, before success was achieved. The screen finally settled upon as the most practicable was a combination of glasses produced by the efforts of Dr. H. P. Gage, of the Corning (N.Y.) Glass Works, working on the specified requirements as to wave-length limits. Still more persistent investigation was required to discover the "chemical eye" which should finally render visible the radiation passed by the incandescent lamp through the necessary screens. To reach success it was necessary to have a receiving screen which should be very sensitive to the one particular region of the spectrum supplied and should fluoresce with the colour of the maximum luminosity value for very weak stimuli. Even when the best substance was finally found it proved to be a rather difficult art to prepare it in the sensitive films necessary for use.

The investigators had particularly in mind the production

of a very light and effective signalling set which had maximum portability so that it could be carried if necessary on a soldier's belt. The first complete apparatus turned out, in fact, consumed less than 20 watts derived from a dry battery carried on the belt and was capable of signalling probably over 1 or 2 km. In the receiving apparatus, again, all traditions were violated, for the "chemical eye" was fixed to an ordinary prism field glass where the rays had to pass through two cemented lenses and 6 or 8 cm. of glass. Glass, in fact, is quite transparent to the particular radiations employed, and ordinary field glasses form as good a receptive device as could be desired.

Finally, the whole outfit, with combined sending and receiving apparatus, battery, and tripod mount, weighed but 13.6 kg. and was capable of working over 6 or 8 km., using only about 25 watts in the lamps. It gave a singularly narrow and sharply defined beam, appearing in the receiving glass as a little green moon blinking a code unseen through the darkness.

Signalling with this particular kind of ultra-violet ray proved successful even in face of a drizzling rain or a snow squall. The absorption by the atmosphere did not appear to be at all severe, and the apparatus was extraordinarily compact and portable.

In the most developed form two telescopes are used side by side. One is used in transmitting and the other in receiving signals. In the former are mounted duplicate lamps, the filter, eyepiece, and transmitting lens. The latter contains a condensing lens, with the fluorescent screen at its focus, and an eyepiece. Clear glass was used in these lenses.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS SEPTON JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

- 21,163 "Electric colour-changing signs." E. W. Chamberlain, August 26th.
21,335 "Incandescent electric lamps." J. F. N. Young, August 11th.
21,342 "Dynamo-electric machines for producing oxides of nitrogen." F. Stacey, August 11th.
21,357 "Paraffin telephone systems." R. C. M. Hastings, August 11th.
21,365 "Apparatus for condensing mercury vapour in metal-vapour rectifiers." Siemens-Schuckertwerke, August 11th.
21,371 "Drawn wire filaments." General Electric Co., Ltd., and F. S. Goodrich, August 11th.
21,438 "Electric emergency lighting installations." P. Das, August 12th.
21,582 "Electric light fitting." J. Hall, August 15th.
21,584 "Terminal connectors for spark plugs, &c." B. Deakin, August 15th.
21,595 "Shade carriers for electric lamp holders." S. Coxon and F. M. Souleby, August 15th.
21,600 "Clips or brackets for holding petrol cans, accumulator boxes, &c." J. H. Holland, August 15th.
21,612 "Electric floor-polishing machine and waxing attachment." G. E. Robinson, F. M. Souleby, and R. A. Stencil, August 15th. (United States, May 23rd.)
21,624 "Dynamo-electric machines." J. A. Kuyser, Metropolitan-Vickers Electrical Co., Ltd., and R. Townsend, August 15th.
21,680 "Electric lamp brackets or supports." Cable Accessories Co., Ltd., and F. H. Reeves, August 16th.
21,681 "Electric plug-and-socket connections, &c." J. A. Crabtree, August 16th.
21,683 "Electric switches." J. A. Crabtree, August 16th.
21,724 "Electric radiators." J. W. Morrison, August 16th.
21,742 "Means for connecting electric conductors to rails." British Power Railway Signal Co., Ltd., and H. E. Cox, August 16th.
21,755 "Electric revolution counters." Evershed & Vignoles, Ltd., and J. C. Needham, August 16th.
21,757 "Electrical moving figure." L. R. Henson, August 16th.
21,761 "Means for increasing sound transmitted by telephones, &c." W. H. Higgs, August 16th.
21,774 "Safety fuses for miners' electric lamps, &c." E. Summerfield, August 16th.
21,786 "Electric transmitters for automatic telegraphy." F. G. Creed and Good & Co., Ltd., August 16th.
21,798 "Electric lanterns for signalling, &c." J. Eaton, Elandem Co., Ltd., and A. H. Williams, August 17th.
21,814 "Apparatus for testing magnetos, insulated plugs, &c." E. J. Davis, August 17th.
21,819 "Electric lamp holders." W. Barnett, B.S.T. Electric Fittings Co., August 17th.
21,846 "Amplification and/or shaping of impulses in telegraphy." Eastern Telegraph Co., Ltd., and W. G. Goss, August 17th.
21,847 "Selective telephone systems." R. C. M. Hastings, August 17th.
21,848 "Telephone systems." R. C. M. Hastings, August 17th.
21,853 "Telephone mouthpieces, &c." L. Whitworth and Dyson & Co., Enfield (1919), Ltd., August 17th.
21,855 "Process of manufacturing carbon filament for incandescent electric lamps." Nippon Kasei, August 17th.
21,857 "Electric telegraphy." Eastern Telegraph Co., Ltd., and W. Goss, August 17th.
21,858 "Spark plug." F. Scott, August 17th.
21,859 "Electric connections between conductors." S. Cohen and J. Firth, August 17th.
21,861 "Electric clutch coupling for dental techniques." E. Huot, August 17th.
21,871 "Electric clutch coupling for dental techniques." E. Huot, August 17th.
21,872 "Electrical precipitation." Lodge Fume Co., Ltd. (International), August 17th.
21,893 "Electro-magnetic engines or motors." H. F. Morley, August 16th.
21,897 "Electric motors." M. Kiyawada and T. Yamamoto, August 18th.
21,933 "Electric motors." M. Kiyawada and T. Yamamoto, August 18th.
21,985 "Electric cut-outs." C. A. Damesy and Kingsmill Electrical Co., August 18th.
21,987 "Telephone photophone." A. S. Reader, August 18th.

- 21,954 "Windings for dynamo-electric machines." W. E. M. Ayres, August 18th.
21,959 "Spark plug." Armstrong Sparking Plug Co., Ltd., and J. H. In Thurn, August 18th.
21,986 "Dimming electric lamps of automobiles." G. E. Webb, August 19th.
22,000 "Mounting electrical apparatus on cycles." S. C. Westwood and F. B. Westwood, August 19th.
22,041 "Electric machines." S. C. Westwood and H. B. Westwood, August 19th.
22,065 "Apparatus for converting acetone, paraffin, &c., lamps for use as electric lamps." C. Hewitt, August 19th.
22,069 "Tramway, &c., rails." E. W. Walsh, August 19th.
22,021 "Electric light fittings." Holophone, Ltd., and E. Stroud, August 19th.
22,026 "Mirrors electric lamps." H. Wade (Concordia Elektricitäts Akt.-Ges.), August 19th.
22,032 "Magnets for electric ignition." B.d.V. Motor Co., Ltd., and C. J. Coleman, August 19th.
22,035 "Connection for electric cable conductors." T. Clarke, August 19th.
22,040 "Instruments for producing interrupted electric current of controlled frequency." J. W. Booley, August 19th.
22,070 "Methods of measuring high voltages." British Thomson-Houston Co., Ltd., August 19th.
22,074 "No. 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 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In view of the fact that the electricity supply system of this country is supposedly undergoing, or about to undergo, a more or less drastic process of reorganisation, it is not surprising that many of the smaller undertakings, both authorised and otherwise, are concerned as to the future prospects of their respective businesses. From time to time we receive inquiries in this regard, one of which appears in our "Correspondence" column to day.

There is no doubt that, as our correspondent claims, in many cases small non-statutory companies have considered public service by providing a supply of electricity in areas which would otherwise have been deprived of that privilege for years. In some respects their operations have been conducted under more advantageous conditions than those of duly authorised undertakers; as a rule they have not been able to lay mains under ground—but that is not necessarily a disadvantage, and, on the other hand, they have enjoyed a measure of freedom denied to the statutory concerns. They have, in fact, embarked on a trading enterprise on much the same footing as a grocer or a dairyman.

Now that the Electricity (Supply) Act, 1919, is in force, and the No. 2 Bill is awaiting Parliamentary approval, these companies are taking stock of their position; but apparently they have little cause for apprehension.

Section 26 of the Act of 1919 enables unauthorised suppliers of electricity to become authorised undertakers by means of Special Orders made by the Electricity Commissioners; they will then enjoy the privileges of such undertakers under the Act—that is, they may sell the whole or any part of their undertakings to the Joint Electricity Authority by agreement, or they may elect to remain outside the Authority, in which case apparently there is no power to interfere with them, but they cannot extend their generating plant or main transmission lines without the consent of the Commissioners. It is impossible to prophesy the policy of the new Authorities, but the Commissioners have definitely stated that they will not forbid the extension of an undertaking if it can be shown that such extension is of greater benefit to the public than the alternative course of obtaining a supply from a distant source (ELEC. REV., March 4th, 1921, p. 269). There is no reason to suppose that an unauthorised supply, commenced before any Provisional Order has been issued for the district, can be shut down by any legal process. Under Section 23 of the Act of 1909, while the initiation of an unauthorised supply in any district for which statutory powers had already been granted was forbidden, the section implicitly permitted the continuance of such competitive supply where it had been commenced before the passing of that Act; it explicitly allowed any company to supply electricity to the public, where the business of supplying electricity was not the main purpose of the company, and it placed no obstacle in the way of the commencement of supply without statutory powers in an area not covered by a provisional order.

The Act of 1919 has not materially altered the position except as indicated above. But it is true, as our correspondent suggests, that an unauthorised undertaking has no *locus standi*; if a public supply becomes available in its area, it certainly need not "clear out," but must face the competition as best it can, without pro-

test, and without hope of extension of plant *unless it can beat its rival on selling price.*

Now, the words italicised contain the kernel of the argument. There is no doubt that in some cases the small local unauthorised undertakings, with plant purchased at pre-war prices, and working on economical lines, will be able to defy any competition from a newly established supply, whether from a distance or locally generated. No one can shut them down—as the law stands at present; and if, as mentioned above, they are able to obtain a special order endowing them with statutory powers, their position will be impregnable.

However, they must not calculate their costs in the manner indicated by our correspondent, who tacitly assumes that the oil-engine set is going to run at full load and maximum efficiency when it runs at all, and makes no mention of interest on capital or allowance for depreciation or obsolescence (say, 20 per cent. per annum together), or rent, rates, labour, lubrication, and repairs. That "horse-power-hour for 1d." is an old story—in a double sense. As we have said, in some cases the small private plant will undercut any public supply of future development; but in many cases it will be found, on an impartial investigation, when all the relevant charges have been fairly taken into account, that the apparent cheapness of the supply given by the small plant is only apparent. Hence we recommend the owners of such plant to make sure of their ground before they commit themselves to any definite policy.

On Wednesday the Shipping, Engineering, and Machinery Exhibition was opened at Olympia for its three weeks' run. Coming at a time when the trade barometer is distinctly rising—as evidenced by the reopening of iron and steel works, the reduction of unemployment, &c.—the Exhibition ought to provide a valuable stimulus and produce useful results. It should be borne in mind by exhibitors that to equip a stand and place a man in charge of it is not the sum of their duties to themselves and to their potential clients; assuming that the exhibit is well selected and displayed, and that the attendant is not merely a man, but a competent demonstrator, able and eager to explain the operation and merits of the items shown, it remains to ensure that he shall be well supplied with visitors interested in the class of goods concerned. There are various ways of attaining this end, which need not be detailed; our object is only to point out that they should not be neglected.

Again, the immense educational value of such an exhibition should be duly appraised, and the opportunity should be taken to turn it to the best possible account. In this respect we appeal not only to exhibitors, but also to manufacturers and traders in general, to make use of the exhibition and increase its efficiency by enabling the members of their staffs, from the heads of departments down to the apprentices, to visit the exhibition, and make a thorough study of its contents. Tickets can be obtained at specially reduced rates for this purpose, and arrangements have been made with the railway companies to run excursion trains. To be up to date is all-important, and the only way to do it is by keeping oneself fully conversant with the march of progress in the engineering world in general. We, therefore, trust that our readers will assist, so far as lies in their power, in promoting the technical education of their fellow-workers by this excellent means.

The Institution of Electrical Engineers.

THE June issue of the I.E.E. *Journal*, which has just been issued, contains under "Institution Notes" a novel feature—a valedictory letter from the President to his fellow-members, recounting the principal achievements of the session which is now drawing to a close, and thanking the members of Council and all the members for the

assistance they have given him during the year. Mr. Atkinson has a gift for doing, and saying, the unexpected thing, with which, fortunately, is associated an unerring sense of what is fitting; and hence no one can fail to appreciate the spirit in which his message is conceived. He pays a special tribute to the effective work of the honorary treasurer, Sir James Devonshire, as well as to that of the secretary, Mr. Rowell, and his staff, but he makes no reference to his own labours, which must have been as arduous as they were successful—and that is no faint praise, for, as he remarks, "in many ways it has proved a record session."

Already we are looking forward to the next, which officially commences when this month ends. The Council is still engaged in debating the very difficult question whether the meetings shall begin at 6 o'clock or at the former hour of 8 p.m.—difficult, because so many members hold strong views one way or the other. While we have our own opinion, it is a matter for individual decision, upon which we do not care to comment. But we think we shall voice the views of a good many members if we suggest that the informal dinners, inaugurated by Mr. Wordingham, and abandoned only because of adverse circumstances, might now be revived, and that no more suitable rendezvous could be found than the Engineers' Club.

The Engineers' Club.

ENGINEERS of all branches of the profession will be glad to learn that the Engineers' Club (London) was duly opened last week, and that from the very first it "made good." On the opening day the luncheon rooms were fully occupied, and most of the sleeping accommodation was booked; and since then the attendance at and use of the club has been all that could be wished. So far as we have been able to ascertain, the members generally are very pleased with the arrangements provided for their comfort and convenience, and there is every reason to forecast a prosperous future for the new institution.

How to Enter the Yugoslav Market.

YUGO-SLAVIA, the kingdom of the Serbs, Croats, and Slovenes, has to import from abroad machinery, all kinds of railway material, scientific instruments, brass, copper, steel, &c., amongst other goods, which the United Kingdom should be in a position to supply. Unfortunately, the purchasing power of the new kingdom is limited, and though gradually recovering, must remain restricted until its resources are developed. To this end capital is needed, transport must be improved, and labour requires to be reorganised. By co-operating in these directions with local interests, British entrepreneurs would be making a useful contribution towards the reconstruction of a promising region, and might at the same time gain an outlet for British goods.

The prospects facing such schemes may be gauged from the report by H.M. Commercial Secretary at Belgrade, which has recently been issued by the Department of Overseas Trade. The main factors which affected trade in British goods last year were: (1) Exchange variations; (2) time taken in transit of goods; (3) terms of purchase—cash or credit; (4) Valuta competition.

The last named was very marked, especially from Austria, Czecho-Slovakia, and Italy. Machinery, copper, motor cars, tires, and iron and steel goods were amongst the articles affected by this competition.

In the Commercial Secretary's opinion, the best way for firms to enter the market is for them to have branches in the country and carry stocks; by this method, the local merchants, by purchasing goods of which they can take immediate delivery, can obviate the risk of loss from exchange fluctuations which must be taken when ordering goods from abroad, the period occupied by the transit of merchandise being so uncertain. Where this is not possible, the next best way is to have a British representative living in the country.

THE TESTING OF ELECTRICITY METERS.

By R. M. MOBERLY.

JUST as a power canvasser does not labour the comparison of costs of electricity *versus* other methods of driving, but rather concentrates on the increased or improved output available when the electric drive is used (since power costs, although important, form only a small portion of the total cost of production, whilst increased sales are very important), so a supply engineer regards, or should regard, the importance of output, and should be willing to go to a reasonable expenditure to increase his sales. Money is spent in advertising, and in canvassing, but expense for the upkeep of meters is frequently frowned upon. The money spent to buy meters represents a by no means negligible portion of the total capital expenditure, and although this may be considered to be depreciated duly by the income received from meter rents, it would be better to regard this revenue as providing a maintenance and renewal fund, and by systematic care to keep the meters in good condition.

The securing of maximum sales implies minimum loss in distribution, which in turn implies meters in good condition, and fast up to the statutory limits. This last desideratum is a reasonable aim, and one which does not necessarily involve great preliminary outlay, elaboration, or running cost, but which, when decided on, must take cognisance of certain incidentals which make all the difference in obtaining quick and reliable results. These incidentals are: (1) Instruments; (2) variation of test load; (3) accuracy of observation; (4) accuracy of preliminary calculations, and calculations during test; (5) personal element, eye strain, fatigue, &c.; (6) miscellaneous items.

In starting a test room of moderate capacity, these incidentals may be considered in the following manner:—

Personal Element.—The way of the man who gets through his work well, but is apparently lazy, is often the best. The "lazy man" method should, therefore, be kept in view in the arrangement of the test room, so that a bench and chair of proper respective heights are provided for one class of meter, and suitable racks and a stool for other types. The position of control should be as nearly central as convenient.

Instruments.—The most exact, showing the clearest definition of the smallest variation over a large range is naturally the best, but no doubt a potentiometer and good reflecting galvanometer with an N.P.L. certificate, or a Kelvin balance, are too expensive to consider, so it is necessary to take the best that the powers that be will pay for, have it periodically checked, and assume it to be correct between checks unless proved otherwise. As the limits of accuracy prescribed are expressed as a *percentage*, values from beginning to end should be considered on this basis. Instrument scales should be as large as possible, and should be calibrated so that fine readings may be taken, a mirror below the needle being, of course, essential. Shunts or transformers should be so graded that for the majority of readings required for every-day meter testing, the pointer will be on the high side of at least 50 scale divisions, where one division (equal to a variation of 2 per cent.) is as clearly read, as at 10 scale divisions where one division is equal to a variation of 10 per cent.

Variation of Load.—For d.c., current from accumulators is essential. As the cost of sufficiently high-discharge-rate accumulators for a separate installation is prohibitive, it is best to use regulating cells of the main battery. Eight cells form a useful group, and these should be the last regulators in the battery, so that the effect of outside conditions is reduced as much as possible. A spirally wound heating element with suitable tappings forms the cheapest type of rheostat for the calibration of voltmeters, whilst voltage from the busbars, with the addition or subtraction of a few volts by

means of test cells or independent small cells, answers the requirements of voltage circuits in energy meters.

For a.c. testing, as the phase difference comes into consideration, and as the type of standard instrument most suitable for obtaining quick results is different, it is often best to use energy from the busbars through suitable banks of lamps, heaters, &c. The instrument recommended for use as a substandard is a portable rotating standard as supplied by the British Thomson-Houston Co., or the Metropolitan-Vickers Electrical Co. Several ranges are obtainable with either instrument by means of variable series coil connections, and usually two or more voltage ranges can be supplied. With such an instrument quick readings can be obtained with the advantage that fluctuations in the supply will not upset the tests. A good ammeter and voltmeter may be obtained, but although useful for power factor tests, such tests are of little practical value with modern meters in which the range of power factor met with in commercial practice makes less than 1 per cent. difference. Suitable inductances and choking coils complete the requisite equipment.

Accurate Observation.—Absence of eye strain is essential. The eye must obviously be in the same alignment at the beginning and end of each test, but need not be in the interval, hence it is obvious that good aligning marks must be available. The meter under test usually contains one such mark such as the spindle, the end of a magnet, &c.; the other alignment can conveniently be external, made to stand or hang in front of the meter. It is then only necessary to align the eyes for perhaps 10 seconds in 60, and to remember whether it was the head or tail of the disk mark that was counted at the start. A lamp with a concentrating lens to throw a beam of light into the meter under test is also helpful.

Preliminary Calculations, and Calculations during Test.—The lazy man will endeavour to eliminate the latter entirely, if possible, by paying more attention to the former. A percentage chart on a large scale showing the error of any reading from the constant, or the variation between any two constants in the tables, saves much time, especially in the case of meters with readily changeable constants, such as Chamberlain & Hookham or Ferranti meters. A variation chart to and from 60 will be required for meters in which the constant is calculated in revolutions per minute at full load. A variation chart to and from 60, and to and from various other numbers will be required for meters in which the constant is calculated in revolutions per unit, and also a standard relationship between this constant, number of revolutions, time and load. (If one works in revs. per minute, fractions of revs. come in, involving the use of a slide rule during test.) In each case variation per cent. must be obtainable from the charts, for direct entry on the test sheet. As the majority of meters to be dealt with will not be above 100 amps. capacity, it is as well to provide circuits as follows:—

D.c. Battery Cables.—So that one or more cells up to the full number (eight) may be used in series the cables of 70-A capacity should terminate in a simple plug and socket, a bar and clamp, or what is more economical in space and expense, a mercury switchboard. From the switchboard at least three circuits should be run to different positions terminating in good screw terminals on walls or benches. Provision should be made on the switchboard so that any of the ammeter shunts can be readily connected into any of the circuits in series with any number of the test cells.

Flexibles for connecting meters may be conveniently made up of 7/18 or 7/20 cable sweated into suitable lugs, easily obtainable from Davis & Timmins, as a standard terminal, but with the screw thread omitted. The terminal to take 7/18 will be found to have the right size stalk for most meters except Chamberlain & Hook-

ham, which require an extra $\frac{1}{4}$ in. length in the stalk. The thimble part of this terminal can be used in larger sized meters. A number of barrel connectors for this size will also be useful.

Resistances.—A pair of good carbon resistances and a small carbon cloth pile will give all the variation required from 100 amperes to 1, 100 load on the smallest meter used. The plate resistance should have either smooth or corrugated plates about $3\frac{1}{2}$ in. square by $\frac{1}{4}$ in. thick. The carbon cloth pile should have three terminals, and be provided with a robust short-circuiting switch so that it may be arranged in the circuit in use and set at the beginning of a range of tests to give the required light load by opening the s.c. switch. Thus full load may be obtained with four cells, half with two cells, one-fifth with one cell, and one-tenth with one cell and the s.c. switch opened. If instruments are so arranged that the tester can tell when any variation in the current occurs during test, one or two small carbon resistances, consisting of full size plates; but only a few in each, may be conveniently connected in the test circuits, so that any such variation may be corrected without interruption of the test.

Comfort makes a considerable difference to the lazy man. A good chair, with the provision for a test pad, and a tray for the small number of tools required for minor adjustments, makes all the difference; the provision of wheels is an improvement, but might be considered too luxurious. A similarly arranged stool for working at meters on the racks, and a good stopwatch complete the main items.

When a batch of meters comes in from the makers, it is as well to look out for one or two different sizes which have remarkably good curves, and to install these permanently in the test room so that after other tests a batch of meters can be put in series with the selected meter of suitable size, and run on dial test. The dial testing may be conveniently done on the office or works lighting or heating circuits, thus not occupying the switchboard, or using current unnecessarily.

A standard set of resistances is arranged so that 1/100 load for any size of meter can be obtained quickly, as all meters should be first tried at this load, the "jibbers" being put on one side for examination, and the good ones passed on for test. Mercury meters which "jib" or pass 1/100 load test, if over five years of age, should be opened up for examination, since disk trouble or oxide, or more rarely jewel trouble may have started. The corrosion of gear wheels, especially when the meter contains any ebonite or similar substances, is sometimes sufficient to cause slow running on light loads. (The remedy for this is to dip the gears and relacquered.) Jewels, in motor meters especially, but also in mercury meters, sometimes split or flaw, and it is of interest to note the serial numbers of all meters in which jewel trouble occurs, since it sometimes happens that the manufacturers have had a poor batch of jewels, and the same trouble may be found over the next serially numbered meters. Although expensive it is not altogether a counsel of perfection to insist on a new pivot for every new jewel—the microscope will show that this is justified in most cases.

When meters have been brought in on account of being "alive" it frequently pays to examine the customer's premises, and in fact sometimes leads to the customer's paying for the repairs. As a.c. meters are of the energy type, and practically all have both heavy and light load adjustments, it is not worth specially detailing the different types. In overhauling the same main features require special attention. The testing is most conveniently carried out by means of the rotating standard, which is connected up with its series coils in series with the meter to be tested, and with the pressure coil across the supply mains, but nearer to the supply than the meter under test (this will obviate measuring the pressure coil loss in either meter).

The pressure coil of the standard has a hand switch in circuit so that the standard can be started readily, run for a period during which N revs. of the disk of the meter to be tested are counted, and the standard stopped

on completion of the counting. The test is made by comparison of the registration on the standard, showing the number of revolutions run during the test, and the number counted on the meter under test. By a little preliminary calculation it will be found possible to measure percentage error directly.

The following brief notes and tables may be of assistance to someone starting a test room:—

Chamberlain and Hookham Meters. Mercury type motor meter, constant = amp. \times secs./revs. Calibration is effected by means of varying the position of the poles of the correcting coil. If the curve is straight, but outside the limits, the constant can be readily changed.

Stock desirable: Set of change wheels, single, double, and triple worms, balance weights, bottom pivots, bottom jewels, spare armature disks and spindles, a few hands for clock dial, a d.e. spanner of brass or non-magnetic material size 9/16 in. across flats and $\frac{1}{8}$ in. square, and a spanner for jewel adjustment 11/32 in. across flats and 7/16 ditto.

For the 1907 type meter the following additional tools are essential: A special grooved box spanner for the spindle and a clip for holding the armature when unscrewing the spindle.

On the 1897 type, adjustments are made by either raising or lowering the brake poles or by altering the effect of the correcting coil by non-magnetic packing between the coil core and its mounting. If full load is slow, half load fast, and one-tenth load slow, speed up the meter or remove the packing. If the curve falls from fast at top load to slow at bottom load too steeply, insert packing. The main point is to try for the best curve, without packing, by altering the speed and then correcting the resultant curve if necessary, finally changing the constant if essential. When overhauling this type of meter the points to be specially noted are the condition of the top bearing, of varnish on the armature disk, of the jewel and bottom pivot, of the leather between the ebonite base plate and the pole pieces (as occasionally the copper connecting strip from the bath to the terminals becomes amalgamated and the mercury penetrates through the leather forming a short circuit), and the position of the bottom pole piece which supports the pivot, since curve variation can be obtained by revolving this pole piece.

For the 1902 type, adjustment is made by varying the strength of the correcting coil by means of tappings provided. In overhauling special attention is required to the condition of the varnish, and light load friction losses.

For the 1907 type, a special box box spanner is required for the spindle and clip to hold the armature when the bath has been opened by the removal of the strap. Adjustment is made on the screws forming the poles of the correcting coil; as this affects top loads most. Friction losses require special attention. The insulation under the clamps holding the meter into the case is liable to split, especially where the fit is not good. Rust may form on the pole pieces in the bath. (See under "Ferranti" also.)

Messrs. Chamberlain & Hookham now claim to have obtained a varnish which will withstand the action of mercury on copper. This will obviate the necessity of burning off the mercury and re-insulating the disks.

Ferranti.—Mercury type motor meter. Constant = amps. \times secs./revs. Calibration by means of adjusting a pole piece, which distorts the flux in conjunction with the series coil, chiefly affects top loads, so attention to friction losses on light loads is important. The constant can be varied by change wheels and pinions.

The stock desirable consists of a set of change wheels, four sizes of pinions, jewels complete with holders, fibre disks for mercury bath (few only), selection of armature disks and spindles. Special tools. No. 2 box spanners for mounting jewels, and special keepers for use on magnets when stripping.

With care a meter may be stripped, overhauled, and re-erected without any or with very slight alteration of the constant being necessary.

Special attention during overhauling is recommended to: Enamel on disk; even if the meter is five years old and the enamel is apparently good, it pays to scrape it off. This can be done with a knife and fine emery, finishing with buff (keep the disk clean so that it amalgamates regularly when put into mercury). If the meter has been in damp situations rust may have started to form on poles under the paper in the bath; if so clean off and re-insulate with shellac or voltaic, as continuation of rusting will pierce paper and short circuit the meter. Examine top jewel for endplay and freedom.

For meters such as those above, in which the constant is quickly changeable, it is not always possible to carry a sufficient stock of change wheels and pinions, or change wheels and worms. An alternative combination can usually be found by working out the ratio between the two multiplied by the corresponding meter constant, the figure obtained being a *train* constant for the remaining tables at the same voltage. Thus with Ferranti tables: $A/B \times k$ equals 313 for 230 volts. So if K is the constant desired (15.4) and a 61 wheel and a 30 pinion are not available, and perhaps a 50 pinion is in stock, then $A = 313/K \times B$, $A = 102$ approximately: the true value of K for this wheel and pinion being 15.35.

Electrical Apparatus Co.—Commutator motor meter. Constant in revs. per unit. Adjustments are made on the main circuit coil, or on the position of the magnets.

Stock desirable: A set of jewels, two types, several pairs of brushes, terminals with their micanite bushes and washers, several armatures, and a balance to check brush tension.

When overhauling, special points requiring attention are: Train friction, commutator, jewel and pivot (apparently very liable to rust), position of commutator with reference to armature windings, brush tension light and equal. It is advisable and repays the time spent to give *special* attention to the surface of the commutator segments. Should the main terminals have been removed, it will pay to use a good varnish on the outside and inside of the bushes and under the washers to practically seal the terminal inlets, as with this type of meter owing to the warmth of the shunt, moisture appears to be drawn into these inlets. Short circuits due to cor-

rosion will be found on the shunts in older types, but this trouble can be minimised by making the case as airtight as possible. If when reassembled the meter will run freely on 1/100 load, but the curve is too steep, it may be best to have the magnets remagnetised.

Landis and Gyr.—Commutator motor meter. Constant in revs. per unit on the smaller meters and in revs. per minute at full load on the larger and energy meters. No special tools required except balance to measure brush tension. Adjustments are made on the main circuit, which is easily accessible. On one class of meter there is no light load adjustment. The jewel is specially protected, which is not altogether an advantage, as it cannot readily be inspected. The worm on the armature shaft may cause trouble due to corrosion; a good feature appears to be the simple device to minimise damage in transit.

Calculations.—For meters whose constant (K) is stated in revolutions per unit.

$T \text{ secs.} = (3,600 \times 1,000 \times N \text{ revs.}) \div \text{volts} \times \text{amps.} \times K$.

Or $T \text{ secs.} = 3,600/V$ when $N/A = K/1,000$.

To obtain a suitable figure for N and a whole number for the revolutions in N secs., the following values are suggested:—

Volts	T secs.	N/A Revs./Amps. K/1,000
50	72	—
70	51.43	—
100	72	K/1,000 × 2
110	65.46	—
120	60.0	—
150	48.0	—
200	72	K/1,000 × 4
210	68.57	—
220	65.46	—
230	62.61	—
240	60.00	—
250	57.6	—
400	72	K 1,000 × 8
440	65.46	—
460	62.61	—
480	60.0	—
500	57.6	—

Example of use: Meter labelled 5,000 revs. per unit, supply at 210 volts. Count $N/A = 4$ K/1,000, or 20 revs. per ampere in 68.57 secs.

FAST.													T	SLOW.												
8	7	6	5	4	3.5	3	2.5	2	1.5	1	0.5	0	0.5	1	1.5	2	2.5	3	3.5	4	5	6	7	8		
55		56	57			58			59			60				61			62		63		64			
2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
44		45		46		47			48			49				50			51		52		53			
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40		
47		48	49			50			51			52				53			54		55		56			
31	33	34	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57		
62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86		
99	97	94	92	90	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69		
55		56	57			58			59			60				61			62		63		64			
2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
57	58		59	60			61					62			63			64		65		66		67		
60	61	62				63			64			65			66			67		68		69		70		
22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46		
53		54	55			56			57			58			59			60		61		62		63		
09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33		
66		67	68	69			70			71			72			73			74		75		76	77		
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48		

Example: Standard time T = 62.61.

Time of N revs. counted = 61.05, error = 2.3%. Fast.

THE SPIRIT OF GOODWILL IN ELECTRICITY SUPPLY.

By J. W. THOMAS, B.Sc., A.M.I.E.E.

THE recent decision finally to disband the Joint Committee which was appointed by the National Industrial Conference in 1919, and the apparent change of attitude on the part of the Government to the formation of a National Joint Industrial Council, brings again into the foreground the question whether the schemes for the re-ordering of the industrial world on a more humane and satisfactory basis, which men set their hearts upon during the war, have borne the fruits that were anticipated.

It will be remembered that when the war ended in 1918, the industrial world was in a state of ferment, and most of the large trade unions were contemplating putting forward comprehensive demands for increased control of industry, and were loudly clamouring for a better standard of living and for drastic changes in the industrial system. Employers were slowly recognising that the principal breakdowns that occurred in industry were not due to the plant, but to what the retiring president of the I.E.E. described as "the unlubricated working of the human element," and on all sides it was felt that now peace had returned, employers must not, as in the far-off days, wrestle and fight with each other in order to secure a larger share of the products of industry, but must learn to foregather round a table and there discuss their common interests, and devise amicable means for settling their differences. The machinery that was to enable them to avoid strife came to be known as "Whitleyism." Its adoption was seriously advocated by the Government, and the fact that large numbers both of influential employers and employes threw their whole enthusiasm and energy into the task of setting the machinery in motion in the more important industries, was sufficient attestation that the promise of success was a fair one. There were, of course, a few who looked upon the advent of Industrial Councils with suspicion and misgiving, and said of them, as Dr. Johnson said of the intention of a friend who was about to be married for the second time, that "they registered the triumph of hope over experience."

Three years or more have now passed since that time, and the recent dissolution of the national body which, in the words of the Prime Minister, was "to inaugurate the new era in industry" tempts one to inquire into the practical results which have been achieved in the meantime, and to endeavour to assess their probable value in the future, particularly as regards the electricity supply industry. The general query was very ably put by a writer in the *Scotsman* recently:—

"What has the experience of departmental chiefs been of the Whitley experiment? Have they found that it has promoted efficiency, or improved harmony? Do they get better and more willing work from their subordinates? If not, has the experiment justified itself in one of the respects for which it was most cordially approved? The National Whitley Council was to decrease friction and increase contentment and, by removing misunderstanding and adjusting grievances, was to create an atmosphere in which better work would be done. If these results have not followed, the experiment has failed in a vital particular."

There are many cynics who would unhesitatingly reply that Industrial Councils have been an unmitigated failure; that they were a war-time product, and that, like munitions, they must now be relegated to the scrap heap. The melancholy Jacques, however, is always with us, and we need not take his cynicism too seriously. At the same time, few would go to the other extreme and assert that they have achieved all that was to be expected of them. That they have been able to harmonise the relations between employers and employed, particularly in public services, and that they have been the means of preventing the itching sores of our industrial system from breaking out into malignant ulcers, few will deny. But in spite of this, there is something which they have

lacked, and it is that something which has prevented them from achieving such effective results as to silence the cynic. That something is wrong is evidenced by the recent secession of important municipalities, such as those of Hammersmith and Aberdeen, from the Industrial Council for the Electricity Supply Industry. Their action is no doubt due to their lack of appreciation of the possibilities that Industrial Councils offer, and partly to their desire to maintain control over their own staff, free and untrammelled by the bonds of any external authority. They have doubtless also been irritated by the decisions with which they have been deluged from what they consider to be some superior caucus in London, which will not allow them to carry on their work in peace. In a word, it is first because their own impression of the work of the Councils is purely a negative one as far as the assistance which they might render is concerned, and secondly, because they feel probably that these external bodies do not adequately represent them.

It will obviously be no solution of the difficulty to attempt to force these municipalities into line again and to impose upon them a scheme which depends fundamentally on good will for its effective working. If their attitude is to be changed, it can only be done by a frank and full discussion by both parties, and by resolutely facing the difficulties which have caused them to adopt their present outlook. They must, therefore, be given satisfaction on two issues, viz.:—

1. They must be convinced of the positive contributions which Industrial Councils can make towards assisting them both with regard to the harmony between themselves and their employes, and to the efficiency of administration.

2. They must be given adequate satisfaction on the question of representation.

With regard to the former, the probable reply of such a municipality as Hammersmith would be that its relations with its staff have always been harmonious, and that it does not require any external assistance to maintain that harmony. Even if such an assertion were made, we should be inclined to question its accuracy. There is in most municipalities an undercurrent of discontent, of which the average member of the Council is oblivious, and it only comes to the surface when the employes affected are able to make trouble. The non-occurrence of a volcanic eruption is not always a sure indication that the fires are not smouldering below.

But even were the statement true, allowance must be made for the new spirit which has come upon employes of all grades and classes, both manual and brain workers, and for the emergence of the desire for increasing control over the conditions of their working lives. The Whitley Report emphasised this, and more than a year ago the symptom was manifested at the annual conference of the National Union of Teachers, when a resolution was passed demanding "direct control of education by the teaching profession in partnership with the representatives of the public."

How the appearance of this new spirit is to be explained is of no consequence; it is there, and it will come to the surface. Nor will the demand of the employes be gainsaid. To try to crush it, or to ignore it, is to attempt to sit on the safety valve, with the attendant consequences when the explosion occurs.

There are many simple souls on councils and elsewhere who still believe in the good old days when the employer was the master, and when the employes were obedient and docile, and who think that those days will return if only the "agitator" and the "extremist" can be got rid of. But to believe this is to cherish a delusion as fatal as that of Canute when he endeavoured to check the progress of the advancing tide.

The desire of the employes for greater freedom must be recognised, and the latent forces possessed by their organisations welcomed and harnessed for the common good of the service, and of those who labour in it.

We can, of course, imagine the question being asked:—What difference will it make to the ordinary worker if he knows that he is represented through his organisation on a Whitley Council? The answer is that the difference will be manifested in the type of leadership, and will spring from the loyalty which he has to his organisation. He will feel that those whom he has elected have a say on any question which affects his particular work, and he will know that any innovations which are introduced have been discussed by them, and have met with their approval. The knowledge that there is always someone who can be relied upon to speak up for him and keep his end up will tend to eliminate the feeling that he is being imposed upon from above. His loyalty to his trade union will then be no longer an opposing force, but will be actively enlisted upon the side which endeavours to maintain the highest possible standard of efficiency that can reasonably be expected.

It is interesting to have the opinion of a reputed social psychologist like Prof. Graham Wallas on this point. In "Our Social Heritage," he says: "I have been for some years an elected representative of my fellow teachers on the governing body of my University, and I am convinced that my life and theirs is made better by the arrangement that representatives or the teaching staff shall influence university administration. I am also convinced that this benefit is not confined to the members of the particular occupation in which such a vocational element exists. I am more likely, as the world now is, to receive my letters and my coal regularly and conveniently if the unions of the postmen and the miners play a part in postal and mining administration: and the students of any university will receive better instruction if the organised teachers of the university help to govern it. Anyone who has worked in the hitherto unorganised occupation of journalism will feel that not only the personal happiness of the journalist, but the public good, would be increased if journalists belonged to a profession sufficiently organised to enable them to assert their self-respect against a bullying or corrupt proprietor. The feeling of human solidarity is so difficult to create under modern conditions that we cannot afford to leave unused for the purposes of social co-operation the unforced knowledge of each other, and the direct goodwill that may arise as an incident of common occupation."

Many municipalities have yet to learn that the primary value of Industrial Councils is that they help to generate a spirit of goodwill, and tend to remove that undercurrent of latent hostility which has hampered industrial development in the past far more than the effect of strikes. By dispelling the atmosphere of antagonism they enable both employers and employed to rise to the conception of combined action in pursuit of common interests, and so assist in laying the foundation for the consideration of constructive measures for the improvement of industrial conditions.

The spirit of goodwill amongst practical men is infinitely valuable, for it can find a way out of a difficulty where other methods fail. It has been proved again and again that regular contact breeds mutual understanding, and that when men meet round a table and work together for the good of an industry and of those who labour in it, a new sense of self respect is created.

This goodwill, however, can only be the outcome of the recognition of common interests. Employers must realise that they are under an obligation to the community to endeavour to form a sympathetic understanding of the lives and outlook of those who carry on their work, and be willing to co-operate without dictation or patronage in every endeavour to improve the conditions of their working lives.

In a public utility service, such as the electricity supply industry, both employers' associations and trade unions must learn to regard themselves as joint trustees of one of the most important industries in modern life. But the above principles can only be impressed upon municipalities in so far as the trade unions are prepared to give up some of their defensive outlook, and to devote more time to the consideration of those pro-

blems relating to the industry itself, which still await solution. They must cease to look upon the electricity supply industry as the key which will open the door of escape when they are in a tight corner in another industry, and they must give up the idea that the appeal to force is the only remedy and the short cut to the realisation of their demands. In short, the employees must realise that they have a direct interest in the welfare of the industry, both as producers and as citizens, and that they stand to benefit both from its efficiency and its smooth working. The other problem is that of satisfactory representation. After June 1st, 1920, assertions were made repeatedly by various electricity supply authorities that they were not properly represented on the National Joint Board; that, in fact, it was purely an autocratic and self-elected body. When it was pointed out to them that they were represented through their constituent associations, such as the I.M.E.A., their reply was that they had not given a mandate to the I.M.E.A. to act on their behalf. This attitude was very general and, in the writer's opinion, it was largely responsible for the inefficiency of the Board. The system of having representatives from the various associations of employers was, of course, in accord with the recommendations of the Whitley Committee, but experience proved that it was far from being effective, at least in the electricity supply industry, where one has to deal with municipal authorities whose connection with their Association is much too loose.

It would seem as if the better arrangement is the one recently decided upon by the N.J.I.C. and the N.J.B., viz., that the municipal representatives should be chosen direct from the District Councils. As this involves a total of 26 representatives on the employers' side (13 from the municipalities and 13 from the companies), it might appear to be open to the criticism of making the national bodies too cumbersome and expensive, but it is not likely to prove so in practice, as it will be very rarely that all the representatives on the employers' side will meet together. Its great advantage will be that it will secure greater co-ordination between the district and national bodies, and will do a great deal towards ensuring that decisions of both will receive the assent of, and loyal acceptance by, the constituent undertakings.

Another difficulty which has seriously hampered the effective working of the N.J.B. has been the representation of the clerical staffs. For many months they have been the Ishmaels of the industry—refused admission on the N.J.I.C., presumably on the ground that the N.J.B. was supposed to represent them, and at the same time cold-shouldered by the N.J.B. A resting-place will, we hope, be at last found for them on the National Whitley Council for Local Government Officers, though we are not sure whether they will be comfortable there or not. The decision of the N.J.B. that in future only the technical staffs will sit on the employees' side may make the Board more acceptable to the municipalities, but it is not so certain that it will simplify the problems which may yet confront the Industrial Councils in the industry. The danger is that it may have the effect of restricting the scope of the Councils almost entirely to questions of wages and conditions of employment, and will make it almost impossible for them to deal adequately with those larger questions, to solve which Industrial Councils were called into being. Instead of the employees in the industry being sectionalised, it may soon appear that the time is ripe for a statesmanlike attempt to be made in the direction of establishing a National Industrial Council for the whole of the industry, and to include all those who are engaged in it, manual, technical, and clerical workers. Such an all-embracing body would be in a position to deal effectively with those larger issues affecting the industry, such as administration and efficiency, and would be able to render invaluable service when trouble was likely to occur. It would also carry much more weight than the present sectional bodies, and would probably gain the respect and adherence of those municipalities which at present are standing outside the movement.

The questions of wages and conditions of employment of the separate sections of employees in the industry would be dealt with by separate boards or committees elected from the parent body.

It is not considered advisable to have a separate board for the clerical staffs; provision could be made for their salaries and conditions of employment to be dealt with by the National Whitley Council for Local Government Officers, which would have a liaison connection with the Industrial Council. Such an arrangement would give the clerical staffs what they are justly entitled to, just as much as the manual workers or the technical staffs, viz., a voice on the Council dealing with the industry, whilst at the same time it would avoid the overlapping with the other departments of municipal administration which has been a fruitful source of confusion in the past.

The solution of the problem of representation is at the root of all good government, and once it is satisfactorily dealt with, and all those connected with the electricity supply industry have a voice on the Industrial Council, and are brought to an understanding of its usefulness, it will mean a transformation in the spirit of one of those public services on the efficiency of which the community is so much dependent.

THE BRADFORD HOUSING SCHEME.

AN EXPLANATION BY MESSRS. HENLEY.

THE advertisement of the Henley wiring system which has appeared in several issues of the ELECTRICAL REVIEW has caused much comment, and, we believe, some doubts. It will be remembered that the advertisement stated that each wireman, with the aid of a boy, completed every day the wiring of two houses, each house containing nine lights. As some contractors seem to be sceptical about the statement, and as we put only the truth in our advertisements, we want to give an explanation of how it is done. Actually, the number of lights per house varies, there being seven, eight, nine, and ten, the two larger numbers predominating. But the number makes no difference to the rate of wiring, for the men wire two 10-light houses per day with the same ease as two 7-light or 8-light houses. This points to the fact that the men are making their own pace. Driving would not produce more, but the men have been known to do more on occasions.

In the first place, the organisation at the contractor's premises has something to do with the ultimate result. Everything is arranged and thought out beforehand, and the workmen get right away to work each day with a minimum of delay and on a pre-arranged plan, which obviates their stopping the actual work of wiring to "think things out." The wiring is repetition work, and each man gets through his job like an actor through his part, and according to plan. And each man is a *conscientious and loyal workman*, having his heart in his work.

It must be understood that the wiring is done while the houses are in more or less "skeleton" form, and before ceiling, laths or plaster have been put in anywhere. Our floorboards are fixed and slates are batten pointed. Thus, there is no cutting away to be done or waste of plaster for the sinking of wires. Holes, however, have to be cut through walls and joists, and the wires threaded through them. The holes through the joists, which are $\frac{5}{8}$ in. and $\frac{3}{4}$ in., are bored at least $1\frac{1}{2}$ in. from the bottom of the joist to ensure that plasterer's bath nails do not reach the wires. All the wires radiate to the various points *via* three-plate ceiling roses. Porcelain connectors were used on the first batch of houses, but these are now eliminated. The present method uses a little more wire, but that is more than compensated for by the saving in labour. Thus all wiring is buried under the plaster, and at switch

points it is protected by a short length of our S.T.3 protective covering.

Erection of fittings is not included in the time given. In order to ensure the best possible insulation test, the ends of the cable, after baring or preparing, are treated with a good insulating varnish to exclude moisture until such time as the houses are plastered, after which another equally conscientious workman erects the fittings and completes the work. The average test is about five megohms for each house. The working day is $8\frac{1}{2}$ hours, but from this must be deducted approximately $1\frac{1}{2}$ hours taken in travelling, so that the actual work of wiring two houses is done in about seven hours. Further, materials, tools, and scaffolding have to be removed from the last house wired to the next ready for wiring, which may be three or four hundred yards distant. This takes up considerable time.

The average number of lights per house is nine, each light being controlled by a separate switch.

The fusing arrangement on the consumer's side consists of a pair of 5-amp. porcelain plaster-lined cut-outs with a 5-amp. linked switch. The internal wiring consists of 3/0.29 in. our class Z.Z.M.F., and the main from the meter to the switch is 7/0.36 in. our class Z.Z.M.F. Three-plate ceiling roses are used for looping, and all the metal sheathing is very carefully bonded with standard clips, and earthed. Over 250 houses have been wired, and there has not been a single case of a low insulation test.

The contractors are Messrs. Jessop & Boydell, Ltd., of Bradford and Manchester, and to their enterprise in organisation, their skill in training, and the personal power which generates such a spirit of good-will in their workmen, the highest praise is due. The use of the Henley wiring system helped very considerably towards this highly satisfactory result, by facilitating the organisation of the work and the speed at which it was carried out.

This article has been submitted to Messrs. Jessop and Boydell, Ltd., before being sent to the Editors of the REVIEW, and they confirm everything in it. Moreover, their workmen are quite willing to give practical demonstration that the statements are correct, and that the work is done—and properly done—at the rate given.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New Speed reducing Gear.

The need for a simple and direct device for reducing the speed of a motor by any desired ratio without loss of efficiency has been but partially met by the expedients with which we are familiar, and therefore the "concentric speed transformer," which has been developed by Messrs. Biscock and Bramley, of Northton, Huddersfield, should meet with a cordial welcome. As indicated by its title, the driving and driven shafts are collinear. The "transformer" is self-contained, and is preferably coupled to the motor and the load through flexible couplings, which are also made by this firm. The speed ratio may be anything from 3:1 to 1,000:1, and even higher.

From the accompanying illustration it will be seen that the gear is of the planetary type, and that there are no small pinions or large wheels; the larger the gear ratio, the more closely alike are the pitch diameters. Referring to fig. 4, a vertical section, the gear planets *b* and *c* are carried by heavy steel plates bolted to the driving member *a*. The planet *b* engages with the fixed sun wheel *d*, this member being rigidly keyed to the gear case casting. The planet *c* engages with the driven sun wheel *e*. All gears are made from high tensile heat treated steel, their teeth being cut by a generating process.

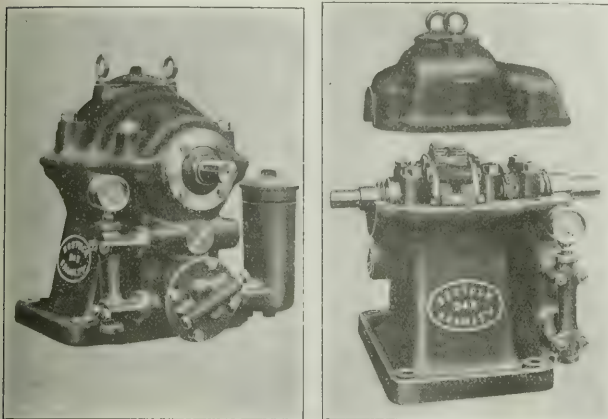
The planet *b* and *c* are in one piece, with no keyways or loose parts. Four sets of planetary gears are used for standard work, thus neutralising the frictional thrust of the gears, and these are mounted on heavy type Timken roller bearings.

The three main bearings are lubricated under pressure, through the passages marked *ff*, whilst oil is also forced, under

pressure, on to the teeth of the gears. There is no splash lubrication and no power lost through the unnecessary churning of a bath of oil.

The oil pump is driven by a chain, and the oil passes through a filter, seen at the right hand of fig. 1. The main

plaid by one cable or fed from both ends similar to a ring main. In the latter case (where the supply is tapped off either at three-phase or three-phase, four-wire main), by passing a loop between the houses, one tapping can be taken off the positive side and the other off the negative side, or off any



FIGS. 1 AND 2.—CONCENTRIC SPEED TRANSFORMER.

bearing caps are independent of the top cover, which can be removed without disturbing the mechanism. Any of the planet pinions can be removed without disturbing the shafts, and the filter can be removed for cleaning while the gears are in motion. The oil pump can also be withdrawn easily. No

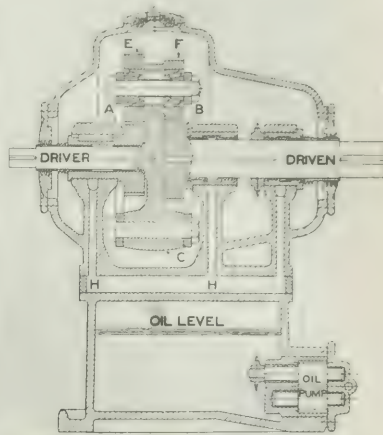


FIG. 4.—SECTION OF SPEED TRANSFORMER.

phase and the neutral. The balance of the system can be easily adjusted by altering the position of the links. As is the case with all "Henley" boxes, the entry of cables is efficiently provided for; ample provision for bonding is made; and armour grips can be fitted. The double-pole fuses are of the firm's standard H.O. pattern connected to the supply cable through special links which enable the supply of one house to

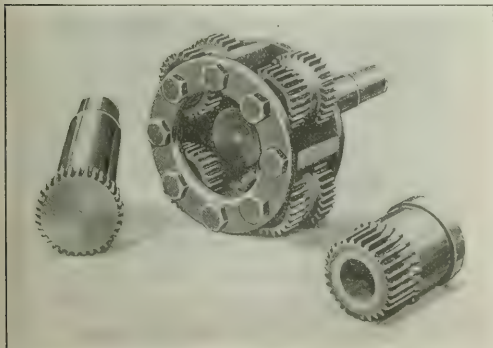


FIG. 3.—THE GEARS DISASSEMBLED.

attention is necessary beyond the addition of oil at long intervals.

The sets are made in seven sizes, to transmit from 10 to 250 h.p. (reckoned at 1,000 r.p.m. of driver, and a gear ratio of 5:1).

Safety Switch for Overhead Cables.

A correspondent informs us that he has invented a safety switch to cut out bare overhead cables, or tramway trolley wires, which has no parts to break, while the wearing parts are renewable and all parts are interchangeable. It can take up slack wire, and is operated by gravity. He claims that a broken line could be repaired, even by a tramcar conductor, in a quarter of the time now taken, and inquires whether there is a demand for such a device. Perhaps readers interested in this subject will give their views.

"Isco" Loop in Cut outs.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, E.C.2, who have recognised the necessity for reducing house service costs to a minimum, have sent us details of their new "Isco" cut-outs. The loop-in system in which these are employed reduces underground jointing, an expensive item, to very small proportions. By means of only two service connections a number of houses can be supplied, as the "Isco" boxes are adaptable to practically any feeding arrangement. A block of houses can be sup-

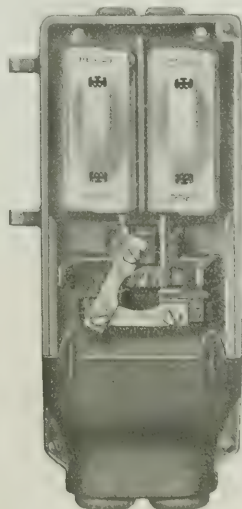


FIG. 5.—"Isco" LOOP-IN CUT-OUT.

be disconnected without interfering with the supply to other houses. The illustration (fig. 5) shows the arrangement for two twin cables entering vertically, with sealing chamber, link chamber, and fuses. The outgoing leads can be taken through insulating bushes or conduit.

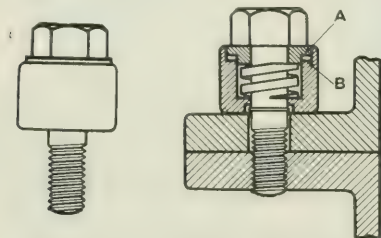
Flame-proof Mining Apparatus.

For years past the method to be adopted for rendering flame-proof electrical gear that is destined for use in fiery mines has been a vexed question, but a successful marshalling of the known facts has enabled the ENTERPRISE APPARATUS CO., LTD., of South Lambeth Road, London, S.W.8, to put forward the claim that it has solved the problem in an extremely simple fashion—namely, by the introduction of its patent relief bolt, as illustrated in figs. 6 and 7.

Stated briefly, the problem is this: the operation of most electrical gear, and certainly all switchgear, involves the mak-

ing and breaking of the electric circuit, which involves sparking, and in the event of an explosion occurring inside an enclosure containing electrical apparatus, it is essential to prevent the explosion from igniting explosive gases outside. This can happen in two ways: (a) The force of the explosion may rupture the enclosure and ignite inflammable gases outside, if no provision is made for relief. (b) Flames may be emitted through joints or openings in the case, or if an ordinary valve is fitted to relieve the rise in pressure inside the case, a spurt of flame may issue from the valve, and thus cause an explosion in the mine. The relief bolt comprises an ordinary bolt together with a spring totally enclosed in a dust-proof casing. The spring is under compression in its casing, and the latter is kept in position by a ring let into a groove in the bolt, so that the relief bolt forms a self-contained unit which cannot be taken to pieces, but is applied and used just like an ordinary bolt.

When used for holding a cover to its box, it is screwed up and the spring still further compressed until the indicating lip is flush with the cap. In this condition, a slight further com-



FIGS. 6 AND 7.—THE E.A.C. RELIEF BOLT.

pression is still possible, so that if the cover of a piece of apparatus is held on by relief bolts and an explosion should take place in the box, the cover will be allowed to lift slightly, and thus relieve the pressure inside, by allowing the products of the explosion to escape between the flanges of box and cover.

The cover is, therefore, in effect the relief valve, and the flames or hot gases which escape through the narrow space between the broad cold flanges of the box and cover are cooled to a sufficient extent to prevent the ignition of any inflammable gases which may be present in the mine.

The action will be obvious, but it should be added that the method has been tested by filling a box fitted with relief bolts with the most explosive mixture which can be met in a fiery mine, and placing the box in a chamber filled with a gas mixture of the most easily inflammable character. Under these conditions, the gas inside the box was exploded by means of an electric spark without causing any damage to box or bolts, and without igniting the inflammable gas outside. Relief bolts have been specially designed for mining use, but, of course, there are many other applications. The amount of movement can be varied and regulated, but having determined upon the amount of lift desired, the relief bolts are supplied so that the indicating lip is flush with the top edge of the collar when the bolt is screwed up to the proper amount. The function of the spring is merely to push back the cover after an explosion—not to resist the explosion. The thrust due to the explosion is taken by surfaces A and B, and unless otherwise specified, relief bolts are supplied to allow a lift of 1/32 in. They can be applied to any make of switch-gear, and are supplied for use as set screws, or as bolt and nut. The following approximate figures will serve as a guide to the internal pressure required to lift a cover that is held on by E.A.C. relief bolts: $\frac{1}{4}$ -in. bolt=14 cwt. per bolt; $\frac{1}{2}$ -in. bolt=2 cwt. per bolt; $\frac{3}{4}$ -in. bolt=34 cwt. per bolt. Thus, a cover 1 sq. ft. in area which is held down by eight $\frac{1}{4}$ -in. relief bolts will lift when the internal pressure rises to the equivalent of 8×14 cwt.=112 cwt., or in terms of pressure per sq. in.= $10 \times 112/144 = 7.7$ lb. per sq. in.

A New Trolley Wire Insulator.

The use of trolley wires to feed electrically-driven travelling machinery is now accepted as standard practice, and since its inception the standard tramway suspension for carrying the trolley wires (composed of a phosphor-bronze line hanger carrying a bolt covered with a moulded insulation, the line ear being screwed on to the end of the bolt) has been used.

Fig. 8 shows one of these bolts and the carrier after a few months' use in a gas works, a short circuit having developed due to surface leakage between the line ear and the phosphor-bronze carrier.

After extensive tests, vitreous porcelain was found to be the only suitable material which would maintain its insulating properties when exposed to the weather and fumes which are common in towns, gas and chemical works, collieries, &c.; and knowing it would stand about 16,000 lb. per sq. in. in compression, an insulator was designed of suitable shape to be easily fixed in the place of the discarded standard suspension, with all strains mainly in compression, providing a long path

to overcome surface leakage, due to rain and snow, deposits of soot, coal and coke dust.

The method of fixing can be varied to suit the structure which carries the trolley wires; fig. 9 shows one of these insulators mounted on the superstructure of a trolley track.

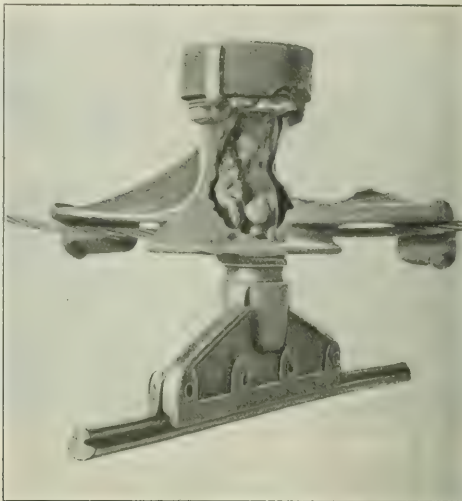


FIG. 8.—OLD TYPE OF SUSPENSION INSULATOR.

The insulator consists of one piece of vitreous porcelain comprising in combination in a unitary structure a recess, receiving the head of the suspension bolt, which is covered with a

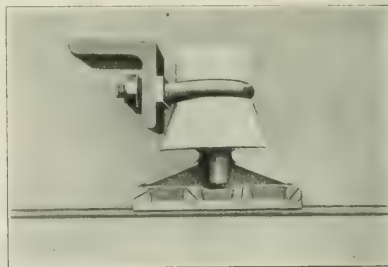


FIG. 9.—NEW TYPE OF SUSPENSION INSULATOR.

non-hygroscopic cement, a groove being substantially vertically below the recess on which the bolt head bears, which is used for suspending the insulator with a "U" bolt or suspension wire. The bottom of the insulator is recessed to accommodate a nut on the bolt to take the strain of the trolley wire by any upward thrust on the bolt due to the trolley arm, which thereby comes upon the porcelain in compression.

These insulators have proved successful on several of the largest gas works and coke oven plants in England; they are covered by patent No. 119,382, and may be obtained from the BENN MANUFACTURING Co., 36, Ladywood Road, Birmingham.

We are indebted to Mr. H. R. Lamb, A.M.I.E.E., of the City of Birmingham Gas Department, for the above illustrations and particulars.

Postal Parcels by Air. The Postmaster-General announces that, in extension of the facilities already provided for the acceptance at certain post offices of parcels for transmission to Paris by aeroplanes, arrangements have been made for a second dispatch of air postal parcels on and from September 1st. The new dispatch will enable air parcels for Paris to be posted at certain post offices in London on the morning of dispatch, and at certain provincial towns up till a later hour overnight than is at present possible if connection is to be made with the existing dispatch. Delivery should normally be effected in Paris on the day of dispatch from London by either service.

ELECTRICAL VEHICLE RESULTS.

Bootle Corporation's Experience.

The Bootle Corporation's electric vehicle fleet consists of 13 vehicles employed on a big variety of local services. The machines comprise two 5-ton and two 3½-ton Electromobiles, two 5-ton General Vehicles, and seven 5- and 3½-ton Orwells. They are all tipping lorries, and the body capacity of the largest is 8½ cubic yards. I.M.V. batteries are employed.

Before considering the economical aspects of the Bootle electric haulage system, it should be pointed out that in arriving at the final working costs, liberal amounts were placed to the sinking fund, stores, depreciation, and loan charges, and these amounts were approximately equivalent to the cost of two new vehicles each year. Depreciation for batteries was calculated on a guaranteed life of two years, within which period a new battery is provided for, but, as a matter of fact, the Motor Vehicle Committee expects to get a life of two and a half or three years each. The Corporation funds benefit by the department to the extent of £740 for electrical power, £554 for rent, and £275 towards the treasurer's department, which, of course, would not accrue if this department were not set up.

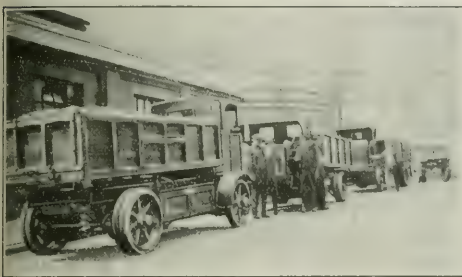


FIG. 1.—TRANSPORTING COAL ELECTRICALLY.

The fleet represents a capital outlay of £22,731, and the surplus on the trading account of £3,541 is equivalent to a profit of 15 per cent., after allowing for reserves. The net profit is given as £1,387, or 6 per cent.

In view of the fact that this is the first year's working, the results are regarded as very satisfactory, particularly as they were attained during a transition stage when the department had only temporary gear, i.e., temporary charging facilities, &c., which proved expensive for the first few months' working.

A new type of switchboard was designed by the motor superintendent, and has effected a saving of about £500 per annum, and Councillor J. Scott, A.M.I.E.E., chairman of the committee, claims that this is one of the most efficient types of charging plant there is in the country. He points out that it must be remembered that the average time each vehicle was in commission was only 7.1 months, and up to June 30th



FIG. 2.—AN ELECTRIC REFUSE-COLLECTING VEHICLE.

the total tonnage weighed was 28,549, and the total mileage travelled was 24,552. Very careful records had been kept by the motor superintendent, which enable the committee to give the exact cost of the work done by the vehicles.

Mr. Scott has noted no published account regarding motor traction on corporation work that indicates that any town is doing better than Bootle, and he advances the opinion that if a rearrangement of the supervision and control of the men working in conjunction with the motors was made, with the fleet of vehicles the Corporation possesses, it would stand well to the front on running costs.

The Birmingham Corporation has a fleet of 32 electric vehicles, and tests have been carried out employing motors on the outer circle and horses on the inner circle. The motors travelled double the mileage of horses, and visited 2½ times the number of houses, showing a saving of £125 per annum on each vehicle.* The cost per house visit is as follows:—

Horse wagon (continuous system) working in the inner area, 3.22d. per house per week.

Electric vehicles, ditto, 2.94d. per house per week, showing a saving in favour of the electric vehicle of 0.28d. per house per week.

The committee advises the purchase of more electric vehicles when the financial position becomes easier.

The Bootle motor superintendent gave an opportunity to one of the leading makers of petrol vehicles to carry out some of the Corporation work, but they were warned that petrol vehicles were not suitable. The makers, however, were very sanguine that their vehicles would very easily do the work. The vehicle arrived with the head salesman and special testing staff, was loaded and sent to the tip, with the result that it sank into the soft ground and could not extricate itself. One of the electric vehicles was attached to the petrol vehicle, and easily pulled it out of the soft ground. It might be as well to mention that the petrol vehicles referred to were specially designed and built for corporation work. On the completion of the test the representatives of the firm agreed that the petrol vehicles were not suitable, and stated that they would not have believed it if they had not seen it for themselves.



FIG. 3.—AN ELECTROMOBILE AT THE BOOTLE ELECTRICITY WORKS.

The total cost for horse cartage for 1920-1921 was 12.29s., against 9.6s. per ton for the motors. The increased cost of haulage was due to shorter hours, increased cost, and principally to the lack of co-operation.

Mr. Scott states without fear of contradiction that the motors could do much more work, and effect a very considerable saving to the ratepayers, if the whole of the men loading vehicles and collecting street refuse were put under the motor superintendent's charge. He quite agrees that there are certain jobs which can be done cheaper by horses than motors, but as they had the motors unprofitable jobs could be done in conjunction with other work, thereby reducing the cost of that particular work.

As regards street sweeping and gully emptying work, the following comparative results are given: One motor (electric) and five men emptied 80 gullies per day at a cost of 2.18s. per gully, against one horse and one man who emptied 16 gullies at a cost of 2.68s. It is believed that one electric vehicle would replace five horses on this particular work.

On street watering one electric vehicle carried 43 loads, covering 22 miles in one day, as against 23 loads for six miles by one horse. If a 900-gallon tank were supplied, as has been proposed, one vehicle would replace four horses on this particular work. On the Highway Committee's work the contractors' price is 6s. 6d. per ton from the docks; motors have carried out this work at a charge of £5 15s. per day, which works out at 5s. 7.66d. per ton.

* ELEC. REV., June 24th, 1921; p. 804.

A record was taken for the years 1920-1921 for seven weeks, during April and May of each year, on the collection of house refuse, with the following results:—

In 1920 14 horses were used and three electric vehicles; the total tonnage removed was equal to 37 tons per horse per week, and 7 tons per motor per week.

In 1921 six electric vehicles and two horses were used with the following results: 73 tons per motor per week, and 25 tons per horse per week.

On street sweepings, shop refuse, and gulleys in 1920 14 horses were used, equal to 6.7 tons per horse per week. Shop refuse, 2.28 tons per horse per week. Gulleys, 45.4 cwt. per horse per week. In 1921 three electric vehicles were used as follows: Street sweepings, 23 tons per motor per week. Shop refuse, 10.4 tons per horse per week.

On the Sanitary Committee's work it has been found that one electric vehicle is equal to from three to five horses. The average load of horses was 25 cwt., and on one week's average, the following details were ascertained, showing the comparative costs:—

Thirty-three horses removed 174 loads, total weight 236 tons 18 cwt., at a total cost of £82 17s., or 7s. per ton.

One motor removed 36 loads, trailers 18 loads, a total weight of 156 tons 14 cwt., at a total cost of £31 12s., or 4s. 9d. per ton.

All these costs are based on 32s. 10d. for horses per day, and 45 15s. per day for motor vehicles; that is, the cost to the committees concerned, and not the motor vehicle department's net cost.

In conclusion, reference may be made to the accompanying illustrations which show three electric lorries carrying slack coal to the electricity works (fig. 1), refuse being tipped into a canal barge (fig. 2), and an Electromobile vehicle (fig. 3) that is also engaged in conveying coal to the electricity works.

DUST REMOVAL EQUIPMENT.

In connection with the discussion on the technical aspect of vacuum cleaner design which has been proceeding in our columns, our attention has been drawn to a paper entitled "Dust Removal Equipment as Applied to Residences, Offices, Public Buildings, &c.," which was read before the INSTITUTION OF HEATING AND VENTILATING ENGINEERS (INCORPORATED) by Major R. GRIERSON, in February last. The author, by virtue of his position as engineer to a large undertaking owning many cinematograph theatres throughout the country, is naturally interested primarily in the type of dust removal equipment which is adapted to the requirements of large public buildings, usually involving the installation of stationary power-driven exhausters at a central point, connected with a system of piping laid to all parts of the building and provided with hose inlets at suitable points. Much of the paper, however, relates to features which are common to all applications of the vacuum cleaner, and the author believes that it is the first paper presented to a British Engineering Institution on this subject, which, as he truly remarks, has not yet been placed on a satisfactory scientific basis.

The author divides the equipment into two broad classes: Carpet cleaning (including tapestry, chairs, curtains, &c.), and bare-floor cleaning, including walls, &c. In carpet cleaning it is possible to obtain more or less intimate contact between the carpet and the cleaning tool, and hence to maintain a relatively high degree of vacuum inside the tool. On the other hand, in floor cleaning, it is not possible to obtain a tight joint between the tool and the surface to be cleaned, and a high degree of vacuum is not employed.

Dealing first with the former, the author points out that almost every type of carpet offers very considerable resistance to the passage of air, necessitating a considerable vacuum within the cleaning tool. Glue-sized-back carpets are practically impervious to air, which must, therefore, pass through the pile; in cleaning curtains a large proportion of the air passes through the fabric.

From the consideration of fundamental principles the author draws the conclusion that when intimate contact can be obtained between the surface to be cleaned and the cleaning tool, a fairly high degree of vacuum should be carried and a small quantity of air should be used, at a high velocity. These conditions also tend to permit of the minimum sizes of pipe and minimum energy losses. In bare-floor cleaning a relatively small vacuum will induce the flow of a large volume of air. In this connection he points out that experienced cleaners paid on the piece-work basis for carpet cleaning invariably select the smallest available cleaning tool, in order to obtain a high vacuum and high air velocity, although the labour involved in covering a given area with a small tool is greater than with a large one.

Turning to details, the author recommends that the "renovator" (the fitting placed in contact with the surface to be cleaned) should not be longer than 12 in.; for average work the slot may with advantage be 5/16 in. wide, and not more than 2 in. A wide slot allows the carpet, if not too stiff, to rise slightly into it, thus beating the dust. The lips of the renovator should not be too sharp, otherwise the tool will sink into the carpet, involving additional labour and undue wear on the carpet. Efficiency tests must be made on natu-

ally soiled carpets, as figures obtained from carpets artificially soiled have been found to be very unreliable.

The effort required to operate a 12 in. x 5/16 in. renovator with a vacuum of about 8 in. mercury on a "Brussels short" or "velvet with glue" carpet has been found to be 18-20 lb., with an expenditure of about 1/2 h.p. at the renovator. On linoleum, with a vacuum of 13 in., the pull was 23 lb., and the power consumption 0.35 h.p. Generally speaking, a vacuum of at least 2 in. mercury is necessary to do even fair work, and 4 to 4 1/2 in. for first-class work, but it should not exceed 5 in. The width of slot should be greater than the height of the nap of the carpet, and the wearing surface of the tool should be of steel or cast iron. For bare-floor cleaning a felt-faced tool is useful. The handle, through which the dust-laden air passes (with a piping system) should not be less than 3 in. bore or more than 1 1/2 in. for a carpet cleaner, and not less than 1 1/2 in. for a bare-floor cleaner. Steel is desirable for the handle, to resist the cutting action of the dust, and right-angle turns must be avoided. The hose is generally 25 or 50 ft. long, 1 to 1 1/2 in. bore.

Many details regarding hose inlets, piping, &c., are given in the paper. The size of pipe should be such that the air velocity is not less than 2,400 or more than 9,000 ft. per minute, and care should be taken to avoid pockets in which dust can collect, and to provide means of cleaning the pipes at any time. Risers should not be less than 2 in. in diameter.

For separating the dust from the air, a combination of an efficient centrifugal or gravity separator and a bag of liberal proportions is recommended; a good centrifugal separator will remove 95 per cent. of the dust.

Various types of exhausters are available, but the ideal machine has yet to be devised. Rotary pumps of the Roots type have the advantages of minimum wearing parts, low speed, quiet running, and economy in first cost and maintenance, but the load on the motor is greatest when no hose inlets are connected. Centrifugal fans keep a fairly constant vacuum, but have to run at a very high speed.

The paper concludes with a section on selecting and testing plant. Three classes of work are considered: Bare-floor work (1/2 to 2 in. vacuum), ordinary carpets, &c. (1 1/2 to 3 in.), and heavy carpets (3 to 5 in.). The plant is rated on the basis of two of the following items: Volume of free air, vacuum within the renovator, or equivalent working orifice of the renovator. The first and last of these are connected by the formula: $Q = 66 \sqrt{A \cdot V}$, where Q = cubic ft. of air per second, A = area of orifice in sq. in., V = head of mercury in inches. Thus, from a table, we have for a residence an equivalent working orifice of 1/2 in. for carpets, a vacuum of 2 in., air-flow 18 cu. ft. per minute, and a consumption of 57 watts. For a large office, using the same orifice, a vacuum of 4 in. gives an air-flow of 26 cu. ft. per minute, and a consumption of 165 watts. A portable type, with equivalent orifice 1/2 in., and a vacuum of 1 in., gives an air-flow of 20 cu. ft. per minute with a consumption of 32 watts.

A convenient instrument for testing is described, and the following formula is given connecting the volume of air in cu. ft. per minute (V), corrected for pressure, with the vacuum in inches of mercury at the point tested (P), and the power expended in watts (E):—

$$E = 1.59 VP.$$

This expression enables figures to be obtained for the power developed at the renovator, the losses in each section, the efficiency of the exhauster, and the overall efficiency of the plant.

A specimen test of vacuum cleaning plant is appended to the paper, from which we gather that the vacuum at the orifice was 4 1/2 in. at the hose inlet 5 in. (50 ft. of hose), at the separator (125 ft. of 2-in. pipe) 5 1/2 in., and at the exhauster 6 1/2 in. The efficiency of the exhauster was 51.2 per cent., and the overall efficiency of the plant (motor input to renovator output) 21.6 per cent. Other appendices relate to a proposed standard test, technical data required for a comparison of tenders, and a chart of air-flow for various orifices and vacua.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

A Motor Problem.

With reference to your correspondent's inquiry under the above heading, I think the trouble is due to the machine being designed for 50 or 60 cycles. I presume it is a 6-pole machine, which would give an approximate speed of 500 revs. per minute, which is out of proportion for that size of machine. I shall be pleased to give Mr. Davies any further information he may require or test the machine for him on a 50-cycle current.

A. C.

September 3rd, 1921.

It is very evident from the letter of Mr. Davies that he has had very little experience with a.c. motors. According to him the motor is not provided with a name-plate—"absolutely no

information," to use his own words. He next informs us that the h.p. is 0.5. How did he discover this, or that the motor is suitable for 230 volts?

It is fairly certain that it was designed for a periodicity of something in the neighbourhood of 60 or 80 cycles. An induction motor having 6 poles and run on a 25-cycle supply would only have a speed of 500 r.p.m., less the slip.

It is impossible to have the motor wound to run on 25 cycles without materially reducing the horse-power, as being designed for a much higher periodicity, there will not be sufficient iron in the stator. Again, it is very doubtful whether there will be enough clearance between the stator and the end-shields to get, say, a 2-pole winding in.

I would suggest that Mr. Davies should take his motor to some firm of winding specialists, of whom there are several, and have the winding re-designed.

Robert Swindlehurst.

London, S.W.
September 3rd, 1921.

A Question of Sincerity.

You will perhaps be interested in the cutting attached.

When I read the sentence in your issue of August 19th, I thought how little the writer of it really realised what his words implied, and how little importance his readers would attach to them. Otherwise those words would never have been written.

It occurs to me that in electrical, or any technical matters, words in your journal really mean what they appear to mean, but when your writers touch on matters sociological, there is no need for truth—cold scientific truth—and the ordinary careless conventional phrases will suffice. . . . Anything will do!

I challenge you to assert, in your next issue, that you really mean that ALL should work—all who are capable—not their hardest (which is an absurd proposition), but that they should work fairly hard.

F. W. Shorrocks.

P.S.—Are you aware of the number of able-bodied parasites in this country in normal times?

London.
September 2nd, 1921.

[The cutting referred to reads as follows:—

Here's more evidence of the Bolshevik conspiracy to compel the idle rich to work:—

From the ELECTRICAL REVIEW of August 19th, 1921 (leading article):—

"What we ought all to be doing now is working our hardest and bearing whatever sacrifice is necessary, in order to keep alive the industry by which we live."—*The Forward*, Glasgow.

We really mean that ALL should work; we mean just what we said. Why should we not?—EDS. ELEC. REV.]

Flickering Light.

In a works taking a 25-cycle bulk supply for power and lighting I, personally, find that the flicker is quite noticeable with vacuum-type lamps, but is rather less pronounced with gasfilled bulbs.

However, from inquiries made in the shops, I have come to the conclusion that there is a certain amount of personal element in the matter, as some men seem to find the light more trying than others.

I should imagine that the continual flicker, however slight, would be very bad for the eyes, especially when doing close work such as tool making, &c.

Stuart F. Philpott.

Birmingham.
September 1st, 1921.

Supply Without Statutory Powers.

I should be very glad of information, if it is available, as to the probable attitude of those who will control the supply of electricity in the various districts under the new Act, towards the many unauthorised undertakings which have sprung up of late years.

The people interested in these small plants have in many cases provided a welcome supply of current since years before the new Act was contemplated, in districts where the local authorities would not move, and some of them are now naturally anxious to know their probable fate. I can find nothing in the Act which seems to me to apply in these cases.

I take it that strictly they have no *locus standi* at all, and that the moment a supply becomes available under an order obtained by the local authority they must clear out and sell their tackle for what it will fetch.

At any rate, information from someone with knowledge would clear the air for those interested, and perhaps save them some useless expenditure in the interval between the present time and the introduction of a statutory supply.

By the way, I should like enlightenment on the merits of the claim for cheap power supply under the new conditions. In this district, for instance, I believe contracts are being made between local authorities and a hydro-electric company on the basis of 1½d. per unit delivered at the authorities' boundary. They must, I think, stand the expense of transforming down, and certainly of distribution. In this event, is 2½d. too high an estimate of the final cost to the consumer?

If not, the cost per h.p.-hour is over 2d. at 90 per cent. efficiency.

But, with a small and very simple high-compression paraffin engine, starting from cold, a h.p. hour can be obtained for about half a pint. This at 1s. 4d. a gallon (some was bought here at 1s. 1d. the other day) costs 1d. I

I leave the crude-oil engine out, and take a class of engine which is cleaner in running, and is being sold to-day in sizes as low as ½ h.p.

The electric motor has undoubted advantages in the way of cleanliness, compactness, and general handiness, especially for intermittent use, but the claim of cheapness, even in small powers like this, at the price mentioned, seems to require substantiation.

A. O. G.

September 2nd, 1921.

[We refer to these questions in our leading columns to-day.—EDS. ELEC. REV.]

Trade Terms and Direct Trading.

I was very pleased to read "Half What's" letter in the current issue of the ELECTRICAL REVIEW.

I recently had a customer in—a motor engineer who ordered up a special voltage lamp. I got these, but when I produced the account showing list prices I was met with: "I get 20 per cent. off list price from —." I looked up the "E.L.M.A." list, but was unable to find his name. I pointed out to him that I was unable to sell to him at less than listed prices. As I know him very well he paid the price.

I communicated with the firm he told me he got discount from, and much to my surprise they wrote me and informed me that my customer's statement was correct, and that I should be quite in order in allowing him a discount. I do not propose to do this, as when one has to pay postage on all lamps that prove faulty, there is not much got out of it.

There is one firm in particular which makes a practice of giving trade discount to those not one bit interested in the electrical profession. I think it is time that the Electrical Contractors' Association studied their members in other ways than by approaching firms of certain repute to give extra discounts to their members. Many of these firms are not even patronised by the members.

M. F.

September 3rd, 1921.

The E.P.E.A. Schedule and Economy Stunts.

As a demonstration of splenetic vehemence, the letter of "Anti-Bunkum" in your last week's issue has its points. He lashes himself into a fine frenzy of scorn and indignation, and punctuates his diatribe with a profuse array of exclamation marks over what he is pleased to characterise as the "bragging letter" of the E.P.E.A.'s General Secretary.

And yet, it seems to me, he misses the entire point of the latter communication, which, as I read it, was intended as merely an emphatic restatement of the principle for which the Association has always stood, viz., unwavering support of constitutional action for the adjustment of differences regarding salaries and working conditions of staff engineers.

In the two cases cited by Mr. Jones, this principle was directly involved and successfully upheld, and, if the upholding of it has produced the "disgust and contempt" of the Committees concerned, it is to be deplored—almost as much so as the tone adopted by "Anti-Bunkum."

This gentleman does not state whether he is a member of the E.P.E.A. or not. If not, his comments may be quietly ignored; if he is a member, his views, as expressed, are so antithetic to all that the Association stands for that his connection with it is quite inexplicable.

His fulminations would have been more effective had he possessed sufficient courage to sign his real name in place of a pseudonym. His example in this respect I do not propose to follow.

W. H. Simpson.

Manchester.

September 5th, 1921.

[Other letters in similar vein have been received too late for insertion.—EDS. ELEC. REV.]

A Warning to Contractors.

In April last I had a traveller call upon me representing a firm I had not previously done business with. I gave him an order. This was a cash transaction. A few weeks later I forwarded another order. Early in July the firm wrote me for a settlement. I replied that I would forward cheque in the course of two weeks. The account was for £20. The week following my letter I was served with a writ to appear in London, &c. The costs on this brought the account up to £40. I wrote to the firm, but my letter was ignored. I saw my solicitor, who took the case up, and would not agree to my paying in full settlement, as he informed me the plaintiffs' solicitors were "sharks," who were out for costs. He placed before them an agreement, which they accepted, namely, paying half the debt and costs on the 15th of the month, the balance on the 15th of the following month. Owing to the delay in post, my cheque was not received by the plaintiffs' solicitor until the 16th. On the 15th of the month a further summons was issued, and, naturally, further costs.

Now, Sirs, I call that a scandal. During the recent labour troubles business was dead, and there was absolutely no money coming in at all.

I had a case some time ago which I reported to my Association, who are supposed to look after their members' interest. (This is in their rules.) I was told that they could do nothing.

I suggest that the best method to adopt is to patronise old standing firms, and not shoddy factors. I should be glad to hear your views.

A Once Bitten Contractor.

September 2nd, 1921.

A Novel Sign.

The other evening, whilst standing outside the Harrow Cinema, I observed a sign which read: "To the Tea Lounge." What drew my attention, was that the letters themselves were glowing, and apparently hanging in space. On examining them more closely, I perceived that the letters were enclosed in a bulb, shaped like the small "3-watt" lamps, and fitted with a bayonet cap. As far as I could see, only one wire led from the cap to the letter, and the other terminated in a horizontal bar, placed very close to, and behind the letter. There was no filament of any description, visible, but each letter glowed with a pale, pinkish light. There was one complete lamp to form each letter.

I should be extremely obliged if someone would kindly explain the working of this lamp.

E. H. K. P.

August 30th, 1921.

[Probably the lamps were of the Neon gas type, which have no filaments, the gas itself being the source of light as in the Moore tubes. Neon tube lamps can be made in the shape of large letters and signs, glowing with a beautiful orange colour.—EDS. ELECTRICAL REVIEW.]

Carpets and the Electric Suction Cleaner.

Your correspondence regarding the brushes as used on the broom type electric cleaners is interesting. For anybody to condemn either sort is foolish, for it can be proved that an electric cleaner can be made to clean carpets efficiently—

- (1) without a brush;
- (2) with a stationary brush;
- (3) with a five-to-one gear-driven brush;
- (4) with a belt-driven brush.

It is a proved fact that lint and tiny pieces of cotton are difficult to remove with suction alone from some types of carpets, and the brush just does the necessary and assists this operation. There is no need for a complicated belt-driven brush; it does no good and often creates a great deal of trouble, for the belts are sure to wear and break. Of course, there is always the possibility of damage being done by a brush revolving at 3,000 or 4,000 r.p.m. on a carpet. Try the experiment of placing underneath a belt-driven brush for ten minutes a piece of blotting-paper or underfelt, and note the results.

The "five-to-one" geared brush as used on the "Universal" cleaner is without a doubt the simplest and best. It creates the desired amount of resistance and performs its duty satisfactorily. It leaves the cleaning of the carpet to be efficiently carried out by the strong suction created by the fan connected with the guaranteed motor.

L. G. Hawkins.

London.

August 30th, 1921.

I am very pleased to see that we have at least one person who has the proper idea of vacuum cleaners, come forward in the interests of simplicity, and would respectfully point out that as an interested party in these matters she has struck the proper note.

Simplicity is the chief feature of the machine that I had in mind, but as I did not expect non-technical readers to take an interest in the REVIEW it now becomes my duty to explain for the benefit of such readers that any purely "suction" cleaner is naturally simple.

Having no brush, it does not need anything but using and putting away; no brush to clean, no belt to adjust, no gears to see to anything but simpler.

The need of a powerful suction has been misunderstood; I only imply that the suction should be sufficient to do the duty, but on any machine with a brush you never find a good suction, hence the need of the brush.

I hope your reader will be satisfied with my explanation, but in any case I shall be happy to be at her service on cleaner problems.

C. B. Oates.

London.

September 6th, 1921.

High-pressure Transmission Line Insulators.

Perhaps the following troubles I have experienced might interest your readers and afford me a way out of my difficulties.

Some time ago I carried 25 miles of 33,000-volt transmission line. This is continuous, anchored every mile on steel

towers with pin insulators, and is through virgin jungle in rough country, with the usual lightning arresters at each end only.

Since it has been put in commission it has twice broken during storms, apparently from a direct hit about a foot away from a pin insulator on the outside wire. Arcing had taken place, as the line was marked for about a foot each side of the break, though the insulators were not damaged.

Moreover, the power station switch trips very often on overload. On more than one occasion birds have been seen to alight on an insulator, and on spreading their wings to take flight, have touched the tower and caused a short circuit. Quite a number of birds have been picked up by the inspectors underneath towers, burned.

I was on a 16-mile line in every respect similar to this, except that suspension insulators were used. In two and a half years I cannot recall a single instance of similar trouble.

This points to the unsuitability of pin insulators where there are birds with large wing span. Now, as pin insulators, especially on straight runs, are cheaper and more advantageous in every way, I would like to know if any firm manufactures a "ceiling" type suitable for the strain of line work. These fitted underneath a bracket would be protected from lightning, and would not offer a resting place for birds.

R. E. Golden.

London.

August 8th, 1921.

LEGAL.

ALLEGED IMPROPER USE OF ELECTRICITY.

At the Dublin Southern Police Court, on August 29th, Miss Bolger, of Ranelagh, a lodging-house proprietress, was summoned by the Pembroke (Dublin) Urban Council on a charge of improperly using electricity supplied by the Council.

It was stated that a meter inspector visited the house and found that one of the slot meters had been altered in such a way that the full quantity used was not being registered. The inspector admitted that this must have been done by someone with technical knowledge. The defendant denied the charge, and the Magistrate considering the evidence against her insufficient, dismissed the summons, but without costs.

EXCESSIVE TRAMCAR SPEEDS.

At Scarborough, last week, W. Thomas and H. Dale, drivers of cars belonging to the Scarborough Electric Tramways Co., were summoned on charges of exceeding the speed allowed by the Board of Trade Regulations. The Chief Constable said as it had become obvious that cars were being driven down Vernon Place and Eastborough at a quicker pace than four miles per hour, the limit in such dangerous places, he had had observations and timing made. Thomas had driven over a measured 110 yards at the rate of eight miles per hour, and Dale had driven over a measured stretch at 8½ miles per hour. Defendants, pleading "Not guilty," said they had no idea they were going at such speeds. They had no speedometers, and it was difficult to judge speed. As they were the first cases of the kind the Bench dismissed the summonses on payment of 4s. costs, and suggested that, whilst the cases should be a warning to drivers, the Tramway Co. might give more particulars to help the men to keep within the speed limits.

Dust Explosions.—A bulletin recently issued by the United States Department of Agriculture asserts that all electric lamps in places where explosive dusts are present should be equipped with vapour-proof globes protected by heavy guards to prevent breakage. Dangerous practices, such as the use of open wiring, drop cords, and unprotected lights, are condemned.

It is believed that any combustible dust will ignite if allowed to collect on the lamp in sufficiently thick layers and remain long enough, probably due to the fact that the very chaffy dusts collected on the globe form a blanket which prevents radiation of the heat generated in the lamp and raises the temperature of the bulb to the ignition temperature of the dust. Some of the dusts seem to melt or congeal and form on the globe a crust which does not burn readily. During a recent campaign to prevent dust explosion about 20 cases were reported where explosions or fires were supposed to have been started by the ignition of dust which had settled on the lamp or by the accidental breaking of the electric lamp in a dusty atmosphere.

Under ordinary conditions, with the small lamps commonly used in industrial plant, and with free circulation of air about the globe, the specialists believe it unlikely that fire will start readily. They recommend, however, as just stated, that all electric lamps be equipped with vapour-proof globes.—*Electrical World.*

BUSINESS NOTES.

Bankruptcy Proceedings.—F. BARRACLOUGH, electrical and mechanical engineer, late of Eastcliffe, Lightcliffe, near Halifax.—Receiving order made August 30th on debtor's own petition.

J. W. GLADWIN, electrical engineer, Sheffield.—First and final dividend of sd. in the £, payable on September 13th at the offices of Poppleton, Appleby & Turner, 155, Norfolk Street, Sheffield.

S. H. DOUGHERTY (Messrs Electric Co.), electrical engineer, Liverpool.—Last day for proofs for dividend September 21st. Trustee, Mr. H. W. Bowler, 30, North John Street, Liverpool.

Company Liquidation.—SUTTON-IN-ASHFIELD MOTOR AND ELECTRICAL ENGINEERING CO., LTD., Sutton-in-Ashfield.—A meeting of the creditors of the above was held recently at Nottingham. Mr. J. Keetley, C.A., submitted a statement of affairs showing ranking liabilities of £5,404. Of that amount £1,668 was due to unsecured creditors and £3,736 represented an unsecured amount due on debentures. The assets were estimated to realise £15,416, from which had to be deducted £61 for preferential claims and £7,009 due to the first debenture holders. This left a balance of £8,346 to meet the claims of the second debenture holders, which amounted to £12,081. The balance was insufficient to fully discharge the claims of the second debenture holders, who were unsecured for £3,736. The assets were as follows: Cash in hand, £1; good book debts, £835; doubtful and bad debts, £715, estimated to realise £200; stock-in-trade, £839; tools, fittings, and utensils, £621; charabancs, lorries, and cars, £5,100; machinery, £746; freehold land and buildings at cost, £7,071; and calls in arrear, £2. The issued capital of the company was 5,226 preferred ordinary shares of £1 each and 525 deferred ordinary shares of 1s. each, or a total of £5,252. As regarded the contributories the deficiency was £10,656. The company commenced trading in November, 1919, and had carried on business at a loss. About a month earlier the bank, which held the first debentures, objected to the overdraft being increased, and as further moneys were not available, a receiver was appointed. The creditors decided to confirm the voluntary liquidation of the company with Mr. Keetley as liquidator.

Dissolution of Partnership.—MOFFETT & ROSHER, consulting engineers, Union Chambers, Temple Row, Birmingham.—Mr. Noel B. Rosher has retired from active partnership, but retains an interest in the firm. Mr. Frank J. Moffett is continuing the work of the firm on the same lines as heretofore, the firm retaining its original title.

Trade Announcements.—THE ENGINEERING & LIGHTING EQUIPMENT CO., LTD., has appointed Mr. R. Garmany, 1, Union Street, Belfast, sole agent for Ireland for the whole of its manufactures.

MESSRS. MILLNS ELECTRICAL CO., of 17, Whitefriars Street, E.C.4, inform us they have been appointed the sole selling agents for Great Britain and the Colonies by Messrs. G. Meidinger & Co., manufacturers of motors, dynamos, alternators, &c., of Basle, Switzerland.

A. & A. ELECTRICAL CO., LTD., of 13, Farringdon Road, state they have been appointed sole distributing agents for the De V. Y. F. Co., Doetinchem, Holland, manufacturers of two and three-phase a.c. motors.

VINCENT SWITCHGEAR MANUFACTURING CO. have appointed as their agents for the whole of Scotland Messrs. Alston and Blyth, 97, Waterloo Street, Glasgow, who will carry stock of the Vincent switch and fuse gear.

THE JACKSON ELECTRIC STOVE CO., LTD., asks us to state that the address of its Scottish agent, Mr. Kirby Johnson, is 68, Gordon Street (not Gordon Road), Glasgow.

Catalogues and Lists.—THE EDISON SWAN ELECTRIC CO., LTD., Fonders End, Middlesex.—List No. G.G.212, "Industrial Lighting." In addition to a large amount of valuable data on the subject, this publication illustrates and describes very fully "Holophane" and numerous other reflectors, tube lighting systems, desk fittings, lanterns, &c. Views of actual installations in machine shops, shop windows, &c., are reproduced.

THE PRIORY ELECTRICAL ENGINEERING CO., Bath Street, Birmingham.—A blotter advertising "Priory" fuses, distribution boards and ceiling fittings.

MESSRS. L. G. HAWKINS & CO., 116, Charing Cross Road, W.C.2.—Two folders—one illustrating and describing the "Universal" electric washer and the other dealing with the "Universal" electric radiator.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich.—An illustrated publication dealing with porcelain in all forms—sheets, rods, tubes, and mouldings. "Keramot," another insulating material is also described.

ANACAS ENGINEERING SUPPLY CO., LTD., 41, Hamilton Square, Birkenhead.—Publication W.117, illustrating and describing horizontal, vertical, and universal milling machines of various types.

GENERAL & ELECTRICAL REPAIRS CO., Hill Street, Park Street, Bristol.—An illustrated leaflet dealing with the "Sunshield" renewable enclosed cartridge fuse.

HEAVY CURRENT ELECTRIC ACCESSORIES CO., Park Road, Edmuntown, N.9.—A trade price list of switches, connectors, switch-plugs, and wall plugs and sockets. Illustrated.

THE STANSON IRONWORKS CO., LTD., near Nottingham.—Monthly list of cast-iron pipes, September.

THE D.C.M. TAP CO., LTD., 17, West Regent Street, Broomwood Square, Glasgow.—Two illustrated leaflets, giving prices, &c., of D.C.M. taps in sizes ranging from 1.16 in. to 2 in. Whitworth and B.A., British Standard pipe and British Standard fine threads.

THE CHICHESTER ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—Circular No. 51, giving illustrations, details of construction, &c., of "Exide" accumulators for the control and operation of oil switches and high-pressure switch-gear.

MILLNS ELECTRICAL CO., 17, Whitefriars Street, E.C.4.—An illustrated list of motors, fans, blowers, transformers, &c., made by G. Meidinger & Co., of Basle.

THE WALTHAM MANUFACTURING CO., 2, Jackson Road, Holway, N.—An illustrated price list of "Waltham auto-lamps" for photographic and kinema work.

MESSRS. S. H. HEYWOOD & CO., LTD., Reddish, near Stockport.—Publications No. 13, a well-illustrated descriptive list of electric lifts, winding engines, transporters, and cranes; and No. 14, dealing with control of electric cranes, showing in detail the "Heywood" resistance system.

THE BRITISH & ALLIED ELECTRICAL AGENCY, LTD., 13, Charterhouse Street, Holborn Circus, E.C.1.—An illustrated and priced folder dealing with "Lova" dimming switches of a number of types, including a special design for car headlights.

THE HASTIE ELECTRIC WATER HEATING CO., Ashley Street, Nottingham.—Two illustrated pamphlets describing the "Hastie" combined electric kettle and tea-pot.

THE LEA RECORDER CO., LTD., 28, Deansgate, Manchester.—Booklet CM' on the "Lea" coal meter for attachment to chain-grate stokers, explaining its operation and application; and booklet C.T. on the measuring efficiency of the meter, giving particulars of two series of tests made this year, showing an accuracy of nearly 24 per cent. in one case, and within 1 per cent. in the other.

Social Events.—The staff and employés of Messrs. J. H. Tucker & Co., Ltd., Tyseley, Birmingham, held their sixteenth annual outing on Saturday last, going by train to Evesham. The Sports Committee had arranged for the usual sporting events to take place in the morning, after which dinner was provided at the Town Hall. The after-dinner speeches included a vote of thanks to the directors and the Sports and Recreation Committee, proposed by Mr. G. Scrivener and supported by Mr. S. R. Davies. Mr. J. B. Tucker replied on behalf of the directors, and Mrs. J. H. Tucker distributed the prizes to the winners of the various sporting events. The afternoon was spent on the river and in the highways and byways and beautiful meadows for which Evesham is noted. Tea was provided at the Cranville Hotel, and in the evening the party returned to Birmingham after a thoroughly enjoyable day.

Under the auspices of the Elliott Social Association the employés of Messrs. Elliott Brothers (London) Limited, of Lewisham, held their fourth annual garden fête and sports on Saturday last at the Colfe Grammar School Sports Ground, Eltham Road. The opening ceremony was performed by Mrs. W. O. Smith, wife of the chairman of the company. A long programme of events had been arranged, and some very keen sport was witnessed by a large crowd. Especially interesting was the departmental tug-o-war, all the teams being very evenly matched, and a great final saw the test room beat the tool room by two pulls to one. In addition to the sterner events, the lighter side was well catered for, and much amusement was caused by the various comic competitions, while a number of events were reserved for the children. The prizes, which had been given by the directors of the company, were presented to the various winners by Mrs. L. W. Smith, the wife of one of the directors. At the close of the sports, dancing took place, the music being provided by the Lewisham Comrades Military Band, under the baton of Mr. E. R. Jennings (late K.R.E.). The arrangements for the meeting, which were admirably carried out, were in the hands of Messrs. W. J. Woodman, W. F. Beaden, E. J. Griffin, F. C. Hart, W. Nicolle, and A. S. Powell, while excellent work was done by the Ladies' Committee in providing light refreshments, &c.

The employés of the firm of Messrs. J. & W. B. SMITH, LTD., of 15-23, Farringdon Road, E.C.1, held their annual outing last week, which was organised by the advertising manager, Mr. A. Marlon. They travelled by charabanc to Brighton, and reached their destination about mid-day. The weather was ideal, and an excellent programme was carried out.

For Sale.—By Direction of the Disposal Board, Messrs. Oliver, Appleton & Kitchen will sell by auction at the C.S. Depot, Barnson, near Leeds, on September 27th and following days, machine tools, plant, engines, boilers, electric motors, &c., and on October 12th and 13th, at H.M. Filling Factory, Coventry, Mr. O. B. Odell will offer by auction machinery and plant, electric motors, railway locomotives, timber, and builders' plant. Full particulars are given in our advertisement columns to-day.

Fusion of Swedish Telephone Manufacturing Companies.—An extraordinary meeting of the H. T. Cedergren Industrial Co. has resolved to merge with the L. M. Rönnersten Telephone Co. by the adoption of a joint proposal, according to which one share of the Cedergren Co. will be exchanged for eleven shares of the Rönnersten Co. Kr. 500. *Reuter's* August 31. Stockholm.

Rail Shopmen's Wages.—The *Electrician* states that a settlement has been reached between representatives of the railway companies and the Amalgamated Engineering Union (No. 18,000) on the subject of wages of shop and steel workers. Under the terms of settlement a joint recommendation is to be made that the wages of all shop and shed workers be increased by 10 per cent. from August 1st. Further arrangements are to be entered into forthwith between the representatives of the A.E.U. and the railway companies to discuss any outstanding rates of wages and conditions of service. This agreement is subject to ratification by the executive of the A.E.U. and the railway companies.

Irregularities in Tenders for Belgian Government Contracts.—The Commercial Secretary to His Majesty's Embassy at Brussels (Mr. B. P. Sullivan) reports to the Department of Overseas Trade that the Belgian Minister of Public Works has recently called the attention of the Administration des Ponts et Chaussées to the fact that tenders for contracts are frequently accepted in the interests of the Treasury despite the fact that they deviate from the prescriptions laid down in the specification in respect of the materials to be used. The Minister is, however, of opinion that if this practice becomes general miscalculations will result and a proper adjudication of public contracts will be made difficult. He has consequently directed that a clause shall in future be inserted in specifications to the effect that contracting parties are particularly reminded that any tender which does not conform with the prescription of the specification will be considered null and void. It is further stated that if irregular tenders are submitted despite this warning, it will be permissible to make use of them in the examination of similar undertakings.

Egyptian Government Contracts.—His Majesty's Commercial Agent for Egypt desires to call attention to the fact that contracts for the supply of goods to the Egyptian Government have been lost through the failure on the part of British firms to comply with the conditions of tender. These conditions stipulate that tenders can only be submitted by firms having a resident agent in the country, and that tenders should be accompanied by a provisional deposit of 2 per cent. of the value of the offer in money. This provisional deposit may be replaced by a letter of guarantee from an approved bank in Egypt, and does not, therefore, necessarily involve any outlay of capital. Copies of the general conditions of tender which form the basis of the conditions which apply to all public tenders, may be obtained on application at the Department of Overseas Trade together with a memorandum of information for the use of those United Kingdom firms which are desirous of submitting tenders for Egyptian Government contracts.

Dutch Electrical Imports.—The imports of electric material into Holland last year, according to a Dutch official report, were contributed by the following countries in the proportions named: Insulated cables and wire from Germany, 60 per cent. of the total, as against 30 per cent. from the United Kingdom and 10 per cent. from other countries. Motors and transformers, Germany, 50 per cent.; Switzerland, 17½ per cent. Measuring instruments, Germany, 70 per cent.

Catalogues Wanted.—The electrical engineer, Electricity Works, Hebden Bridge, wishes to receive catalogues and full particulars of large electric sirens or similar appliances to take the place of large steam whistles for fire alarm purposes.

Scottish Electricians' Wages.—The Electrical Trades Union is putting forward a counter-proposal to the demand of the Scottish Contractors' Association for a further reduction in wages. The union suggests a sliding scale agreement, while the employers propose a cut of 2d. an hour—1d. on October 1st and 1d. on November 1st. An early conference will be held. *Glasgow Herald*.

The Norwegian Hydro-electric Co.—The Norwegian Hydro-electric Nitrogen Co. and its subsidiary hydro-electric works, the A/S Rjukanfos, have concluded a loan for 50 million kroner with a syndicate of Scandinavian and French banks. At present the plant in operation represents 345,000 h.p., and a further 100,000 h.p. is available for future use. The proceeds of the loan are for the purpose of increasing the working capital. *Financier*.

New Australian Electrical Company.—The prospectus has been issued of the Commonwealth General Electric, Ltd., which is seeking registration in Victoria. The authorised capital is £1,000,000, of which £50,000 will be offered to the public. The new enterprise is to acquire a Sydney electrical works and a number of large extensions here and abroad. The production of the head office for electrical appliances, including switchgear, transformers, turbine, and other electrical apparatus, is needed in the Commonwealth. The total cost of the works and plant is estimated at £2,000,000. The company has also leased an area of 15 acres at Spotswood, a near suburb of Melbourne. *Reuter's Trade Service* (Melbourne).

The E.T.U. and Theatrical Employés.—At the April Scottish Trade Union Congress a resolution was moved approving the action of a number of theatrical employés' associations in endeavouring to "unionise" every place of amusement in the United Kingdom. An E.T.U. representative endeavoured to pass an amendment including the name of the E.T.U. among the approving societies. The meeting apparently resented the intrusion of an electrical union, for the amendment was lost.

The general secretary of the National Association of Theatrical Employés states that the Parliamentary Committee of the Trade Union Congress, having heard both sides, consider that each union should retain its members, but that the N.A.T.E. is the proper body to cater for the cinema operators and not the E.T.U.

British Properties in Germany.—The *Bulletin* of the F.B.I. reminds members that October 1st next is the last day for submitting claims through the Enemy Debts Clearing Office for:

- (a) Proceeds of liquidation of property in Germany;
- (b) Compensation under Articles 287 and 300 (b) of the Peace Treaty, in respect of damage inflicted upon their property rights and interests in Germany by the application of exceptional war measures, measures of transfer or of execution.

Claims for compensation received before that date, will be presented by the Controller to the German authorities, with a view to effecting agreements for submission to a formal judgment of the Mixed Arbitral Tribunal, thus obviating, as far as possible, the delay and expense of legal proceedings.

Claimants who are not yet in a position to furnish all the information necessary to support their claims, should send in forms giving general particulars and the total amount of compensation to which they consider themselves to be entitled on the information available.

Trade with Mexico.—The British Chamber of Commerce in Mexico City is forming a permanent exhibition of British wares, and manufacturers are invited to forward samples, catalogues, &c., for inclusion therein; the address is: Central British Chamber of Commerce, Apartado 900, Mexico, D.F.

The Italian Customs Tariff.—His Majesty's Consul-General at Milan (Mr. W. A. Churchill) points out that the new tariff which came into force on July 1st does not appear to be generally known or understood by United Kingdom firms. The effect of the high exchange and the high Customs tariff has been to bring imports into Italy from this country, in common with others, to a standstill. Exporters to Italy should therefore make careful inquiries as to duties and other points before shipping. The complete new Customs tariff appeared in the *Board of Trade Journal* of July 21st. The Department of Overseas Trade is prepared to render assistance to inquirers.

Celluloid Regulations.—The Home Secretary has drafted regulations relating to the manufacture and storage of celluloid and articles made of it, according to which stocks of celluloid must be kept in a special store outside the workrooms, and if more than 1 cwt. is stocked, the store-room must be constructed of fire-proof materials. Open lights and fires must not be used near celluloid, except to the extent necessary for manufacturing processes, and adequate means of extinguishing fire and of escape in case of fire must be provided. Objections to the regulations may be submitted before September 20th.

Lead Market Report.—Messrs. James Forster & Co., in their report of September 3rd, say:—Closing prices yesterday were £23 7s. 6d. for September and £22 15s. for December; there being no change on the week. The market has been remarkably quiet, Monday to Thursday (inclusive) transactions on the open market totalling only 650 tons, with practically no change in value from day to day. Arrivals in August were about 10,000 tons.

Reduction in Switchgear Prices.—The Ironclad Switchgear Co., Ltd., state that their prices are now considerably reduced; particulars can be had on application.

Trade with Italy.—In view of the difficulty of dealing adequately with calls for tenders by public bodies in Italy, when the tendering firm is of foreign origin, the question of establishing a native house for the purpose has recently been considered by the Commercial Counsellor to His Majesty's Embassy at Rome. In the opinion of the legal adviser to the Embassy, United Kingdom contracting firms might find it advantageous to consider the question of establishing branch houses ("filiali") in Italy, the directors of which can be either British or Italian. British firms which may wish to adopt the course suggested can obtain particulars as to the formalities necessary for registration and information on the taxation to which they would become liable on application to the Department of Overseas Trade, reference being made to *Trade Service*.

Protection for the Glass Trade.—According to *The Times*, representatives of the operatives in the flint-glass section of the British glass trade have approached the Board of Trade with a view to obtaining protection from foreign competition under the Safeguarding of Industries Act, averring that unless steps are immediately taken to stop the flow of glassware from abroad, the industry in this country will be killed.

Book Notices.—"The Journal of the Institution of Electrical Engineers," Vol. LIX., No. 302, June, 1921, contains the following papers: "Some Recent Developments in Large Steam Turbine Practice," by K. Baumann; President's (Mr. L. B. Atkinson) address to the Western Centre; "Wireless in the Royal Air Force," by Major J. Erskine-Murray, R.A.F. "The Bulletin of the Hydro-electric Power Commission of Ontario," Vol. VIII, No. 3, May-June, 1921.—This issue contains a report of proceedings at the June convention of the Association of Municipal Electrical Utilities, including papers on "Advertising," "Window Dressing," and "Sales Campaigns," with accompanying discussions. Two papers on "Safety First" principles and devices are also published. An illustrated progress report upon the Queenston-Chippawa development is included.

"The Transactions of the South African Institute of Electrical Engineers," Vol. XII, Part 7, July, 1921. Price 2s.—This part includes notes on "Recent Development in Steam Turbine Design."

"The Journal of the South African Institution of Engineers," Vol. XX, No. 1, August, 1921, includes a discussion on the method of cleaning wood-lined pipe columns.

"Gears in a Nutshell," by Capt. S. Bramley-Moore, M.C. (Bostock and Bramley, Huddersfield, price 3d. net), is almost sufficiently described by its title; it contains a set of "gear rhymes" for memorising gear formulae, which are also given separately in the usual notation, for spur, helical, bevel, and worm gearing. A table of standard pitches, &c., is included, together with a pitch conversion table, making in all a very useful "kernel."

"The Practice of Electric Wiring," by D. S. Munro. Revised edition, pp. xii+268; figs. 97. London: THE ELECTRICAL REVIEW, Ltd. Price 5s. net.

"The Utrecht Fair Bulletin of the Federation of British Industries," which has just been issued, is printed in Dutch and English, and contains articles by various authorities on the trade relations of the two nations, and on the facilities possessed by this country for supplying the industrial needs of Holland and the Dutch Colonies. Mr. C. H. Wordingham, C.B.E., contributes an article in Dutch on "British Engineering in Peace and War," and other writers deal with the value of experience in connection with narrow-gauge railways, mechanical power in cargo handling and harbour construction, and electric welding. The issue is intended for circulation at the Fair, which lasts from September 6th to 16th, and in the Dutch East Indies.

A Wireless Listening Station.—The private station of Messrs. Cunningham, Ltd., of 169/171, Edgware Road, is now in operation, and anyone is invited to inspect it and listen to the signalling and telephony—the latter being very clear. Mr. C. J. Close, late of the Government Wireless Service and Marconi's, is in charge, and at all times ready to give advice and assistance to amateurs.

Inquiries.—Makers of electric irons, &c., suited for 25-volt circuits are inquired for.

LIGHTING AND POWER NOTES.

Aberayron.—ELECTRIC LIGHTING SCHEME.—The Urban District Council has decided to engage an engineer to advise on an electric lighting scheme. Mr. Eric Richards, of Lampeter, has purchased Llyswen Mill for the purpose of generating electricity for the town.

Belfast.—CONSULTANTS' REPORT DISCUSSED.—At the monthly meeting of the City Council, on the 1st inst., the Lord Mayor presiding, Sir James Johnston, in proposing the adoption of the minutes of the Electricity Committee, said that a report had been received from the consultants, Messrs. Preece, Cardew & Rider. The committee had met that morning, but it had not time to examine the report, and had decided to ask that a special meeting of the Council in Committee should be held on September 22nd, if that would be a suitable date, for the purpose of discussing the whole question—not only the report, but many other matters in connection with the electricity undertaking. The question of the ordering of switchgear had been sent back at the last meeting of the Council, and the committee had decided to readvertise so that the matter need not come up for discussion. Councillor Oswald Jamison seconded the motion. Subsequently Councillor T. E. Alexander moved the resolution which stood in his name, regarding the consultants' legal responsibility (Elec. Rev., Sept. 2nd, p. 312). Various appeals were made to Councillor Alexander to postpone the motion, but he declined to do so on the ground that it was a matter of vital importance. He reviewed the position from the time that Sir John Snell assumed responsibility, beginning with the extension scheme at East Bridge Street; at a cost of £67,000; the installation of a 6,000-kW set; the £310,000 scheme of February 21st, 1918; the £600 air filter which, when delivered, was obsolete and useless (the company would not take it back). Mr. Rider, who came after Sir John, frankly stated that the original estimate was too low. After discussion, the question was referred to a special committee meeting on the 22nd inst.

Barnard Castle.—WATER POWER.—The Urban District Council has decided to support the scheme for generating electricity by means of the river Tees.

Bradford.—NEW PLANT. Preparations are nearing completion at the Valley Road generating station of the Corporation electricity department for the installation, in October, of the new turbo-generator of from 12,000 to 15,000 kW capacity, a similar unit to the generator installed shortly after the armistice. The new installation will increase the capacity of the station to about 40,000 kW. The department is anticipating a steadily-growing demand for power, both for domestic and industrial purposes, and much is hoped from the development of the Thornbury district as an engineering quarter, following upon conditions arising out of the progress of that area during the war.

Canada.—NEW HYDRO-ELECTRIC PLANT.—The largest hydro-electric plant in the Maritime provinces has just been completed at the works of the Bathurst Lumber Company at the Nepisquit Falls, in Restigouche County. Work was begun in May, 1919, and the plant has been completed at a cost of \$1,750,000. Provision has been made for three generators, and two have been installed, but at present only one, with a capacity of 4,500 h.p., will be used. The Bathurst Lumber Company will require about 2,500 h.p. for its own plants; another 1,000 h.p. will be used by the Newcastle and Dominion Pulp Mills, leaving a margin of 1,000 h.p. for other demands.—*Reuter's Trade Service* (Bathurst, N.B.).

Continental.—LATVIA.—According to the *Financier*, the Latvian Government is in possession of various plans for the installation of hydro-electric stations on the Duna (Dvina) River, which, for the most part, were developed by engineers of the Imperial Russian Government prior to the war. These plans constitute a somewhat complete scheme for utilising the power of the Duna and also for developing the river, through a system of locks and short lateral canals, to make it navigable well into the interior of Russia proper and eventually, through a system of canals connecting with the Dnieper and other Russian rivers, to form an elaborate system of interior water transportation. Five stations are contemplated, and the total cost is estimated at 53,600,000 Russian roubles (1914 gold basis). These are to be at Dahlen (24,000 kW); Kegsum (36,000 kW); Ascheraden (16,000 kW); Kokenhusen (80,000 kW); and Stockmannshof (36,000 kW).

HUNGARY.—Hungary, even with her pre-war boundaries, was not entirely self-supporting as regards coal. Now her situation is far worse, and can only be remedied by an extensive application of water-power. Unfortunately the Peace Treaty also deprived her of much potential water-power, but as it aims at a joint organisation of common water resources between nations, with the help of international capital, large water-power stations may be established. The Lower Danube could, for instance, supply the whole district round Budapest with electric power. The water resources still in Hungarian territory could also be exploited by means of canalisation, but for this scheme international capital is absolutely necessary, as neither Hungary nor any of the Succession States has the capital required.—*Economic Review*.

GERMANY.—At the twenty-seventh yearly meeting of the Verband Deutscher Elektrotechniker, held at Essen, the presiding engineer, Herr Vogt, gave a brief account of the progress of the German electrotechnical industry during the past year. Referring to the conference on hydraulic power which occupied the last meeting of the Verein, he stated that the water-power works of Bavaria would be able to supply electricity before the end of the present year, and that the Prussian Government would start in the autumn three works on the river Mein. The utilisation of falls on rivers would call for special turbines, and also for special regulators; the Kaplan turbine might become of first importance, although its merits were still under discussion. A certain amount of apprehension had also been entertained regarding the carrying through of very high-pressure lines. At Berlin, a 100,000-V line had been set up linking the Moabit sub-station with that at Berlin-Friedrichsfeld; it was 15 km. long, and the supports, 26 m. high, were situated in populous streets. At the crossings of rivers, canals, and railways, supports 37 m. high were employed.

Dundalk.—PROPOSED PRICE INCREASES.—To counteract the increased cost of fuel oil, increases in the charges of 1d. per unit for power and heating, and 1d. per unit on bioscope supplies to cinema houses were recommended. This had been approved by the Electricity Committee, the increases to take effect on October 1st, but members of the Council objected on the ground that cost of production was coming down, and the matter was referred back to the committee for reconsideration.

Dublin.—PUBLIC LIGHTING.—The full all-night lighting system in Dublin will come into force at the beginning of October. Complaints continue to be made of the present restriction—from 10.15 p.m. to 12.15 a.m.

PROTEST AGAINST REORGANISATION.—Mr. Fred Allan, secretary of the Electricity Committee, has protested against any alteration in his position, duties, or status, stating that, if necessary, steps will be taken to assert his legal rights. The Electricity Committee recommended that Mr. Allan's status be not interfered with pending his release from Ballykinlar Internment Camp, where he is detained, and the Lighting Committee sent

a similar recommendation. The proposal of the Special Committee was to abolish Mr. Allan's secretaryship of both these committees and of the Cleansing Committee. An amendment in favour of delay was moved but was rejected, and the re-grouping of various committees approved.

Hereford.—**YEAR'S WORKING.**—We have received from the chief electrical engineer (Mr. W. T. Kerr) a copy of the report upon the electricity undertaking for the past financial year. The total income was £21,674, as compared with £16,688 in 1919-20. Working expenses amounted to £17,323, as against £12,654 in the preceding year, leaving a gross profit of £4,351 (£1,911). The net financial result was a loss of £491, this compares with a net profit of £524 realised in the previous year. Referring to this result, the engineer states that he estimates that a loss of £1,200 was caused by the unnecessary restriction of lighting when the department never had less than a three months' stock of coal in hand. The rural supply scheme shows a loss of £1,227, but a note explains that of this sum £1,612 is receivable from the Treasury as a subsidy until the scheme is self-supporting.

Hexham.—**ERECTION OF POLES.**—A letter from the Electricity Commissioners, read at a recent Urban Council meeting, stated that the necessity for an inquiry into the Council's objection to the erection of wood poles in the district for transmission lines had not been established. This was interpreted as over-ruling the Council's objection. It was resolved to reply that the erection of steel poles would be approved, but if the use of wood poles were persisted in, the Council would move for an injunction restraining their erection.

Isle of Wight.—**PROPOSED PRICE INCREASE.**—The Rural District Council has decided to oppose a renewed application by the Isle of Wight Electric Lighting Co. for power to raise the charge for electricity supplied to Carisbrooke and Northwood to 1s. per unit, on the ground that the prices of coal and other necessities for the works have decreased.

Keith.—**PROPOSED ELECTRICITY SCHEME.**—A special committee of the Town Council having reported favourably upon the suggested introduction of an electricity supply scheme to the town, it has been decided to appoint a consulting engineer to draw up proposals.

Liverpool.—**FINANCE.**—The electricity inquiry which was held in Liverpool some time ago is recalled in the Birkenhead Corporation's abstract of accounts, which was issued recently. It now appears that the amount of £1,375, which the Council had to pay in counsel's fees, turned what might have been a profit on the local electricity undertaking into a deficit of £788. *—Liverpool Daily Post and Mercury.*

London.—**HAMPSTEAD.**—The total income of the electricity undertaking during the year ended March 31st last was £149,550, and the working expenses £112,996, leaving a gross profit of £36,554. Capital charges amounted to £24,809; the net profit was thus £11,753. After appropriations for renewals, services, a new boiler, &c., a balance of £5,789 remained, which, with £551 from the previous year, was carried forward to the next account.

Maidstone.—**LOAN.**—The Town Council has applied for a loan of £5,135 to meet an excess on the estimated cost of new plant for the electricity works.

Peterborough.—**EXTENSION OF SUPPLY AREA.**—The Town Council has applied for a special order to extend the area of supply under the Electric Lighting Order. All the local authorities concerned are offering no objection to the application.

Reigate.—**PRICE REVISION.**—The Town Council has revised the charges for electricity for heating and cooking and commercial power, as from the September reading of the meters; the charges will be: heating and cooking, 6d. per unit; and power 4d.

Salford.—**SALE OF ROTARY.**—The Corporation has accepted the offer of the Stretford Urban District Council to purchase a rotary converter, which is installed at the Broughton Copper Co.'s works, for £1,750, plus alteration and removal costs, estimated to be £365.

South Africa.—**CAPETOWN.**—For years past it has been a matter of extreme difficulty for any new factories in Cape-town and the neighbourhood to get power for motor installations, &c., the power station having been so overloaded that the supply has not nearly equalled the demand. Now, however, with the new machinery that is being installed the supply will be greatly increased, and industry will be able to go ahead once more. Moreover, "in accordance with plan" the local electricity department has for some time past been gradually substituting three-phase a.c. in place of d.c. in various districts, the intention being to provide within a few years the whole of the municipal area with this service, the "City proper" alone remaining on d.c. These changes will, of course, affect to some extent the types of fittings imported. *—South African Report Gazette.*

Victoria Falls.—In an article published in a recent issue of the *South African Engineer & Electrical Review* a writer discusses the feasibility of harnessing the Victoria Falls. He states that a detailed survey and the taking of records over a period of eight months was carried out. At the most suitable spot the head available was 360 ft., due to the actual fall, in addition to a 20-ft. drop from the intake to the crest

of the Falls. Assuming that the turbines were kept 10 ft. above the water in the cañon and disregarding pipe-line friction, the actual head would be 370 ft. At flood times there is a rise of 44 ft. in the cañon, and at rainy seasons 55 ft. This would reduce the head to 315 ft. Assuming an efficiency of 85 per cent. and a further loss for pipe-line friction the power available is 350,000 kW if the total volume of water could be utilised. The author considers that there is no early prospect of development owing to the high transmission costs involved.

Southport.—**COMMISSION FOR ENGINEER DISCUSSED.**—At a meeting of the Town Council, at which it was resolved to advertise for an electrical engineer at a salary of £800 per annum, the question of paying the engineer commission for securing lower working costs was discussed. A member said that the reduction of costs often depended upon circumstances entirely beyond the engineer's control, i.e., coal price reductions, lower wages, &c. It was decided to leave the question for the consideration of the Electricity Committee.

Todmorden.—**EXTENSION OF SUPPLY.**—In considering further supplies of electricity to outlying districts, the Town Council has agreed to extend to Lydgate, at an estimated cost of £330, and to Robinwood and Cornholme, at an estimated cost of £3,170, subject to agreement being reached with a certain large manufacturing firm as to supply of power to it.

Weymouth.—**YEAR'S WORKING.**—The report upon the Weymouth and Melcombe Regis Borough electricity undertaking (engineer, Mr. G. Nicolson, A.M.I.E.E.), for the year ended March 31st last, records a total revenue of £23,359, as compared with £21,981 in the preceding year. Working expenses amounted to £21,673, as against £18,748, leaving a gross profit of £6,686 (£3,233). After the payment of capital charges, &c., a balance of £1,911 was transferred to reserve for renewals, &c.; the previous year's result was a net deficit of £1,551. The number of units sold rose from 1,110,223 to 1,202,591. While the capacity of the plant was 1,131 kW, the maximum demand was only 606 kW.

Walmer.—**GAS COMPANY'S POWERS.**—The Ministry of Transport has informed the Urban District Council that it has been decided to defer consideration of the question of revoking the electric lighting powers of the Gas Co. for this year. It was added that at the expiration of this period, if active steps had not been taken to establish an electricity undertaking, the Minister as at present advised would at once proceed to consider the question of revoking the powers under the Act.

Wallasey.—**GROWTH OF UNDERTAKING.**—The chairman of the Electricity Committee, reporting on the growth of the supply of electricity in the borough, states that there have been 517 new consumers during the year, and an increase of 98,000 units generated. Owing to the non-delivery of a turbine which should have been received in January, but could not be expected to arrive before December next, the Electricity Committee, with its present commitments, cannot take on any more power load and will have to restrict new domestic consumers. During the year arrangements had been made for several transformer stations in the district. Three were now working and four were in hand. About 7,500 yd. of h.p. cable had been laid.

Wakefield.—**EXTENSION OF AREA OF SUPPLY.**—The Corporation is applying to the Electricity Commissioners for authority to supply electricity for private and public purposes in the parish or township of Lupset in the rural district of Wakefield.

Wimbledon.—**HOUSING SCHEME.**—The *Morning Post* states, in connection with the Borough Council's housing scheme, that the Ministry of Health refuses to sanction the electric lighting scheme, and also to pass the tenders submitted by the gas company for laying on gas in the estate. It suggested that what it called the high charges of the company might be due to the Corporation's competitive electric scheme, which deprived the company of the advantage of supplying gas for lighting as well as heating. Acceptance of the Council's proposal would make it impossible to refuse the same to other municipalities. The Ministry added that it was responsible for the erection of many thousands of houses, and strict economy was essential.

Winchester.—**YEAR'S WORKING.**—The annual report of the city electrical engineer (Mr. R. Ayton) for the year ended March 31st last shows that the revenue of the electricity undertaking was £33,563, as compared with £25,986 in the preceding year. Working expenses totalled £25,147, as against £17,333, leaving a gross profit of £8,416 (£8,653). Although the gross balance was practically the same as that of 1919-20, capital charges reduced the net profit from £2,683 to £1,022. The engineer records that plant which should have been installed by last winter was held up by labour troubles. The existing distribution system is loaded to its fullest capacity, but extensions are in hand to relieve it.

Wrexham.—**BULK SUPPLY.**—The Town Clerk has been instructed to continue negotiations with the North Wales Power Co. for a bulk supply of electricity. It was stated at a recent Town Council meeting that the total cost would amount to between £80,000 and £100,000.

York.—**SUBMARINE ENGINES.**—Two engines from the German submarine U63 are being installed in the city electricity works.

TRAMWAY AND RAILWAY NOTES.

Aberdeen.—**YEAR'S WORKING.**—The report of the general manager of the city tramways (Mr. William Forbes, M.L.S.T.) for the year ended May 31st last shows that the total income from all sources was £191,471, as compared with £169,731 in 1919-20. Working expenses amounted to £157,585, as against £141,582, leaving a gross profit of £33,886 (£27,879). Interest, sinking fund, &c., absorbed £32,305; the net profit was therefore £1,581, a result comparing very favourably with a deficit of £5,203 in the previous year. The total number of passengers carried was 42,953,807, and the total car-miles run 2,307,260.

Belfast.—**STRIKE.**—Last week, upon their wages being reduced by 2d. per hour, the men who are engaged on the reconstruction of the tramway track, promptly downed tools. The sum of 1s. 4d. per hour had been agreed upon, and at the meeting of the Corporation on September 1st the matter was discussed, and it was held that these men were engaged on special work, and were entitled to the special wage of 1s. 4d. per hour.

Bradford.—**GOODS SERVICE.**—It is announced that in the next Corporation Parliamentary Bill powers will be sought to transport goods' weights up to ten or twenty tons by the tramways. At present the Tramway Department has powers to carry only moderately-weighted parcels on any route, and on several of the routes only up to 56 lb. One of the chief ideas behind the proposed new powers is to enable the Department to convey coal to factories and bring back factory goods for transfer to the railways for transport to other parts of the country. Cartage in Bradford is difficult because of the city's situation in a hollow of the hills, and cartage charges have always been extremely high. It is held that tramway transport, by saving much handling and time, would enable transport to be very much cheaper. The goods transport could either run in amongst the passenger traffic or be run chiefly at night.

Brighouse.—**PROJECTED EXTENSION.**—In carrying out road improvements in Crowtrees Lane, Rastrick, the Brighouse Corporation has laid a single track of tramway lines. There is reason to hope that this section is in anticipation of a start being made in the spring with the full scheme of extension of the Huddersfield tramways via Rastrick to Brighouse. This extension will link up Huddersfield and Halifax and Huddersfield and Bradford.

Japan.—New electric tramways are projected by the Tobu Tramway Co., Ltd., to cost 6,000,000 yen. The Musashi Electric Tramway Co., a new concern, is to construct and work a line between Tokio and Yokohama, and to supply electricity for other purposes.

Leeds.—**RAILLESS CARS.**—The Tramway Committee has decided to substitute double-decked railless cars on the Whitehall Road route in the place of the present service of railed cars. Two of these cars are to be run, and one is already completed. The passenger capacity will be 55, as against 30 in the older type of railless car run on several Leeds routes. It is intended to remove the tramway lines on the Whitehall Road route.

Liverpool.—**NEW TYPE CARS.**—The Tramways and Electricity Committee has adopted a new standard type of car built to the designs of the general manager. Its principal features are better means of ingress and egress, simple but efficient ventilation, and improved cleaning facilities. About 20 of these cars are now in use, fourteen of them being old cars reconstructed. The accommodation is arranged as follows:—Upper deck, 28; lower deck, 22; and ten under the canopies. Route indicators are fitted inside the windows of the lower saloon. The Tidswell patent side and lifeguard supersedes the wooden plough shaped frame, which was found costly to maintain.

Llandudno.—**INCREASED CHARGE FOR TRACTION POWER.**—Owing to a loss of £1,136 upon the power supplied to the Light Railway Co. during the past year, the Council has notified the company that from September 1st the charge will be at the flat rate of 8d. per unit for a period of twelve months.

London.—**COLLISION.**—On September 1st two L.C.C. cars collided in the Walworth Road. The only damage that occurred was the shattering of the windows of both cars. Four passengers received minor cuts and bruises.

Manchester.—**DISMISSAL OF CLEANERS.**—The decision to dismiss a number of car cleaners, as an economy measure, has led to unrest among the Corporation's tramway employees. Representations are being made by the men to the City Council and the general manager of the undertaking.

New Zealand.—**TRAMWAY DEVELOPMENTS.**—The Auckland City Council has decided to authorise tramway extensions in the suburbs, involving an expenditure of £82,000. Seven new cars will be required. *—Reuter's Trade Service (Wellington).*

Portrush.—**ELECTRIC TRAMWAY.**—In relation to the possible closing down of the Portrush and Giant's Causeway electric tramway, it is explained that this will be due to the loss of water-power and the compulsory evacuation of the generating station. Hopes are entertained, however, that the latter difficulty may yet be surmounted. The line was opened 38 years

ago. The power is generated by the River Bush at Bushmills, where the power-house is situated. Originally a third rail was employed, but subsequently the overhead trolley system was substituted.

Salford.—**THREATENED STRIKE.**—Owing to the secession of 21 inspectors from the United Vehicle Workers' Union, a strike is threatened at Salford this week-end. The inspectors who remain in the union, and who are in the majority, have resolved to support any action taken by the remainder of the tramway employees to secure the return of those who have left the union. The national executive of the union also signifies its approval.

Wallasey.—**TRACK REPAIRS.**—The Tramway Committee is finding that the tramway rails are wearing away very quickly and is faced with two alternatives: (1) To let the wear continue until replacement is necessary; or (2) to arrest the deterioration by the electric welding of the joints and retreading where the rails are badly worn, and hardening the surface by the oxy-acetylene process. Last year the Council agreed to have three miles done at a cost of £9,500. The work has been completed, and it is now necessary to proceed with the second three miles, which will cost £9,000. About one-third of the length of track will have to be repaired very soon, it is stated.

TELEGRAPH AND TELEPHONE NOTES.

Cyprus.—**MONEY ORDER SERVICE.**—The Postmaster-General announces that a telegraph money order service between the United Kingdom and Cyprus commenced on September 1st. A feature of the new service is that the telegrams of advice may be sent at the deferred rate, which is one-half of the full rate. The full-rate service is available for cases of special urgency.

Malay Archipelago.—**WIRELESS INSTALLATION.**—Though it is situated in Borneo, the State of Brunei (for administrative purposes) is affiliated with the Straits Settlements, and promises in time to share in the prosperity of the other British possessions in the Archipelago, if one may judge from the report for 1920 by the British Resident, Mr. G. E. Cator. In spite of the depression which marked its closing months, the year was the most successful that Brunei has ever known. During 1920 there was under construction a wireless telegraphic installation which will place Brunei in communication with Singapore and Europe. Purchases of material were made in England on behalf of the Government by Mr. F. H. Dupree, of the Singapore wireless telegraph station, from the Disposals Board and War Office. It is considered probable that the total cost of the installation (including fees and the cost of training operators) will not exceed £800 per station, and there are four stations—at Brunei, Labuan, Brooketon, and Temburong. At present prices that sum would not ordinarily suffice even to purchase the necessary material. By the end of the year, the four stations named above had been erected and equipped, and they were to be ready for use as soon as the balance of the material arrived from England. Mr. Cator acknowledges indebtedness to the Government of British North Borneo and the Island Trading Co. for valuable assistance in connection with the installation.

Mauritius.—**WIRELESS TELEGRAPHY.**—The Imperial authorities have decided to discontinue the working of the wireless station erected at Rose Belle, in Mauritius, during the war. As the result of representations by the commercial community, it is possible that this decision may be reconsidered, provided that the local Government will assume financial responsibility for the station. Owing to frequent congestion on the cables passing through Mauritius the wireless station has proved very convenient for the dispatch of messages direct between Mauritius and the Seychelles and Mauritius and Antananarivo, the chief town of Madagascar, says *The Times Trade Supplement*.

Restrictions on Wireless Apparatus Removed.—With reference to the restrictions hitherto in force on the manufacture, purchase, sale, and possession of wireless apparatus, the Postmaster-General announces that, in consequence of the lapse of Regulation 22 of the Defence of the Realm Regulations, such apparatus may now be made (or bought, sold, or held) without permit or restriction. The supervision by the Post Office of dealings in such apparatus has accordingly ceased so far as Great Britain is concerned, but Regulation 22 is still in force as regards Ireland. The Postmaster-General's licence under the Wireless Telegraphy Act, 1904, is still necessary before any apparatus for wireless telegraphy may be installed or worked. An arrangement has, however, been adopted for allowing "toy" sets of wireless apparatus to be used (in Great Britain only for the present) without formal licence, provided that the designs of the sets have been approved by the Postmaster-General, and that the sets have been stamped or marked to that effect before sale. Firms or persons who desire to sell "toy" sets of apparatus for use under this arrangement should furnish full particulars (including illustrations or diagrams) of the apparatus, in order that the design of the sets may be considered. Where the designs appear suitable, it will be necessary to require that specimen sets shall be submitted for inspection before definite approval

is given. Generally speaking, a "toy" set will be regarded as apparatus arranged for transmission and reception as a Hertzian oscillator, and not intended for connection to earth or to any aerial other than small rods with or without valves. The range of such sets should not exceed 50 yards.

Sweden.—**Wireless Telegraphy.**—The telegraph authorities are now conducting experiments for linking up the ordinary telephone with the wireless telephone, by means of which a wireless call can at any time be connected with the ordinary telephone system. The experiment has so far been very successful, says the *Daily Telegraph*.

The Telephone Service.—**NEW EXCHANGE.**—A new public telephone exchange, named Grosvenor, was opened on September 3rd at 39, South Audley Street, Oxford Street, W. 1, and as it is within the five-mile circle from Oxford Circus, it is within the local fee area of all exchanges within a radius of ten miles from Oxford Circus. The Grosvenor exchange, which has central battery equipment, will start with the transfer of 850 and 110 lines from the Mayfair and Gerrard exchanges respectively, and two weeks later another batch of 200 lines will be transferred from Mayfair.

U.S.A.—The Radio Corporation of America has absorbed the International Radio Co. and thereby acquired patents which are necessary to maintain efficient operation, says the *Financier*.

Wireless Telegraphy.—A MESSAGE FROM MARS?—Mr. J. C. H. Macbeth, the London manager of Marconi's Wireless Telegraph Co., Ltd., described at a recent luncheon assembly, says a New York message to the daily Press, the recent experiments made on the yacht *Eletra* in the Mediterranean Sea which led Mr. Marconi and others to believe that some planet was seeking to communicate with the world. Mr. Macbeth said the apparatus intercepted waves of a length of 150,000 metres, whereas the maximum wave-length produced in the world was 14,000 metres. He said the regularity of the wave-lengths disproved the belief that it was due to electrical disturbances. It is also reported that a number of important experiments in wireless telephony are at present being carried out between Rome and Sicily, a distance of over 500 miles, which are regarded as most satisfactory. At the recent annual meeting of the company held in London, Mr. Marconi is reported to have said: "The results obtained during the last few weeks are of signal importance, and I now believe that, if we have not completely mastered the troubles arising from adverse atmospheric conditions, we have gone far enough to enable me to tell you that this work is of transcendental importance and epoch-making in the conduct of wireless telegraph services throughout the world. The new arrangements not only enable communication to be carried on under conditions which previously made it impossible, but also allow of a very considerable increase in speed and improvement in accuracy." With regard to wireless telephony, considerable progress had also been made, and he had no doubt that this new method of communication might profitably be utilised at once as a practical and reliable system. They foresaw in this direction the possibility of a very large business in all parts of the world both for public and private use. They hoped in the near future, subject to satisfactory arrangements with the Post Office, to create telephonic services with several foreign countries, and also, provided they had the opportunities they hoped to have, a wireless telegraphic service between England and Australia.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Argentina.—October 21st. State Railways. Twelve months' supply of electrical stores.*

Australia.—**MELBOURNE.** Victorian Government Railways. October 26th. D.c. arc welding plant (Cont. No. 34,377). Armature banding machine with electric motor and starting gear (Cont. 34,378). *November 2nd. Electric storage battery complete for automatic telephone exchange (Cont. 34,229).*

The closing date for the receipt of tenders for 132 sets of accumulator cells (Cont. 34,171) has been extended to September 24th.*

ADELAIDE.—October 12th. Postmaster-General's Department. 2,750 yds. telephone cords, 120 hand sets, 160 jacks.*

Bristol.—September 16th. Electricity Department. One 500-kW rotary converter. (August 26th.)

Belgium.—October 3rd. Municipal authorities of Schaerbeek. Terminal boxes complete with circuit breakers and accessories. Service de l'Electricité, 40, Rue de Bethlehem, Schaerbeek. Tenders to the Collège des Echevins, Hotel de Ville, Schaerbeek, Brussels.

Belgian State Railway authorities, at La Salle Madeleine, Brussels, are inviting tenders for the supply at Malines, of 22 lots of miscellaneous electric train lighting material.

Dorchester.—September 10th. Electricity Committee. Replanting battery, &c. (August 26th.)

Eastbourne.—September 26th. Electricity Department. One water-tube boiler, fan and chimney, boiler-feed pump and piping; one 2,500-kW turbo-alternator with condensing plant and pipework. (September 2nd.)

France.—October 4th. French Ministry of War. 1,500 kilometres of light cable. Ministère de la Guerre (Service du Génie), 24, bis Boulevard de la Tour-Maubourg, Paris.

Halifax.—September 10th. Electricity Committee. Steelwork in connection with foundations for new turbine set at the electricity generating station.—Mr. A. C. Tipples, acting borough engineer, Crossley Street.

London.—H.M. Office of Works. September 16th. Supply of electrical and mechanical labour-in-daywork in the Carful district. (August 26th.)

BERMONDSEY.—September 23rd. Board of Guardians. Six months' supply of electric lamps. Mr. H. Reeve, clerk to the Guardians, 285, Tooley Street, S.E.

Manchester.—September 13th. Tramways Committee. Motors, controllers and trucks, &c. Mr. J. M. M'Elroy, general manager Corporation Tramways, 55, Piccadilly, Manchester.

New Zealand.—**WELLINGTON.**—September 27th. Public Works Tender Board. Six sets 3-phase, 50,000-V air-break switches for the Waikato electric power scheme.*

November 29th. Public Works Department, Mangahao electric power scheme: 3 water wheels, three 6,000-kVA and two 3,000-kVA a.c. generators, two 3-unit exciter sets, seven 4,000-kVA single-phase transformers, insulators, lightning arresters, switchboard, &c.*

October 15th. Corporation. Two water-tube boilers with feed-water heaters, superheaters, stokers, &c.; one 5,000-kW turbo-alternator with condensing plant. (September 2nd.)

Salford.—September 13th. Tramways Department. General supplies for three or six months. General Manager, 32, Blackfriars Street, Salford.

South Africa.—**JOHANNESBURG.** November 7th. Rand Water Board. Two 350-kW steam-driven electrical generating sets, complete with switchboards and all accessories.*

Uruguay.—September 19th. Board of State Electrical Stations. Generating plant for four electrical groups, consisting of a.c. and d.c. generators, Diesel engines, &c.*

Uxbridge.—Board of Guardians. Tenders for converting the electric power plant at the Institution, Hillingdon, from 100 V d.c. to 200 V single-phase, 50 periods, and supplying machinery for same. (See this issue.)

Warrington.—September 27th. Board of Guardians. Electrical goods for three months. Mr. A. Bottomley, Bewsey Chambers.

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CLOSED.

Australia.—Further to our note on page 55 of July 8th, the Electricity Committee of the Sydney City Council recommended that the offer of Thompsons Pty. Ltd., to supply a 17,500 (nominal) kW turbo-alternator, 3,000 r.p.m., with auxiliary plant and accessories, for £125,000, erected complete, be accepted; the plant is a Westinghouse type manufactured under licence from the Metropolitan-Vickers Electrical Co., Ltd.

The recommendation was considered by the Council on July 12th, but referred to the General Purposes Committee to consider the objections to the acceptance of the contract.

The objections are based on the claim of the English Electric Co. of Australia Ltd., for priority in this contract, and the protest of the Amalgamated Society of Engineers against the work being placed outside the State. The claim of the English Electric Co. goes back to the arrangement made with Messrs. Willans & Robinson, Ltd., in 1918, when the last-mentioned firm contracted for a 3,000-kW plant, but was unable to proceed with construction owing to War Office requirements. The Council agreed to cancel the contract, and was compensated by the firm to the extent of £208 on condition that the Council placed its next order for main generating plant with Willans & Robinson, Ltd., or Messrs. Dick, Kerr & Co., Ltd. Subsequently Messrs. Willans & Robinson, Ltd., incorporated with the English Electric Co. of Australia, Ltd., and the Council about the middle of 1920 renewed its promise to order the next generating set from the successors of Willans & Robinson, Ltd., namely, the English Electric Co. In the meantime the Council placed a contract with the British Westinghouse Electric & Manufacturing Co., Ltd., for the supply of an 8,000-kW turbo-alternator, and the protest of Messrs. Willans & Robinson to this course resulted in the renewed promise mentioned.

A report by the city electrical engineer made in April last on the matters received showed that the English Electric Co. of Australia, Ltd., offered to land a 16,000-kW turbo-alternator at £103,150 f.o.b. a British port, or manufacture a similar plant in Australia at cost plus 15 per cent. Messrs. Thompsons (Crombie) Proprietary, Ltd., offered a 12,000-kW alternator at £122,000. The engineer recommended acceptance of the English Electric Co.'s offer of a plant at £103,150, if it was decided to accept a firm offer, though his opinion was that it would be to the Council's advantage to have the alternator constructed locally by the English Electric Co. Another offer for the supply of this plant was received after the date fixed for receipt of these tenders, but was not reported upon.

The General Purposes Committee, on July 19th, decided to confirm the recommendation of the Electricity Committee and give the contract to Messrs. Thompsons (Castlemaine) Proprietary, Ltd.—*Tenders*.

Belgium.—No less than twenty concerns, including the Metropolitan-Vickers Co., competed for the recent contract of the municipal authorities of Schaarbeek, Brussels, for the supply of electricity meters; the lowest prices were submitted by M. F. Van Sintjan, of Brussels.

Nine concerns, including one French and one Italian, competed for the recent contract of the municipal authorities of Ixelles, Brussels, for the supply of a quantity of low-pressure armoured cables required in connection with the electric lighting undertaking. The lowest quotation was that of Messrs. Noel, Van Gastel & Mertens, of Brussels.

The Belgian Ministry of National Defence, in Brussels, recently invited tenders for the supply of 5,000 3-electrode valves for use in connection with the military wireless telegraph service. Six concerns competed for the contract, the lowest offer (51,900 fr.) being that of M. J. Vink, of Brussels.

Salford.—Health Committee.

Electric lighting installation at the Nab Top sanatorium, Marple, £1,935.—E. M. Evans & Sons, Ltd.

Tramway Committee.

Gear wheels, £292.—British Hydro-Shaw, Clutch Co., Ltd.
100 tons of B.S. No. 4 tramway rails, £1,800.—Walter Scott, Ltd.

Electricity Committee.

H.P. switchgear in connection with the supply of electricity to Lloyd's Packing Warehouses, Ltd., Weaste, £406.—Metropolitan-Vickers Electrical Co., Ltd.

Lighting and Cleansing Committee:—

Swan necks for attachment to street lamp pillars (37s. 6d. each), £412.—Brighton Lighting & Electrical Engineering Co., Ltd.

Tasmania.—Tasmanian Hydro-electric Power Supply.

Erection of the transmission lines Waddamana-Ridson and Waddamana-Launceston, £37,900.—G. Cheverton, of Hobart, for the erection of both lines. The contractor will make an immediate start. The contract provides that both lines are to be completed by August, 1922.—Tenders.

FORTHCOMING EVENTS.

British Association for the Advancement of Science.—September 7th-14th. At Edinburgh. Eighty-ninth annual meeting.

Shipping, Engineering and Machinery Exhibition.—September 7th to 28th. At Olympia, W.

Birmingham and District Electric Club.—Saturday, September 10th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper, "Canadian Notes," by Mr. N. Deykin.

Salford Technical and Engineering Association.—Saturday, September 10th. At the Royal Technical College. At 7 p.m. Lecture on "Modern Developments in the Manufacture and Use of Coal Gas," by Mr. E. West.

Institution of Mining Engineers.—Wednesday, September 14th. At the Town Hall, Stoke-on-Trent. At 11 a.m. Annual general meeting.

NOTES.

Appointments Vacant.—Switchboard attendant (£83s.) for the redditch Urban District Council electricity works; charge engineer for the Torquay Corporation electricity department; plumber-jointer for the Farnworth Urban District Council electricity department. See our advertisement columns to-day.

Shadowless Light.—A lamp that throws a brilliant shadowless light has been introduced to London, says the *Daily Mail*, by a French firm. It is claimed that if an object is placed between the lamp and the surface to be illuminated, no shadow is cast on the latter. This result is accomplished by means of a cylindrical prismatic lens and a number of silvered mirror reflectors. "There is no heat."

The Theory of Relativity.—Einstein's theory of relativity is to be the subject of a cinematograph film which a German company has engaged some leading scientists to prepare for the autumn. By the use of diagrams and apparatus of various kinds the principles of the new theory will be made intelligible, it is said, to persons who are entirely incapable of understanding mathematical formulae.—*Evening News*.

Fatilities.—A most unusual fatality occurred last week. Walter Ashton (33), stonemason, was standing on the causeway in Montagu Square, Moxborough, close to an electric light standard when the trolley arm of a passing tramcar slipped the wires, struck the light standard, and knocked off the head, which crashed down and fractured Ashton's skull. He died in the hospital within an hour of the accident.

Caught by the revolving claws of an electrically-driven dough mixer which he had been cleaning, George Gobel, a Deptford baker, was drawn into the machine and terribly injured; he died soon after being admitted to hospital.

"Straphanging" to Remain.—The *Daily Mail* understands that straphanging in tramway-cars and omnibuses, which was due to end on October 1st, is to be allowed to continue until the needs of the travelling public are met with adequate services. This extends the permission given during the war for a certain number of standing passengers in public vehicles. The report of the investigations made by Mr. Frank Elliott, Assistant Commissioner of the Metropolitan Police, is to be issued in a few days, and is expected to delay the operation of the ban for at least six months.

Service Notes.—Major G. A. Bruce, T.D., M.I.E.E., has relinquished his commission in the Territorial Force Reserve of Officers as from the 1st inst. Major Bruce was associated with the Tyne Electrical Engineers for many years, becoming captain in 1903 and major in 1915. Lieutenant C. A. Stephens, Tyne Electrical Engineers, has resigned his commission, to which he was appointed in 1916, getting his second star in 1918. Captain W. H. U. Marshall, M.I.E.E., having attained the age limit, has resigned his commission in the Dorset (Electric Lights) Engineers. Major Marshall joined the regiment in 1910, was promoted captain in 1915 and major in the present year. The following officers of the Tyne Electrical Engineers have been posted to the Reserve of Officers of the Territorial Force in their respective ranks: Capt. J. F. B. Hunter, M.B.E., Capt. L. S. Winkworth, Capt. M. C. James, Capt. D. A. Williamson; Lieuts. H. S. Ripley, M.B.E. (to be captain), Lieuts. R. G. Ellis, A.M.I.E.E., F. S. Corby, and F. W. Bond, all from the 27th inst.

The Trade Union Congress.—"Millions of people lack employment, while the world cries for more and more goods to supply only the bare necessities of life. . . The workers should press for a shorter working week. . ."

That is the strange argument of the President, Mr. E. L. Poulton (Boot and Shoe Operatives), in his presidential address to the Trade Union Congress which opened at Cardiff on September 5th. The idea is apparently that with still shorter hours the work of production would be shared by a greater number of men. There were 850 delegates, representing 212 unions, with a total membership of nearly 64 millions. The reappearance of Mr. Smillie, the veteran miners' leader, was a feature of the Congress.

News Value or Nuisance Value?—The following editorial under this heading in our excellent contemporary *Chemical and Metallurgical Engineering*, contains a sentiment with which we cordially sympathise:—

On the hottest day yet there came to us a "news note" from a well-known corporation that shall be nameless because it ought to know better. Probably the Old Man does know better but is away on his vacation. The item reads as follows: "Blank Co. Distributes New Blotter. The Blank Co. are placing in the hands of their representatives for distribution a new and attractive blotter. The Blank Co. have always been strong advocates of the blotter for advertising purposes because of its usefulness, its attention value and its ability to drive home its sales message."

This is the kind of information for which our readers are supposed to hunger and thirst; to pay good money for subscriptions so that they may read it and still more good money to have their advertisement accompany it. It pains us to have anybody think so. We have a high opinion of our readers; a sense of brotherhood with them. We talk out of our hearts to them, and feel that they understand, and in return they often talk straight from their hearts to us and we think we understand. We don't set up to be professional highbrows (who are those, according to Brander Matthews, whose instruction exceeds their mental capacity), but at the same time we do not worry over reducing the expression of our opinions to words of one syllable. We do not worry over the adenoids of our readers; we take it for granted that if they ever were congested, they were duly removed; and we do not try to reach the feeble minded or those who are defective.

On the other hand, we want news; all the news that is really news, and that is worth reading and fit to print. Had the company in question developed a new product or process, different from any that is known, and of such value that in our judgement our readers would be glad to know of it, we should have been glad to publish a technical article on the subject. We are not influenced by the advertising value such an article may have to the concern that produces the apparatus or product, if we think it worth while to print it; whereas, if we do not think it worth while, there isn't any money that can get it printed except at advertising rates, and as an advertisement in the advertising section.

We do not print advertisements either as so-called "reading matter"—to fool our readers, or interspersed with it—to disturb them. Advertising is a legitimate art, but it has been made the subject of serious malpractice. One of the most serious phases of this malpractice is to give it nuisance value. It consists in stealing the attention of busy men to tell them something they do not want to know. It has not a tithe of the value ascribed to it. Men with things to do and with obligations to perform are beginning to realise this. If we do not chew tobacco, we do not want to be told which preparation of tobacco to chew. When we read our morning newspaper, and are trying to learn what is being done with the tariff bill in Washington, we do not want to be interrupted by the information that the Maison de Paris is having a grand marked-down sale of lingerie. On the other hand, the woman of the household may want to know about the sale, but may not be interested in the tariff bill. This misplacement of news and advertising is a mistake, so far as we are concerned.

Worse than such a mix-up of understanding and underwear is the publication as news of such inane items as that a corporation has bought some blotting paper and had its name printed on it. That brings the corporation's name before our readers, but it offends them, and rightly so. It does not interest us and we don't see how it can interest anybody else.

Institution Notes.—INSTITUTION OF ELECTRICAL ENGINEERS.—The offer of Mr. E. M. Hughman to give a donation of £250 to the Benevolent Fund, on condition that 19 similar amounts were contributed by June 30th, has been extended by him to December 31st, 1921.

BRISTOL AND DISTRICT ELECTRIC CLUB.—The arrangements for the annual hall of the 1921 session include the reading of papers on "Commercial Efficiency at the Telephone," on October 8th, by Mr. C. G. Findlay; and on "The Gyroscopic Compass," on November 12th, by Mr. H. E. Stevenson. The annual meeting is to be held on December 10th.

ASSOCIATION OF ENGINEERS-IN-CHARGE.—The president for the season 1921-22 will be Capt. H. Riall Sankey, C.B., C.B.E., who will deliver his address on October 12th. Mr. L. Pendred has become a vice-president. The annual dinner will take place on October 8th.

A Watt Memorial.—To mark the recent centenary of James Watt, the Institution of Shipbuilders and Engineers has founded two new chairs in Glasgow University—a James Watt Chair of Electrical Engineering, and a James Watt Chair of the Theory and Practice of Heat. The appointments are likely to be made by the University Court next month.—*The Observer.*

A Swedish Electrical Invention.—Ludvika Elektromekaniska Verkstad has begun the manufacture of a newly invented apparatus by the use of which, it is claimed, all risk in handling high-pressure electric lines is eliminated. The inventors of the apparatus are Mr. Olof Jacobsson (a foreman) and Mr. Gustaf Hendeberg (an engineer). The contrivance, which is simple and easily handled, costs kr. 250.—*Reuter's Trade Service* (Stockholm).

Joint Electricity Authorities.—In accordance with expectations, the financial state of the country has interfered with the movement for co-ordinating electrical undertakings. It was intended to establish a Joint Electricity Authority for the Mid-Lancashire area, and to erect three generating stations, but at a conference on Monday it was decided to postpone the scheme *sine die* in view of the financial obligations which it would involve. Though this does not amount to actual abandonment, the proposal is not likely to be put into operation for a considerable time. Had the scheme gone forward it would certainly have marked a new industrial era in North-East and West Lancashire.

Machinery Required in Sofia.—The Department of Overseas Trade informs us that His Majesty's Legation, Sofia, reports the receipt of an inquiry for quotations required in Philippolis for the equipment of new constructions. The inquirer is also desirous of receiving catalogues for machinery of all descriptions, including dynamos, motors, flour milling plant, pumps (hand and power), stationary and portable electric sets, &c. The Legation has also transmitted an inquiry received from Bourgas for the names of some United Kingdom firms dealing in small machinery and textiles. The names and addresses of the inquirers may be obtained by United Kingdom firms interested on application to the Department.

The Society of Technical Engineers.—We understand that after a long period of preliminary work the Society of Technical Engineers has at last arrived at a general agreement throughout its membership with regard to the broad lines of its policy, and that only the details of the form in which that policy shall be stated remain to be settled. This will shortly be accomplished, and the Society will then be in a position to publish an account of its aims and organisation.

It is noted by the Labour correspondent of *The Times* that the movement towards the organisation of the brain-workers has become international, proposals having been put forward in that connection in Switzerland and Italy, whilst in Austria an Act has already come into force affecting them in certain professions.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Mr. W. J. HANCOCK, M.Inst.C.E., M.I.E.E., Government electrical engineer, Western Australia, has retired after 37 years' service. Mr. Hancock was responsible for the construction and establishment of the first Perth and Fremantle telephone exchange systems, repairing and relaying of the Breaker submarine cables, &c.

Mr. J. ONYEMAH, permanent head of the Commonwealth Postmaster-General's department, has returned to Australia from a business visit to England, America, and the Continent.

The marriage took place at the Parish Church, Crediton (Devon), on September 4, of Mr. R. J. WHEAT, M.I.E.E., engineer of the Elbro Irrigation & Power Co., of Barcelona, and Miss ALISON FRANCIS, eldest daughter of Mr. S. B. Francis, of Crediton.

Mr. W. M. MILNES, chief assistant engineer, of the Coventry Corporation Tramways, who is leaving to become general manager of the Corporation Tramways at Wigan, has been pre-

sented by the staff with a silver fruit dish, rose bowl, and attached case.

Mr. CHAS. MALLINS, M.I.A.E., A.I.E.E., late general manager of the Liverpool Corporation motor-bus and tramway service, is joining the board of the Samuelson Transport Co., Ltd.

Among the arbiter's awards following claims made by Leith electricians arising out of the amalgamation of the borough with Edinburgh appears the following: Mr. A. P. RUTHERFORD, late electrical engineer, Leith, amount of claim, £6,500; Corporation's offer, £1,500; award, £4,000.

Major-General G. O. SODER, chief signal officer of the U.S. Army, left London last Saturday, the 3rd inst.

Mr. WILLIAM WALKER, director of health and safety in the Mines Department and formerly chief inspector of mines, retired on August 31st.

Mr. H. NIMMO, M.I.E.E., of the Public Works Department, Burma, who is at home on leave (address: The Sports Club, St. James's Square, S.W.1), will be glad to give our readers any information at his disposal regarding the cost of living, trade prospects, &c., in Burma.

Alderman BARRETT has been appointed chairman of the Salford Corporation Tramways Committee, and Councillor H. S. HIND has been elected deputy-chairman.

Mr. F. AYTON, M.I.E.E., at present chief engineer and manager of the Corporation Electric Supply and Tramways at Ipswich, is taking up his new position with Messrs. Ransomes, Sims & Jefferies, Ltd., on the 14th instant, after which all communications should be addressed to him at Orwell Works, Ipswich. On and after the date mentioned communications relating to the business of the Corporation Electricity Supply and Tramway Departments should be addressed to the new chief engineer and manager, Mr. A. S. Black, M.I.E.E.

On August 23rd, at All Saints' Church, Habergham, Mr. T. W. HORTON, shift engineer at the Corporation Electricity Works, Leigh, Lancs., was married to Miss Edith Walley, only daughter of Mr. and Mrs. F. Walley, Lightenhill, Burnley.

Mr. H. WILSON is vacating his position as mains superintendent to the Maidstone Corporation early in October on appointment as distribution engineer at the Croydon Electricity Works.

Mr. E. E. HOADLEY, M.I.E.E., engineer and manager of the Corporation Electricity Supply Undertaking at Maidstone, has been appointed honorary secretary of the Electric Vehicle Committee, in succession to Mr. F. Ayton, M.I.E.E., who has held the position since the committee's inception, and who resigned upon his appointment as joint managing director of Messrs. Ransomes, Sims & Jefferies, Ltd. Upon severing his connection with municipal work, Mr. Ayton ceases to be a representative of the I.M.E.A. on the Committee, and accordingly, at the last meeting of the Committee, he was elected a member in his personal capacity and re-elected chairman for the year ending March 31st next. All communications in connection with the Electric Vehicle Committee and its work should in future be addressed to Mr. E. E. Hoadley, Electricity Works, Maidstone, Kent.

Obituary.—SIR F. BRAIN.—We regret to learn from the *Evening News* of the death of Sir Francis Brain, a distinguished mining engineer and a pioneer in the use of electricity in mining operations, who was a member of the Advisory Committee under the Government control of coal mines. Knighted in 1913, Sir Francis belonged to an old Forest of Dean family, and was an alderman of the Gloucester County Council.

VICTOR E. JOYCE.—We regret to learn of the death of Mr. Victor E. Joyce, who was works manager and a director of Park Royal Engineering Works, Ltd. On his return from holidays he was taken ill through blood poisoning, which developed rapidly, and death ensued in the course of a week. The interment took place at Ealing on the 3rd instant, when a large number of the employés from Park Royal, together with the staff and such of the directors as were in town, attended to show their sympathy and esteem.

NEW COMPANIES REGISTERED.

Tisbury Electric Supply Co., Ltd. (176,539).—Registered August 30th. Capital, £20,000 in £1 shares. To generate and supply electric current for light, power, and other purposes in Tisbury, Wilts. Minimum cash subscription 50 per cent. of the shares offered. The first directors are: A. J. Pippard, Broad Sanctuary Chambers, Westminster, S.W.1; W. W. Kennell, High Street, Tisbury; A. B. Randall, 27, Victoria Road, Salisbury; L. D. Webb, Ganton Manor, Tisbury. Qualification, £25. Remuneration as fixed by the directors. Secretary: A. B. Randall. Registered office: Town Mill, Salisbury, Wilts.

Electrolux, Ltd. (176,547).—Private company. Registered August 31st. Capital, £5,000 in £1 shares. To carry on the business of electricians, electrical and mechanical engineers, &c., and to acquire from the A. B. Electrolux, Stockholm, the trade-mark "Electrolux," and the goodwill of the business carried on by them in England in connection therewith. The subscribers (each with one share) are: A. Urry, 17, Acton Street, W.C.1, clerk; J. C. Hawes, 10, Endsleigh Terrace, Dulock Road, W.C.1, clerk. The first directors are: A. L. Wenner-Gren (chairman) and J. Scrivener. Registered office: 73, Newman Street, W.1.

Scottish Engineering Corporation, Ltd. (11,852).—Private company. Registered in Edinburgh August 31st. Capital, £10,000 in £1 shares. To acquire the business of the Scottish Engineering Corporation, carried on at 138, Hope Street, Glasgow. The first directors are: J. A. Beveridge, 31, Clifford Street, Ibrox, Glasgow, clerk; A. H. Hughes, 46, Woodlands Road, Glasgow, merchant. Qualification, 100 shares. Secretary: J. A. Beveridge. Registered office: 128, Hope Street, Glasgow.

British Association for the Advancement of Radiology and Physiotherapy. (The word "Limited" being omitted from title by licence of the Board of Trade.) (176,568). Registered September 1st as a company limited by guarantee. The object, are: To promote the advancement of radiology and physiotherapy on scientific lines under the direct control of the medical profession. The management is vested in a Council, the first members of which are: R. Knox, 38, Harley Street, W., consulting radiologist; F. Hornaman-Johnson, 66, Harley Street, W., consulting radiologist; C. MacGregor, 14, Welbeck Street, consulting electrotherapist; S. G. Scott, 6, Bentinck Street, W., consulting radiologist; Sir Archibald D. Reid, 30, Welbeck Street, W., consulting radiologist; S. Melville, 9, Chandos Street, W., consulting radiologist; Agnes Savill, 77, Devonshire Place, W., electrotherapist and dermologist. Solicitors: Bristows, Cooke and Carmichael, 1, Copthall Buildings, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dartmoor Electric Supply Co., Ltd.—Particulars of £2,500 debentures authorised November 27th, 1919, whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital. Particulars filed August 16th, 1921.

Bell's United Asbestos Co., Ltd.—Issue on August 25th, 1921, of £1,700 debentures, part of a series already registered.

Babcock & Wilcox, Ltd. (65,805).—Return dated June 1st, 1921. Capital, £2,460,000 in 41 shares (100,000 6 per cent. preference, 200,000 5 per cent. second preference, and 2,160,000 ordinary), 100,000 6 per cent. preference, 179,056 5 per cent. second preference, and 2,148,828 ordinary shares taken up, £1,027,875 paid. £1,400,000 considered as paid. £9 remains in arrears. Mortgages and charges, nil.

Hooper's Telegraph & India-Rubber Works, Ltd. (40,947).—Return dated July 13th, 1921. Capital, £50,000 in £10 shares (1,000 preference and 4,000 ordinary). All shares taken up. £40,000 paid and £10,000 considered as paid. Mortgages and charges, nil.

CITY NOTES.

French Companies. *Société d'Electro-Chimie et d'Electro-Metallurgie.*—According to the report presented to the ordinary general meeting on May 25th, the net profit on the working of 1920 amounted to 3,709,495 fr., from which a dividend of 45 fr. per share was sanctioned.

Compagnie Electrique du Nord.—The accounts for 1920 presented at the ordinary meeting on July 29th showed net profits, after setting aside 300,000 fr. to the sinking fund, of 375,000 fr., which were again carried forward. The capital has now been increased from 12,500,000 fr. to 14,500,000 fr.

Eclairage et Force par l'Electricité à Paris.—The accounts for 1920, presented at the meeting on June 27th, showed net profits of 436,423 fr., against 370,200 fr. in the previous year. The available balance after addition of the carry-over of 1,682,656 fr. from the last report, amounted to 2,121,085 fr., against 2,182,655 fr. The amount of the distribution was not stated. A dividend of 25 fr. per share was declared last year.

New Issues.—The issue of £350,000 debentures of the *Thames Valley Electric Power Board (N.Z.)* having been over subscribed, the list was closed at 11 o'clock on Wednesday morning last week; owing to the heavy over subscriptions it was found impossible to consider applications received through the post.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Stock Exchange Committee under Rule 143a:—

Thames Valley Electric Power Board.—£350,000 six per cent. debentures of £100 each, issued at 96 per cent. 46 per cent. paid (guaranteed by New Zealand Government), after issue of allotment letters.

The undermentioned have been ordered to be officially quoted:—

Barcelona Traction, Light & Power Co.—£1,050,000 8 per cent. secured debentures, Nos. A1 to A7,000 (£100), and B1 to B700 (£500) bearer.

Shanghai Electric Construction Co.—3,490 shares of £10 each, fully paid. Nos. 36,511 to 40,000.

Direct Spanish Telegraph Co., Ltd.—Dividend at the rate of 10 per cent. per annum on the preference shares and an interim dividend at the rate of 8 per cent. per annum, free of income tax, on the ordinary shares for the half-year ended June 30th.

Canadian General Electric Co., Ltd.—Dividend of 2 per cent. for the three months to September 30th on the common stock and 3½ per cent. for the half-year on the preference stock.

Fraser & Chalmers, Ltd.—The liquidator is now making a further payment of 9d. per share, which will bring the total return of capital up to 32s. 3d. per £1 share.

Brazilian Traction, Light & Power Co.—Quarterly dividend of 1½ per cent. on preference shares.

Davis & Timmins.—Interim dividend of 3 per cent., free of tax, on the ordinary shares for the half-year.

American Telephone & Telegraph Co.—Dividend of 2½ per cent., less tax.

STOCKS AND SHARES.

TUESDAY EVENING.

THE holiday season being regarded as practically over, the Stock Exchange markets are displaying a reasonable amount of activity, and the trend of values has been generally upward. In spite of the calls which are made upon capital, investment continues to absorb readily enough whatever good stock comes to market. The Thames Valley (New Zealand) Power Company's 6 per cent. debentures, guaranteed by the New Zealand Government, were promptly over-subscribed. The subscription-lists were open for a couple of hours only. The market in the scrip began to-day, Tuesday, and the price is quoted 1 premium. The Southland Power Company's debenture stock, offered at the same price and on similar terms, commands a premium of 1½.

Nor are the home country's issues neglected. North Metropolitan 7½ per cent. Extension debenture and Metropolitan Electric 7½ per cent. debenture have both risen to 3 premium over and above their issue price of 95. General Electric 7 per cent. debenture has risen to 98, a premium of 5 points. The Shropshire Electric Power 7½ per cent. debentures remain about ½ premium. Several of the issues recently made by iron and steel companies, the prices of which have been standing at a discount, are recovering to their par levels.

It is worth noticing, in the strong investment demand, that Home Railway debenture stocks are again coming into favour. Metropolitan 3½ per cent. debenture stock has risen to 57½. District debentures are difficult to obtain. The 6 per cent. permanent debenture stock is quoted at 89, which compares, incidentally, with 137½ at which the stock stood on the outbreak of war. District 4½ per cent. first preference changed hands this week at 60. London Electric 4 per cent. preference has been done at 52, at which the yield on the money is 7½ per cent. East London debentures continue to be put up. The company's 4 per cent. "A" debenture stock stands at 60. The "B" debenture, which received ½ per cent. for last year, changed hands the other day at 37½, while a little speculation is springing up in the 4 per cent. third debenture stock, a fair number of bargains having been done about 15½. The company's ordinary stock has strengthened to 4.

Metropolitan ordinary at 25½ is ½ lower, but Districts remain at 17½. Underground Electric Income Bonds are quoted 76½ ex the coupon of £2 net due on September 1st. The market valuation of the coupon is £2 11s. per cent. net, owing to the premium it commands by reason of the interest being payable in New York as well as in London.

Electricity supply shares are a better market. County of London have risen 5s. to 8½. St. James's at 6½ are similarly better. Metropolitan are half-a-crown higher at 3½. Westminster ordinary, although quoted at 5½ middle, are more like 5½. Dealers in the market are not anxious to put up prices, but their hands are being forced against themselves, and the pressure to buy is consistent. With the early termination of Summer-time, this is, of course, the season of the year to which the investor begins to pay a little attention to what are called illumination securities, and with the improvement in electrical shares, there has come a pretty general advance in gas stocks.

The manufacturing list is inclined to be slightly harder, but there is still a good deal of nervousness in regard to the possibility of German competition. Edisons have dropped to 6s. 3d., recent transactions being marked at 7s. India-Rubber shares have been done at 15s. On the other hand, there is a noticeable demand for the pre-ordinary issues. British Insulated 4½ per cent. debenture at 55½ is 2 up, and the company's 5 per cent. debenture stock at 93½ shows a gain of 5 points. British Aluminium debentures, although unchanged in price, are also wanted. The 5 per cent. prior lien debentures stand nominally about 73 and the 5½ per cent. debenture stock at 71. Stock changed hands in the last-named the other day at this price. General Electric debenture, as already noted, has jumped to 98. The company's ordinary shares remain at £1, and both classes of preference stand about 17s. 6d. Callender's preference have risen to 18s. 3d. Telegraph Construction at 21½ are the fraction to the good. In the foreign list, Calcutta Electric new preference shares, 5s. paid, have hardened to 5s. 9d. The recent nervousness perceptible in stocks and shares connected with India is passing away, and most of the recent falls have been recovered.

Further progress has been made in the exchange process that is going on between Mexican Light & Power Fives and Mexico Tramway Fives. The price of Mexican Light First Bonds has dropped to 49½, while Mexico Tramway 5 per cents. at 58 have recovered the full amount of the coupon taken off last week. Brazil Tractions are better at 29, but in the British Columbia group, the deferred stock at 55 is 3 points lower. Anglo-Argentine Tramways show no changes. Midland Electric 5 per cent. debenture stock at 78½ is about a point down.

Anglo-American Telegraph preferred at 86 has again improved, and Great Northern Telegraphs, after being 25½, went back to 25, at which they still show a rise of 12s. 6d. on the week. The Eastern group is a little easier, with Eastern Telegraph ordinary down a point to 102½. Parenthetically, reference may be given to the fact that the wonderful summer weather makes it seem almost paradoxical for the Eastern company to be playing Rugby football matches these hot afternoons at its Hampstead training school. Marconis at 1 13/16 are 1/16 down, owing to the complete absence of public interest in the shares, and Marconi Marines, after giving way to a guinea, recovered to 21s. 9d. Business in this market has dwindled to negligible proportions.

Babcock & Wilcox at 2½ show a rise of 1s. 3d., but the advance that had been taking place in iron, coal and steel shares received something of a check from the speech of the President of the Trade Union Congress, in which he foreshadowed a demand for shorter hours of work. This affected armament shares as well. Vickers, after being over 14s., went back to 13s., and Armstrongs from 12s. 3d. dropped to 12s. 6d. The strength of the iron and steel market attracted a little local selling from Cardiff and Sheffield. Interest in the rubber market is confined to the efforts that are being made to establish, upon a sound foundation, the new Rubber Shareholders' Association. We understand that up to the present the Association has secured support from about 500 proprietors of rubber shares, but as it is computed that there are at least 50,000 people who own shares in rubber-producing companies, it is obvious that the Association has a wide field left from which to draw that measure of support which alone can render its inauguration a success in the way of making itself felt in regard to control of the industry.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price	Rise or fall.	Yield.
	1919. 1920.	Sept. 6.		p.c.
Brompton Ordinary	12 12	12 12	—	10 0 2
Charing Cross Ordinary ..	7 4	7 4	—	9 8 4
do. do. 4½ Pref. ..	4 4	4 4	—	7 4 4
Chelsea	4 4	4 4	—	9 4 8
City of London	18 14	18 14	—	10 3 0
do. do. 6 per cent. Pref. ..	6 6	6 6	—	7 1 0
County of London	6 8	6 8	—	9 0 6
do. do. 6 per cent. Pref. ..	6 6	6 6	—	7 7 4
Kensington Ordinary ..	7 9	7 9	—	10 18 8
London Electric	24 24	24 24	—	9 4 8
do. do. 6 per cent. Pref. ..	6 6	6 6	—	10 9 0
Metropolitan	6 7	6 7	—	9 0 8
do. 4½ per cent. Pref. ..	4 4	4 4	—	7 16 0
St. James' and Pall Mall ..	12 12	12 12	—	9 4 8
South London	6 7	6 7	—	10 13 2
South Metropolitan Pref. ..	7 7	7 7	—	8 17 10
Westminster Ordinary ..	10 10	10 10	—	8 13 10

TELEGRAMS AND TELEPHONS.

Anglo-Am. Tel. Pref. ..	6 6	6 6	—	6 19 6
do. Def. ..	14 14	14 14	—	8 14 9
Chile Telephone	6 6	6 6	—	5 14 3
Cuba Sub. Ord. ..	7 7	7 7	—	9 6 8
Eastern Extension ..	10 10	10 10	—	6 2 0
Eastern Tel. Ord. ..	10 10	10 10	—	6 3 0
Globe Tel. and T. Ord. ..	10 10	10 10	—	6 0 4
do. do. Pref. ..	8 8	8 8	—	6 6 4
Great Northern Tel. ..	22 24	22 24	—	9 12 0
Indo-European	10 10	10 10	—	6 8 8
Marconi	36 15	36 15	—	8 5 6
Oriental Telephone Ord. ..	12 12	12 12	—	6 16 8
United R. Plate Tel. ..	8 8	8 8	—	6 10 4
West India and Panama ..	Nil Nil	Nil Nil	—	Nil.
Western Telegraph ..	10 10	10 10	—	6 1 2

HOME RAILW.

Central London Ord. Assented ..	4 4	4 4	—	8 8 6
Metropolitan	12 12	12 12	—	5 17 8
do. District ..	Nil Nil	Nil Nil	—	Nil
Underground Electric Ordinary ..	Nil Nil	Nil Nil	—	Nil
do. do. "A" ..	Nil Nil	Nil Nil	—	Nil
do. do. Income ..	4 4	4 4	—	1 19 5

FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ..	6 12 12	6 12 12	—	10 0 0
do. do. 2nd Pref. ..	Nil Nil	Nil Nil	—	10 0 0
do. do. 5% Deb. ..	6 6	6 6	—	7 16 0
Brazil Traction	Nil Nil	Nil Nil	—	Nil
British Columbia Elec. Ry. Prio. ..	6 6	6 6	—	8 5 6
do. do. Preferred ..	6 6	6 6	—	8 11 2
do. do. Deferred ..	6 6	6 6	—	11 3 2
do. do. Deb. ..	4 4	4 4	—	7 2 10
Mexico Trams 6 per cent. Bonds ..	Nil Nil	Nil Nil	—	Nil
do. do. 6 per cent. Bonds ..	Nil Nil	Nil Nil	—	Nil
Mexican Light Common ..	Nil Nil	Nil Nil	—	Nil
do. Pref. ..	Nil Nil	Nil Nil	—	Nil
do. 1st Bonds ..	Nil Nil	Nil Nil	—	10 2 0

MANUFACTURING COMPANIES.

Babcock & Wilcox	15 16	15 16	—	8 8 0
British Aluminium Ord. ..	10 10	10 10	—	11 8 0
British Insulated Ord. ..	15 15	15 15	—	9 12 0
Callenders	15 16	15 16	—	10 8 8
do. 6½ Pref. ..	6 6	6 6	—	6 18 8
Crompton Ord. ..	10 10	10 10	—	13 12 10
Edison-Swan	10 10	10 10	—	6 9 6
do. do. 6 per cent. Deb. ..	6 6	6 6	—	7 7 1
Electric Construction ..	10 10	10 10	—	11 18 10
English Electric	8 8	8 8	—	11 11 0
Gen. Elec. Pref. ..	6 6	6 6	—	8 11 6
do. Ord. ..	10 10	10 10	—	7 13 0
Hawley	15 15	15 15	—	10 0 0
do. 4½ Pref. ..	4 4	4 4	—	8 18 6
India-Rubber	10 10	10 10	—	Nil
Mos. Vickers Pref. ..	8 8	8 8	—	3 9 4
Siemens Ord. ..	10 10	10 10	—	6 13 1
Telegraph Con. ..	20 20	20 20	—	6 13 1

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 8th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
Acid, Oxalic	84d.	..
Ammonia Sal	255	..
Ammonia, Murate (large crystal) ..	238	..
Bisulphide of Carbon .. ..	..	..
Borax	231	43 dec.
Copper Sulphate	63	..
Potash, Chlorate	per lb.	..
Perochlorate	6d.	2d. dec.
Shellac	per cwt.	14 10s.
Sulphur, Sublimed Flowers ..	216	..
do. Lump	215	..
Soda, Chlorate	per lb.	34d.
do. Crystals	27	..
Sodium Bichromate, cakes ..	6½d.	1d. dec.
METALS, &c.		
Babbitt's Metal Ingots	per ton	£90 to £275
Brass (rolled metal 2" to 12" basis) ..	per lb.	10½d.
do. Tubes (small drawn) ..	..	1/0 to 1/0½
do. Wire, basis .. ..	..	11½d.
Copper Tubes (small drawn) ..	..	1½d.
do. Bars (best selected)	per ton	116s.
do. Sheet .. ..	..	110s.
do. Rod .. ..	..	110s.
do. (Electrolytic) Bars .. ..	..	110s.
do. Sheets .. ..	..	114s. 10s.
do. Wire Rods .. ..	..	109s. 10s.
do. H.C. Wire	per lb.	11½d.
Ebonite Rod .. ..	..	8/6
do. Sheet .. ..	..	8/6
German Silver Wire .. ..	..	2/9
Gutta-percha, fine .. ..	..	13/7
India-rubber, Para fine .. ..	..	13/7
Iron Pig (Cleveland Warrants) ..	per ton	Nom.
do. Wire, galv. No. 8, P.O. qual. ..	..	£80
Lead, English Pig .. ..	..	£24 6s.
Mercury	per cwt.	£10 6s.
do. (in original cases) small ..	per lb.	3/6 to 3/8
do. "medium" .. ..	..	4/6 to 5/6
do. "large" .. ..	..	10/6 to 20/6 & up
Phosphor Bronze, plain castings, ..	..	14/6 to 18/6
do. rolled bars and rods ..	..	21/6 to 23/6
do. rolled strip & sheet ..	..	2/2 to 2/7
Silicium Bronze Wire	per lb.	1/8
Steel, Magnet, in bars .. ..	..	13s.
do. Block (English)	per ton	£181
do. Wire, No. 1 to 16	per lb.	3/6
White Anti-friction Metals ..	per ton	£65 to £275

Quotations supplied by—

A. G. Boor & Co.	G. James & Shakespares,
C. Thos. Bolton & Sons, Ltd.	J. Edward Till & Co.
D. Frederick Smith & Co.	J. Bolling & Lowe.
E. F. Wiggins & Sons.	J. Richard Johnson & Nephew, Ltd.
F. India-Rubber, Gutta-Percha and	P. F. Ormiston & Sons.
Telegraph Works Co., Ltd.	
	R. W. F. Dennis & Co.

New System of Sanding Rails.—Mr. James Southworth, of Wigan, an engine driver on the Lancashire & Yorkshire Railway, has invented and patented a new system of sanding rails to prevent locomotives and other railway and tramway vehicles slipping. An engine has been fitted with the invention at the Wigan sheds of the Lancashire & Yorkshire Railway, where demonstrations of the utility of the system have been successfully carried out. The apparatus can be used on railways and tramways generally, and its utility as a money and labour-saving invention is said to be manifest in collieries, engineering works, and other industrial establishments where heavy loads are continually being moved in the sidings and on the works railways. The device, by the use of which all the paraphernalia at present required for the sifting, drying and pulverising of sand, may at once be done away with, can be easily fitted to all existing types of engines.—*Manchester Guardian*.

Electricity in the Antarctic.—Sir Ernest Shackleton's Antarctic Expedition is to utilise wireless telephone apparatus which will insure all its sections being kept in constant touch with one another while engaged in work of exploration. Marconi's Wireless Telegraph Co. is fitting two 100-watt YB wireless telegraph and telephone sets on board the *Quest*. One of these is for permanent use on board the ship, and the other for base work on land; their range is about 100 miles. The Avro aeroplane which is being taken with the expedition will also be fitted with a Marconi wireless telephone so that it will be able to maintain telephonic communication with the *Quest* and also with the land base. Electricity is to be made use of for many purposes, including the heating of clothing for the crew.

School of Instruction in Radiography, &c.—A school for the training of technical assistants in X-ray and electrical departments has been instituted at the King's College Hospital, Denmark Hill, S.E. The school is under the supervision of Dr. R. Knox, director of the radiographic department. For full particulars see our advertisement pages to-day.

THE BRITISH ASSOCIATION.—I.

THE eighty-ninth annual meeting of the British Association for the Advancement of Science, and the fifth which has been held in Edinburgh, opened on Wednesday last with the delivery of the presidential address by Sir T. Edward Thorpe, which we review below.

Edinburgh, as perhaps is only natural, claims a long and intimate acquaintance with the Association, which first met in the city in 1834, when the Association was only two or three years old; the attendance of about 1,300 members then was considered very satisfactory. The next Edinburgh meeting was in 1850; the third, in 1871, was under the distinguished presidency of Lord Kelvin, then Sir William Thomson. The last meeting was held in 1892, when the eminent geologist, Sir Archibald Geikie, was president; electrical subjects loomed large on this occasion. Prof. Unwin, addressing the Engineering Section, mentioned a hydro-electric installation of 1,600 h.p. at Genoa, and the "huge scheme now nearly complete at Niagara, an available power of 7,000,000 horse." Messrs. Purdon and Walters contributed copious notes on the utilisation of water power by means of turbines, and mentioned that it might be possible to use the enormous power of tidal rivers—but did not touch upon the Severn. Mr. Alexander Siemens spoke of the working results of two "Siemens" electric locomotives, developing a maximum of 110 b.h.p., supplied to the City & South London Railway. Mr. (Dr.) Gisbert Kapp read a paper on the transmission of power by alternating current. A report by a committee of the most distinguished electrical men of the time, upon the construction and issuing of practical standards for use in electrical measurements, bore witness to a great deal of work by Mr. (Sir Richard) Glazebrook. The German view of British standards was presented by Prof. von Helmholtz, who was accorded a wonderful reception. Prof. S. P. Thomson, and many others, also read papers upon a variety of electrical subjects.

Sir T. Edward Thorpe, this year's President, is well known as one of the most prominent of British chemists. He is Emeritus Professor of General Chemistry in the Imperial College of Science and Technology, and has held numerous other educational and scientific positions. Among these may be mentioned the offices of Treasurer and President of the Chemical Society; President of the Society of Chemical Industry; Vice-President of the Royal Society; and Director of Government Laboratories, London. His connection with the British Association is a long one; he was President of the Chemical Section in 1890, and Vice-President in 1900. He has written a number of works on chemistry, including two on qualitative and quantitative analysis and a "Dictionary of Applied Chemistry."

Prof. A. H. Gibson is presiding over the Engineering Section (G), and his address will be abstracted in a later issue.

We have recorded in recent issues one or two innovations which have been introduced into the proceedings this year. One of the most important of these is the decision to permit discussions upon the addresses of the presidents of Sections. This will no doubt allow of the elucidation of obscure points, which are always liable to inclusion, and also afford the speakers an opportunity to amplify their statements.

The first half of the President's address reviewed the activities of the Association from its inception in 1831, appropriately emphasising the fact that it was largely Scottish in origin, and mentioning in this connection the work of Sir David Brewster, described as the virtual founder, and Principal Forbes. Lord Kelvin's year (1871) was described in glowing terms, reference being made to his advocacy of the institution of national research laboratories. Sir Edward here mentioned that it was in 1871 that his connection with the Association commenced. Touching upon the principal scientific events of the intervening 50 years, he recalled the discovery of argon by Lord Rayleigh; of radium by

Madame Curie; of helium as a terrestrial element by Ramsay; and the production of helium from radium by Ramsay and Soddy. In pure physics the half-century had witnessed Hertz's discovery of electromagnetic waves and the rise of Lorentz's electron theory. The telephone, incandescent lighting, wireless telegraphy, the application of the Röntgen rays, the electric transmission of energy, and the kinematograph had all appeared since the Edinburgh meeting of 1871. The need for research was again emphasised, and satisfaction was expressed at the great step accomplished by the establishment of the Department of Scientific and Industrial Research. Sir Edward then dealt at some length with the molecular theory of matter, and spoke of the work of the most prominent men in this field of research. The discovery of the electron was commented upon, tribute being paid to such scientists as Soddy, Rutherford, J. J. Thomson, Collie, and Mosely. The speaker referred to the experiments of Mr. F. W. Aston, who had succeeded in showing that a number of elements were in reality mixtures of isotopes; he gave several examples of this fact, including argon, chlorine, bromine, &c. It was now known that the number of electrons in an atom of an element was equal to the atomic number of that element corresponding, that is, to the position which it occupied in the series when the elements were arranged in the order of their atomic weights. The investigations of Sir J. J. Thomson into the electronic theory of matter were described in some detail by the speaker, who showed that the periodic law evolved agreed with that of Mendeléeff or the Law of Octaves of Newlands. Referring to the horrors of scientific warfare such as had been witnessed in the last few years, Sir Edward concluded his address by hoping that the Association would set its face against the continued degradation of science in this augmenting the frightfulness of war, and use its influence in arresting a course which was the very negation of civilisation.

This year's *Journal* is quite a bulky publication, and there are those who think that too much is being attempted in the short space of a week. This will probably lead to those interested in a particular section confining their attention solely to that section, lest mental indigestion supervene.

Section G—Engineering—commenced its duties early on Thursday morning, devoting the first part of the day to the study of stresses and strains in timber, ship's plates, steel ropes, &c. Prof. T. Hudson Beare read a paper on "The Influence of the Width of the Specimen upon the Results of Tensile Tests of Mild Steel and Rolled Copper," and Prof. Henry Briggs described two new forms of rescue apparatus for use in mines. The address of the president of the section was given this morning (Friday).

In Section A—Mathematical and Physical Science—Mr. A. A. Campbell Swinton described the reception of wireless waves on a shielded frame aerial. Mr. J. J. Dowling demonstrated, on Thursday afternoon, the recording ultra-micrometer in which variations of the capacity in an oscillating valve circuit cause variations of the plate circuit current. A potential balancing device enables a sensitive galvanometer to be employed to record these changes and extremely minute changes in capacity due to the relative displacement of plates (10^{-9} cm. or less) are readily detectable. The apparatus is used for seismographical work and as a micro-pressure manometer, among other things. Dr. Dawson Turner and Mr. D. M. R. Crombie demonstrated the behaviour of an electrified pith ball in an ionised atmosphere. The experiments showed the effectiveness of various sources of ionisation, such as an arc light, burning magnesium wire, incandescent platinum wire, Nernst filament, a Bunsen flame, X-rays and radium rays. The directive influence of a charged Leyden jar was demonstrated by the concentration of the ions along a line joining the centre rod of the jar and the source of ionisation; unless the pith ball was in this line,

it appeared to be unaffected. The effect upon the ball appeared to be independent of the nature of its charge. Prof. O. W. Richardson, the president of Section A, delivered his address on "Problems of Physics" this morning, and an abstract of it is given below.

Wages and the cost of living were the main subjects of Section F Economic Science and Statistics; Mr. W. J. Hickens, president, spoke on "The Principles by which Wages are Determined," this morning.

Some of the (to our readers) more important papers and addresses are given in abstract form below.

Problems of Physics.

Presidential Address by PROF. O. W. RICHARDSON, D.Sc.
F.R.S. (Abstract.)

Section A.—Mathematics and Physics.

The theoretical researches of Einstein and Weyl suggest that not merely the material universe but space itself is perhaps finite. As to the probabilities I do not wish to express an opinion; but the statement is significant of the extent of the revolution in the conceptions and fundamental principles of physics now in progress. That space need not be infinite has, I believe, long been recognised by geometers, and appropriate geometries to meet its possible limitations have been devised by ingenious mathematicians. I doubt, however, whether these inventive gentlemen ever dreamed that their schemes held any objective validity such as would assist the astronomer and the physicist in understanding and classifying material phenomena. It is not certain that they will; but the possibility is definite. Apart from this, the whole development of relativity is an extraordinary triumph for pure mathematics. Had Einstein not found his entire calculus ready to hand, owing to the purely mathematical work of Christoffel, Riemann, and others, it seems certain that the development of generalised relativity would have been much slower. It is a pleasure to be able to acknowledge this indebtedness of physics and astronomy to pure mathematics. Relativity is the revolutionary movement in physics which has caught the public eye, perhaps because it deals with familiar conceptions in a manner which for the most part is found pleasantly incomprehensible. But it is only one of a number of revolutionary changes of comparable magnitude. The various consequences of the electronic structure of matter are still unfolding themselves to us, and are increasing our insight into the most varied phenomena at a rate which must have appeared incredible only a few decades ago. The enormous and far-reaching importance of the discoveries being made at Cambridge by Sir Ernest Rutherford cannot be over-emphasised. These epoch-making discoveries relate to the structure and properties of the nuclei of atoms. At the present time we have, I think, to accept it as a fact that the atoms consist of a positively charged nucleus of minute size, surrounded at a fairly respectful distance by the number of electrons requisite to maintain the structure electrically neutral. The nucleus contains all but about one-two-thousandth part of the mass of the atom, and its electric charge is numerically equal to that of the negative electron multiplied by what is called the atomic number of the atom, the atomic number being the number which is obtained when the chemical elements are enumerated in the order of the atomic weights; thus hydrogen=1, helium=2, lithium=3, and so on. Consequently the number of external electrons in the atom is also equal to the atomic number. The evidence, derived from many distinct and dissimilar lines of inquiry, which makes it necessary to accept the foregoing statements as facts, will be familiar to members of this Section of the British Association, which has continually been in the forefront of contemporary advances in physical science. But one of the important pieces of evidence was supplied by Prof. Barkla's researches on the scattering of X-rays by light atoms. The diameters of the nuclei of the atoms are comparable with one-millionth of one-millionth part of a centimetre, and the problem of finding what lies within the interior of such a structure seems at first sight almost hopeless. It is to this problem Rutherford has addressed himself by the direct method of bombarding the nuclei of the different atoms with the equally minute high-velocity helium nuclei (alpha-particles) given off by radioactive substances, and examining the tracks of any other particles which may be generated as a result of the impact. A careful and critical examination of the results shows that hydrogen nuclei are thus expelled from the nuclei of a number of atoms such as nitrogen and phosphorus. On the other hand, oxygen and carbon do not eject hydrogen under these circumstances, although there is evidence in the case of oxygen and nitrogen of the expulsion of other sub-nuclei whose precise structure is a matter for further inquiry. The artificial transmutation of the chemical elements is thus an established fact. The natural transmutation has, of course, been familiar for some years to students of radioactivity. The philosopher's stone, one of the alleged chimeras of the mediæval alchemists, is thus within our reach. But this is only part of the story. It appears that in some cases the kinetic energy of the ejected

fragments is greater than that of the bombarding particles. This means that these bombardments are able to release the energy which is stored in the nuclei of atoms. Now, it is known from the amount of heat liberated in radioactive disintegration that the amount of energy stored in the nuclei is of a higher order of magnitude altogether, some millions of times greater, in fact, than that generated by any chemical reaction such as the combustion of coal. In this comparison, of course, it is the amount of energy per unit mass of reacting or disintegrating matter which is under consideration. The amounts of energy which have thus far been released by artificial disintegration of the nuclei are in themselves small, but they are enormous in comparison with the minute amounts of matter affected. If these effects can be sufficiently intensified there appear to be two possibilities. Either they will prove uncontrollable, which would presumably spell the end of all things, or they will not. If they can be both intensified and controlled then we shall have at our disposal an almost illimitable supply of power which will entirely transcend anything hitherto known. It is too early yet to say whether the necessary conditions are capable of being realised in practice, but the speaker sees no elements in the problem which would justify us in denying the possibility of this. It may be that we are at the beginning of a new age, which will be referred to as the age of sub-atomic power.

Thermionic Emission.—At the Manchester meeting of the Association in 1915, when the speaker opened a discussion on thermionic emission—the emission of electrons and ions by incandescent bodies—the opinion was expressed by some of the speakers that these phenomena had a chemical origin. That view is one which would find very few supporters now. It is not that any new body of fact has arisen in the meantime. The important facts were all established before that time, but they were insufficiently appreciated, and their decisiveness was inadequately realised.

It may be worth while to revert for a moment to the issues in that controversy, already moribund in 1915, because it has been closely paralleled by similar controversies relating to two other groups of phenomena—namely, photoelectric emission and contact electromotive force—which, as we shall see, are intimately connected with thermionic emission. The issue was not as to whether thermionic emission may be looked upon simply as a type of chemical reaction; this would have been largely a matter of nomenclature. There is a good deal to be said for the point of view which regards thermionic emission as an example of the simplest kind of reversible chemical action, namely, that kind which consists in the dissociation of a neutral atom into a positive residue and a negative electron, inasmuch as we know that the negative electron is one of the really fundamental elements out of which matter is built up. It was suggested that the phenomenon was not primarily an emission of electrons from the metallic or other source, but was a secondary phenomenon, a kind of by-product of an action which was primarily a chemical reaction between the source of electrons and some other material substance such as the highly attenuated gaseous atmosphere which surrounded it. This suggestion carried with it the view that the source of power behind the emission was not the thermal energy of the source, but was the chemical energy of the postulated reactions. Establishing the primary character of the phenomenon does not, however, determine its nature or its immediate cause. Originally the speaker regarded it as a manifestation of the fact that as the temperature rose the kinetic energy of some of the electrons would begin to exceed the work of the forces by which they were attracted to the parent substance. It is permissible to inquire how the escaping electrons obtain the necessary energy. One answer is that the electrons have it already in the interior of the substance by virtue of their energy of thermal agitation. But thermal agitations now appear less simple, and do not exhaust the possibilities. We know that when light of short enough wavelength falls on matter it causes the ejection of electrons from it—the so-called photo-electric effect. Since the formula for the radiation emitted by a body at any given temperature contains every wave-length without limitation, there must be some emission of electrons from an incandescent body as the result of the photoelectric effect of its own luminosity. Two questions arise. Will this photoelectric emission caused by the whole spectrum of the hot body vary as the temperature of the incandescent body is raised in the way which is known to characterise thermionic emission? A straightforward thermodynamic calculation shows that this is to be expected from the theoretical standpoint, and the anticipation has been confirmed by the experiments of Prof. W. Wilson. Thus the auto-photoelectric emission has the correct behaviour to account for the thermionic emission. The other question is: Is it large enough? When every allowance is made, the conclusion is that the photoelectric effect of the whole spectrum is far too small to account for thermionic emission. The same dilemma is met with in the search for the actual *modus operandi* of evaporation, chemical action, and a number of other phenomena. These, so far as we know, might be fundamentally either kinetic or photochemical or a mixture of both. The last alternative is thought the most probable. The term "Photochemical" is used in the wide sense of an effect of light in changing the composition of matter, whether the parts affected are atoms, groups of atoms, ions, or electrons. The photochemical point of view has recently been put very strongly by Perrin, who would make it the entire *motif* of all chemical re-

action, as well as of radioactivity and changes of state. The speed of chemical decomposition of certain gases is independent of their volume, showing that the decomposition is not due to molecular collisions. The speed does, however, increase very rapidly with rising temperature. What the increased temperature can do except increase the number and intensity of the collisions, and increase the amount of radiation received by the molecules, is not too obvious. It seems, however, that, according to calculations by Langmuir, the radiation theory does not dispose of this difficulty, for, just as in the ordinary photoelectric case, there is not enough radiation to account for the observed effects. It seems that in the case of these monomolecular reactions the phenomena cannot be accounted for either by simple collisions, or by radiation, or by a mixture of both, and it is necessary to fall back on the internal structure of the decomposing molecule. This cannot at present be regarded as much more than a field for speculation.

Contact Electricity.—A controversy about the nature of the contact potential difference between two metals, similar to that referred to in connection with thermionic emission, has existed for over a century. In 1792 Volta wrote: "The metals . . . can by themselves, and of their own proper virtue, excite and dislodge the electric fluid from its state of rest." The contrary position that the electrical manifestations are inseparably connected with chemical action was developed a few years later by Fabroni. Since that time electrical investigators have been fairly evenly divided between these two opposing camps. Among the supporters of the intrinsic or contact view of the type of Volta we may recall Davy, Helmholtz, and Kelvin. On the other side we have to place Maxwell, Lodge, and Ostwald. In 1862 we find Lord Kelvin writing: "For nearly two years I have felt quite sure that the proper explanation of voltaic action in the common voltaic arrangement is very near Volta's, which fell into discredit because Volta or his followers neglected the principle of the conservation of force." On the other hand, in 1896 we find Ostwald referring to Volta's views as the origin of the most far-reaching error in electrochemistry, which the greatest part of the scientific work in that domain has been occupied in fighting almost ever since. These are cited merely as representative specimens of the opinions of the protagonists. Now, there is a close connection between thermionic emission and contact potential difference, and the speaker thinks that a study of thermionic emission has already settled this dispute. How is it that there is a connection between thermionic emission and contact potential difference? and what is the nature of that connection? Imagine a vacuum enclosure, either impervious to heat or maintained at a constant temperature, containing two different electron-emitting bodies, A and B. Let one of these, say A, have the power of emitting electrons faster than the other, B. Since they are each receiving as well as emitting electrons, A will acquire a positive and B a negative charge under these circumstances. Owing to these opposite charges A and B will now attract each other, and useful work can be obtained by letting them come in contact. After the charges on A and B have been discharged by bringing them in contact, let the bodies be quickly separated and moved to their original positions. This need involve no expenditure of work, as the charges arising from the electron emission will not have had time to develop. After the charges have had time to develop the bodies can again be permitted to move together under their mutual attraction, and so the cycle can be continued an indefinite number of times. In this way we have succeeded in imagining a device which will convert all the heat energy from a source at a uniform temperature into useful work. Now, the existence of such a device would contravene the second law of thermodynamics. We are therefore compelled either to deny the principles of thermodynamics or to admit that there is some fallacy as to the pretended facts in the foregoing argument. We do not need to hesitate between these alternatives, and we need only look to see how the alleged behaviour of A and B will need to be modified in order that no useful work may appear. There are two alternatives. Either A and B necessarily emit equal numbers (which may include the particular value zero) of electrons at all temperatures, or the charges which develop owing to the unequal rate of emission are not discharged, even to the slightest degree, when the two bodies are placed in contact. The first alternative is definitely excluded by the experimental evidence. The second means that bodies have natural states of electrification whereby they become charged to definite potential differences whose magnitudes are independent of their relative positions. There is an intrinsic potential difference between A and B which is the same, at a given temperature, whether they are at a distance apart or in contact. Admitting that the intrinsic potentials exist, a straightforward calculation shows that they are intimately connected with the magnitudes of the thermionic emission at a given temperature. The relation is, in fact, governed by the following equation: If A and B denote the saturation thermionic currents per unit area of the bodies A and B respectively, and V is the contact potential difference between them at the absolute temperature T , then $V = \frac{kT}{e} \log \frac{A}{B}$, where k is the gas constant calculated for a single molecule (Boltzmann's constant), and e is the electronic charge. The speaker and Mr. F. S. Robertson have made measurements of the contact potential difference between heated filaments and a surrounding metallic cylinder, both under the high-vacuum and gas-free conditions which are now attainable in such apparatus, and also when small known

pressures of pure hydrogen are present. As is well known, both contact potentials and thermionic emission are very susceptible to minute traces of gas, but it is found that under the best conditions as to freedom from gas there is a contact potential of the order of one volt between a pure tungsten filament and a thoriated filament. They have also been able to measure the thermionic emissions from the filaments at the same time, and find that the contact potential calculated from them with the help of the foregoing equation is within 20 per cent. of the measured value. Considering the experimental difficulties, this is a very substantial agreement. Whilst the evidence is not yet as complete as it is hoped to make it, it goes a long way towards disproving the chemical view of the origin of contact potential difference. From what has been said, it will be realised that the connection between contact potentials and thermionic emissions is a very close one. To account for the facts of thermionic emission it is necessary to assume that the potential energy of an electron in the space just outside the emitter is greater than that inside by a definite amount, which we may call w . The existence of this w , which measures the work done when an electron escapes from the emitter, is required by the electron-atomic structure of matter and of electricity. Its value can be deduced from the temperature variation of thermionic emission, and, more directly, from the latent heats absorbed or generated when electrons flow out of or into matter. These three methods give values of w which, allowing for the somewhat considerable experimental difficulties, are in fair agreement for any particular emitter. The data also show that in general different substances have different values of w . This being so, it is clear that when uncharged bodies are placed in contact, the potential energies of the electrons in one will, in general, be different from those of the electrons in the other. If, as in the case of the metals, the electrons are able to move freely they will so move until an electric field is set up which equilibrates this difference of potential energy. There will thus be an intrinsic or contact difference of potential between metals which is equivalent to the difference in the value of w and is equal to the difference in w divided by the electronic charge.*

Photoelectric Action.—It has been seen that there is a connection on broad lines between thermionic emission and both contact potentials on the one hand and photoelectric emission on the other. The three groups of phenomena are also related in detail and to an extent which up to the present has not been completely explored. Perhaps the most striking feature of photoelectric action is the existence of what has been called the threshold frequency. For each metal whose surface is in a definite state there is a definite frequency n_0 , which may be said to determine the entire photoelectric behaviour of the metal. The basic property of the threshold frequency n_0 is this: When the metal is illuminated by light of frequency less than n_0 no electrons are emitted, no matter how intense the light may be. On the other hand, illumination by the most feeble light of frequency greater than n_0 causes some emission. The frequency n_0 signals a sharp and absolute discontinuity in the phenomena. Owing to the fact that the electrons emitted by a metal when illuminated by monochromatic light of frequency, let us say, n , may originate from different depths in the metal, and may undergo collisions at irregular intervals, it is only the maximum kinetic energy of those which escape which would be expected to exhibit simple properties. As a matter of fact, it is found that the maximum kinetic energy is equal to the difference between the actual frequency n and the threshold frequency n_0 multiplied by Planck's constant h . In mathematical symbols, if v is the velocity of the fastest emitted electron, m its mass, e its charge, and V the opposing potential required to bring it to rest,

$$eV = \frac{1}{2} m v^2 = h(n - n_0).$$

From this equation it is seen that the threshold frequency is evidently that frequency for which kinetic energy and stopping potential fall to zero. This suggests strongly that the reason the electron emission ceases at n_0 is that the electrons are not able to get enough energy from the light to escape from the metal, and not that they are unable to get any energy from the light. If the threshold frequencies for any pair of metals, and the contact difference of potential K between them are measured, we find that K is equal to the difference between their threshold frequencies multiplied by this same constant h divided by the electronic charge e . These results admit of a very simple interpretation if it is assumed that when illuminated by light of frequency n the electrons individually acquire an amount of energy hn . It has been seen that in order to account for thermionic phenomena it is necessary to assume that the electrons have to do a certain amount of work w to get away from the emitter. There is no reason to suppose that photoelectrically emitted electrons can avoid this necessity. Supposing that this work is also definite for the photoelectric electrons and denoting its value by hn_0 , then no electron will be able to escape from the metal until it is able to acquire an amount of energy at least equal to hn_0 from the light—under the suppositions made—until n becomes at least as great as n_0 . Thus n_0 will be identical with the frequency which we have called the threshold frequency, and the maxi-

* This statement is only approximately true. In order to condense the argument certain small effects connected with the Peltier effect at the junction between the metals have been left out of consideration.

kinetic energy of any electron after escaping will be $h(\nu - \nu_0)$. The relation between threshold frequencies and contact potential difference raises another issue. It has been seen that the contact potential difference between two metals must be very nearly equal to the difference between the amounts of work e for an electron to get away from the two metals by thermionic emission, as defined by the electronic charge e . The photoelectric experiments show that the contact electromotive force is also nearly equal to the differences of the threshold frequencies multiplied by $1/e$. It follows that the photoelectric work is almost equal to the thermionic work e to the same order of accuracy. We have to except here a possible contact difference between the two. The speaker did not see, however, how any value other than zero for such a constant could be given a rational interpretation, as it would have to be the same for all substances and frequencies. The photoelectric and thermionic works are known to agree to within about one volt. To decide how far they are identical needs better experimental evidence than that available. The indirect evidence for their substantial identity (within the limits of accuracy referred to above) is stronger at the moment than the direct evidence. The complete identity of the thermionic work e and the photoelectric $h\nu_0$ is not a matter which can be inferred *a priori*. This depends to a considerable extent on the condition of the electrons in the interior of metals. There is no real knowledge of this at present. Unless the electrons which escape all have the same energy when inside the metal we should expect the thermionic value to be an average taken over those which get out. The photoelectric value, on the other hand, should be the minimum pertaining to those internal electrons which have most energy. The apparent sharpness of the threshold frequency is also surprising from some points of view.

The threshold frequency is a perfectly definite quantity when the condition of the body is or can be definitely specified, but it is extraordinarily sensitive to minute changes in the conditions of the surface, such as may be caused, for example, by the presence of extremely attenuated films of foreign matter. Interesting calculations have been made by Franck which bring surface tension into close connection with the thermionic work e . Broadly speaking, there can be little doubt that a connection of this nature exists, but whether the relation is as simple as that given by the calculations is open to doubt. It should be possible to answer this question definitely when there is more precise information about the disposition of the electrons in atoms such as the continuous progress in X-ray investigation seems to promise.

Light and X-Rays. One of the great achievements of experimental physics in recent years has been the demonstration of the essential unity of X-rays and ordinary light. X-rays have been shown to be merely light of particularly high frequency or short wave-length, the distinction being one of degree rather than of kind. The actual gap in the spectrum of the known radiations between light and X-rays is also rapidly disappearing. The longest stride into the region beyond the ultra-violet was made by Lyman with the vacuum grating spectroscopy which he developed. For a short time Prof. Bazzoni and the speaker held the record in this direction with their determination of the short wave limit of the helium spectrum, which is in the neighbourhood of 450 Angstrom units. More recently this has been passed by Millikan, who has mapped a number of lines extending to about 200 Angstrom units—that is to say, more than four octaves above the violet limit of the visible spectrum. The longest X-ray which has been measured appears to be a zinc K-ray by Pinner of a wave-length of 12.4 Angstrom units. There is thus at most a matter of about four octaves still to be explored. In approaching this unknown region from the violet end the most characteristic property of the radiations appears to be their intense absorption by practically every kind of matter. This result is not very surprising from the quantum standpoint. The quantum of these radiations is in excess of that which corresponds to the ionising potential of every known molecule, but it is of the same order of magnitude. Furthermore, it is large enough to reach not only the most superficial, but also a number of the deeper-seated electrons of the atoms. There is evidence, both theoretical and experimental, that the photoelectric absorption of radiation is most intense when its quantum exceeds the minimum quantum necessary to eject the absorbing electron but does not exceed it too much. In the simplest case, where the absorption is zero for radiations whose quantum is below the minimum quantum, rises to a maximum for a frequency comparable with the minimum, and falls off to zero again at infinite frequency. This case has not been fully investigated, but, broadly judged, the experimental results are in agreement with it. On these general grounds we should expect intense absorption by all kinds of matter for the radiation between the ultra-violet and the X-ray region. The speaker is the authority in the properties of X-rays and is not a person to be generally misled. It is not merely a matter of degree, however, but it extends to a remarkable degree of detail. In the case, perhaps most conspicuous in the domain of photoelectric action and of the inverse photoelectric effect, the experimental results for spectral lines by electron impact, which have been very carefully investigated, still leave room for doubt as to the interpretation of some of the experimental data. The speaker has pointed out that such important advance tends to unify rather than to disintegrate these two important groups of phenomena.

The Reception of Wireless Waves on a Shielded Frame Aerial.

By ALAN A. CAMPBELL SWINTON, F.R.S. (Abstract.)

Section 1.—Mathematics and Physics.

The following experiments were recently carried out by the author in his laboratory in London, in order to test a suggestion made by Mr. N. P. Hinton, a member of the Subcommittee on Directional Wireless of the Radio Research Board, that something of the nature of a wireless "telescope," with improved direction-finding properties, might be made by placing a frame aerial in a large metal tube or wire spiral open at the ends. Particulars are published with the permission of the Radio Research Board.

The frame employed was a circular one, 1 ft. in diameter, with 100 total turns of No. 20 S.W.G. cotton-covered copper wire, all the turns bunched together, with a four-way switch so arranged that the number of turns in use could be diminished to 20, 40, or 80 turns, as desired. With 80 turns in use, and with an adjustable condenser connected across its ends, this frame recorded, in London, the spark emission from the Eiffel Tower in Paris loudly when coupled to a 5-valve resistance amplifier connected to a 3-valve transformer-coupled note magnifier, and had fairly good directional properties. All the experiments were made with the spark emission from Paris, which has a wave-length of 2,600 metres. The shielding tube first employed consisted of an oblong wooden frame of square section, 18 in. wide, 18 in. deep, and 4 ft. long, wound round with No. 18 S.W.G. bare copper wire spaced 1 in. apart, and connected to earth. With the ends of the tube open, and with the extremities of the square copper spiral unconnected, the frame, when placed within the tube, gave signals from Paris of approximately the same strength as outside of the tube. When, however, the ends of the spiral were connected together so as to form a closed circuit, the signals received on the frame were considerably weakened, say, by about 50 per cent., and this weakening was accentuated so that the signals only retained about 25 per cent. of their original strength by short-circuiting the individual spirals with four longitudinal copper wires along the corners of the tube. It was found, however, that the tube itself possessed no appreciable directional screening effect upon the frame, it making no detectable difference in what direction the tube was pointed provided the frame itself was in the plane pointing to Paris. This continued to be the case even when the open ends of the tube were closed by grids of copper wire connected at numerous points to the spiral, the putting on or removal of these grids making no noticeable difference in the strength of the signals. Finally, the whole tube, including its ends, was completely covered in with iron wire netting of about $\frac{1}{2}$ in. mesh in contact with the copper spiral and end grids, when it was found that, although the signals were slightly further diminished in intensity, to about 20 per cent. of their original strength, Paris could still be easily heard on the frame, which continued to have directional properties quite irrespective of the position of the wire-netting-covered tube. It would appear from the experiments that, while completely enclosing the frame in a conducting network considerably damped the currents in the frame, and thus diminished the strength of the signals, this conducting network by no means entirely screened the frame from incoming waves of the 2,600-metre length sent out on the spark emissions of the Eiffel Tower. The result would appear to be dependent on the considerable wave-length tested, as copper wire grids such as are mentioned above, with the wire parallel to the plane of polarisation of the waves, pretty well completely screen off the very short waves of a few centimetres length such as were used in the original lecture-room experiments with Hertzian waves many years ago by Sir Oliver Lodge.

Further experiments were made with the frame placed within a box in the form of a 2-ft. cube made of sheet copper about 1/32nd of an inch thick. This box was completely closed in with soldered joints excepting on one side, which was open, but which could be closed by means of a close-fitting lid also made of similar sheet copper. In all the experiments this copper box was connected to earth. The same circular frame aerial 1 ft. in diameter, used in the previous trials, was employed, but a more compact transformer-coupled 6-valve amplifier was used in place of the 5-valve resistance amplifier and the separate 3-valve note magnifier. In this box was placed not only the frame, but also the amplifier and all the other apparatus, the telephone being listened to through a rubber pipe. Signals were heard of equal strength with the open end of the box pointing towards, or directly away from, Paris, but ceased when the box was turned so that the open end faced at right angles to Paris, the frame still pointing to Paris; or when the open end was completely closed with a copper or tinfoil cover. In the latter case the signals were still audible unless the cover actually touched the box on all sides. For other positions of the box with the end open, signals could only be heard when the relative positions of the box and frame were such that a prolongation of the plane of the frame towards, or away from, Paris, no matter which, came out of the open end clear of the copper sides of the box.

The result obtained with the frame inside the copper box, in getting signals of equal strength with the open side of the box facing away from the source of the waves as when

the open side faced towards such source, may perhaps be of some interest from the point of view of theory, in throwing some light upon the mechanism of electromagnetic wave phenomena, inasmuch as it gives evidence that, in addition to what is analogous to a "push" upon an aerial in front of the wave front, there is also something of the nature of a "pull" upon an aerial behind the wave front. Otherwise, the experiments go to show that, at any rate upon the small scale employed, the use of a shielding tube or box does not assist in improving directional reception. It is possible, however, that if tried on a larger scale, with much more space between the frame and the shield so as to avoid damping, the results might be different.

Cost-of-Living Sliding Scales.

By MISS G. JEBB. (Abstract.)

Section F.—Economics.

IN this paper it is argued that the effect on distribution of the automatic adjustment of wages to changes in the cost of living depends mainly on the cause of the change in price level. When a rise in prices is due to currency or credit expansion, or a fall in prices is due to currency or credit contraction, the cost-of-living sliding scale tends to prevent arbitrary changes in the distribution of real income. When, however, price changes are the result of changes in the volume of production the effect is reversed. If prices are rising because goods are diminishing the purchasing power of wages can only be maintained at the expense of other incomes. Conversely, if prices are falling because goods are increasing the automatic reduction of wages to keep pace with prices lessens the relative share of the wage-earner in the goods income.

The Breakdown of the Minimum Wage.

By A. A. MITCHELL. (Abstract.)

Section F.—Economics.

IN all the recent wages controversies, it seems to have been assumed as an axiom that wages must conform to a predetermined standard of living. This conception seems to find little or no place in economic textbooks. On the other hand, there seems to have been little or no audible protest on the part of economists. According to the subsistence theory of wages, it is impossible for general wages to fall below what is required to keep not each individual workman but the supply of workmen in existence. That purports to be true economic law, a corollary from the laws of supply and demand, population and diminishing returns. A wage based on an arbitrary standard of life beyond actual subsistence is not based on economic law, though of course it may be made a matter of legal or moral obligation. Minimum wage is inconsistent with the nature of wage which is a payment for a service. No one is compelled to employ at all, and no one can be compelled to employ at a loss. Even the rulers of a socialist state could give their workmen no more than an equal share of the total national product, which might very well be less than the desired standard. We are coming near, or perhaps have reached, the point where the entire wealth of the country is insufficient to pay the wages that are demanded. A wage based on standard of living, not on the value or selling price of the product, tends to (a) unemployment, (b) inefficiency.

GERMAN COMMERCIAL PENETRATION IN SWITZERLAND.

THE *Anglo-Swiss Review* has performed a useful service by drawing attention to a recent article published by the *Gazette de Lausanne*, which in turn quotes various German-Swiss newspapers in support of its complaints, concerning the commercial penetration of Switzerland by German companies, which on the one hand seek to elude Swiss vigilance by the formation of holding companies in Switzerland, and on the other to evade, if possible, the taxes on joint-stock companies in Germany, which are higher than those in force in Switzerland. The holding companies have their headquarters and administration in Switzerland, while the industrial equipment, works, stocks, and effective management are located in Germany. Among the other objects aimed at by the holding companies is said to be the intention to escape the taxes placed by the Allies on German exports by sending goods abroad "naturalised" in Switzerland, while again Swiss houses are sought to be absorbed by the investment of capital in them in order to gain control over a group of industries, and thus conquer the Swiss market.

As Swiss joint-stock legislation requires that the board of directors of a company shall have a majority of Swiss subjects, it is nominally impossible for Germans to have a majority; but this difficulty is overcome in a very simple way. If, for instance, a board consists of eleven members, six of them must be Swiss, while five can be foreigners. The *Lausanne* newspaper states that the Germans always arrange to have on the board one or two Swiss who lend their names, or neo-Swiss, newly naturalised, whose compliance can be relied on, and the thing is done. In this connection it is unsatisfactory to be told that "there are Swiss, even of good old stock, bearing highly respected names, who consciously or unconsciously lend themselves to this kind of thing." The Swiss

organ refers to what is termed a typical case, namely, that of the Industrial Securities Co., which was formed at Lucerne in June, 1920, with a share capital of 2,500,000 fr., which is to be increased to 32,000,000 fr. by means of an agreement with the Sichel Co., of Mayence, which company is declared to have just laid hands on several electrical works in central Switzerland, and also obtained possession of the Swiss production of calcium carbide. A second instance mentioned is that of a mill construction company which is administered by Swiss at Basle, and which is stated to be simply a branch of the German industry established in Switzerland, and is completely unfair with Swiss industry; and the newspaper says that further cases of this insidious penetration could be cited, which is accentuated at the very moment when Swiss export trade is in decline.

If our Swiss contemporaries have not short memories, they will remember that the German invasion, although perhaps in a slightly different form, commenced many years before the great war. As the files of this journal show, the Zürich Bank für Elektrische Unternehmungen was originally conceived by, and formed with the co-operation of, the Berlin A.E.G., for the investment of capital in supply companies and tramway undertakings and the grant of loans to them, with the ultimate object of procuring from Germany the machinery and plant required by these undertakings. Those who financed these undertakings generally dictated the allocation of the orders placed by the latter. It would be of particular interest in this connection to learn how many of these undertakings apportioned their orders to Swiss native electrical manufacturing works. We also have some recollection during the course of the war of certain German members of the board of the Neuhausen Aluminium Industry Co. being compelled to resign their positions—nominally or really is a matter of individual opinion—although we believe that most of the share capital is or was held in Germany and that the actual administration was centred at Frankfurt-on-Main. It is also well to bear in mind the Petrograd Electric Lighting Co., of 1888, which although a Russian registered company, was controlled by Germans, who supplied such machinery and plant as were not made in Russia. It is, however, believed that the Germans unloaded in Switzerland during the early part of the war as large an amount of their shareholdings in the Russian company as was possible. Although Swiss interests in the latter company, in the course of their negotiations with the late Imperial Russian Government, contended that their shares were acquired in pre-war times, they were unable to convince the Russian authorities of the fact, and the latter refused to recognise any liability to redeem the shares or obligations then in Swiss ownership, as the Russian Government held that the Petrograd Electric Light Co., of 1888, was essentially a German concern, and consequently sequestered the property.

Coming to more recent events, the case of the Alpine Montan Co.—the greatest iron and steel company in post-war Austria—will be fresh in the minds of our readers. The majority control over this Alpine Company was recently secured by Herr August Stinnes on behalf of the Siemens-Rhine-Elbe-Schuckert Union, and the large number of shares taken over has, for some reason or other, also been vested in a Swiss holding company, and Swiss territory is therefore being utilised for a German scheme in relation to Austria.

The Sichel Co., already mentioned, or to give it its proper title—Julius Sichel & Co., Partnership company of Mayence, is an undertaking having wide financial interests in German iron and steel works and other industrial concerns in that country, and is also connected with the well-known Belgian steel company, the Société d'Ougrée-Maribay. At the moment the Sichel Co. is on the point of concluding an agreement with the steel merchant and metal firm of Wolf Netter and Jacobi, of Berlin and Frankfurt-on-Main, on the basis of a community of interests. In addition the present parts (shares) of 50,000,000 marks in the Sichel Co. are now to be exchanged for shares in the A.G. für Industriewerte (the previously cited Industrial Securities Co.) of Lucerne, whose existing share capital of 12,500,000 fr. is to be provisionally increased to 32,000,000 fr. for the purpose of carrying out the transaction. Thus the Sichel Co. will be transferred to a Swiss holding company, and the Mayence branch, in the words of a German newspaper, will merely become an appendage of the Lucerne concern.

The whole problem of German "illicit" invasion naturally rests with our Swiss friends as being a national matter which directly concerns themselves. It is therefore satisfactory to learn from the *Lausanne* newspaper that the danger of the insidious penetration and the harm which it may do abroad to the good Swiss name have been recognised by the Federal authorities, who in recent years have modified the laws respecting the registration of commercial firms, making them more severe and applying them more vigorously. But as attempts to defraud become more numerous as legislation becomes more severe, the Federal Council has just submitted to Parliament a Bill to deal further with the subject. The Bill provides for the imposition of heavy penalties, up to one year's imprisonment, and a fine of 20,000 fr., in cases where deception is exercised as regards nationality in connection with the registration of limited companies. The *Lausanne* newspaper concludes with the expression of the hope that when passed the measure will be successful in combating German camouflage, as the economic independence of Switzerland is at stake.

ELECTRICAL ENTERPRISE IN CZECHO-SLOVAKIA.

On July 22nd, 1919, the Czechoslovak National Assembly passed an Electricity Bill, the purpose of which is the systematic utilisation of water power and the electrification of the country, with the financial assistance of the State.

The electrical industries in Czecho-slovakia are very considerable, and, especially in recent years, the shortage of coal and petroleum has caused an increase in the employment of electricity as a motive power both for lighting and domestic purposes to a very large extent.

The present annual requirements in electrical energy, not including the needs of the railways, are about 2.5 milliard kWh. This demand is met by 345 electrical concerns, which are intended for the public supply, while in addition, a considerable number of power stations supply private needs.

In future the energy is to be supplied by a uniform system of 22,000 and 100,000 volts, being generated by nine large thermo-electric power stations in the coal districts out of which the three largest will be set up at Duchcov (Dux) (Bohemia), Moravska Ostrava (Moravia), and in Slovakia. In addition, water power stations will be erected on all the rivers in the republic.

According to statistics relating to Bohemia and Moravia, the chief provinces of the new State, the output from water power in millions of kWh, is estimated as follows: In Bohemia, Labé (Elbe) above Hradec Kralovo, 17; Hradec Kralovo-Melník, 87; below Melník, 92; tributaries, 76; Vltava (Moldau) above Ces. Budejovice, 156; Ces. Budejovice-Prague, 450; Prague-Melník, 166; tributaries, 674. Hence, these two main rivers can supply 1,658,000,000 kWh.

In Moravia the following rivers are important: Morava (March), 2; Svarcava, 22; Jihlavka, 35; Dyje, 103; making a total of 162,000,000 kWh.

To this, however, Silesia and Slovakia must be added. In Slovakia especially, the water power resources are almost unlimited. If the capacity of water power is estimated at only 800,000 h.p., an annual saving of 6 million tons of coal will be effected, which is about 20 per cent. of the entire coal output.

In accordance with the Bill, the State will take over the development of water power and construction of water power plants, while the construction of transmission and distribution systems and thermo-electric plants will be left to companies, at least 60 per cent. of whose capital will be held by the State and local authorities, and the remainder by private shareholders. The State will have to secure a permanent interest in the management of these companies. For 1919, 8 million crowns were appropriated for this purpose and included in the State Budget.

The estimated costs of the complete electrification scheme according to published figures, will amount to two milliard Czechoslovak crowns for the construction of hydro-electric plants, and $\frac{1}{2}$ milliard crowns for plants driven by steam power. The transmission system will cost about $\frac{1}{2}$ milliard crowns, and the distribution system the same amount.

The National Assembly has assigned 75 million crowns towards the commencement of this systematic electrification. This sum is to be distributed by instalments over the annual budgets from 1919 to 1928. The money will be placed at the disposal of the Ministry of Public Works for the erection of hydro-electric plants, and for the financial co-operation of the State in any electrical undertakings which may form a substantial part of the system.

The building of the thermo-electric power stations and the system of mains is spread over 20 years, and the construction of the water power stations over 50 years. At present new large electrical associations are in course of formation, and a Government Commission has been established to deal with all matters concerning the electrification.

REVIEWS.

Telegraphy, Telephony, and Wireless. By J. POOL. 120 pp.; 68 figs. London: Sir I. Pitman & Sons, Ltd. Price 3s. net.

This book is one of the well-known "Common Commodities and Industries Series," which fact, together with the author's reputation, is a sufficient guarantee of its excellence. The aim is to provide a general introduction to the three main electrical methods of transmitting intelligence, and the historical method of treatment has been adopted in order that the reader—whether young or old—who is new to the subject, may appreciate the technical growth of the methods and applications of telegraphy and telephony.

The general principles of electricity and magnetism, sources of electromotive force, bells and relays, are first considered. It is doubtful whether the layman will be able to follow the author completely (for instance, inductive capacity in relation to inductance between wires is mentioned on p. 11), but the writer certainly explains the subject as clearly as possible in the space available, and if there is a demand for such a technical treatise in this series the reader must be prepared for some difficulty in the above direction. Personally, we should

imagine that the book would be more useful to the technical student and to the junior engineer or workman in the fields covered. The commercial and industrial aspect which is given prominence in other volumes of this series is not considered in the present volume. This, however does not detract from the excellence of the treatment which is actually presented. It would be impossible to deal with both the technical side and the broader commercial aspect in a single volume of this size.

In two chapters, occupying only 55 pages, the author accomplishes the remarkable feat of explaining the construction and action of all the main types of telegraph and telephone apparatus from the original inventions down to the multiplex telegraph systems and the telephone exchange systems of to-day—including useful notes on automatic exchanges. The reader with some grounding in electrical matters could not wish for a more concise and useful introduction to the subject, but it is doubtful whether a layman could follow the treatment. The short chapter on telegraph and telephone lines does not offer such great technical difficulties, and the two concluding chapters, on wireless telegraphy and telephony, appear to be less severely technical than those on the wire systems.

This volume is technically sound, excellently written and produced, and is recommended confidently as an exceptionally comprehensive and accurate introduction to the subject.

Power Factor Correction. By A. E. CLAYTON, B.Sc. (Eng.). Pp. xi+108; 36 figs. London: Sir I. Pitman & Sons, Ltd. Price 2s. 6d. net.

The author of this little book has set himself the difficult task of explaining to the ordinary and presumably non-scientific business man a highly intricate scientific subject. Within the limitation which he himself mentions in the preface, he has succeeded fairly well. We are told that his aim has been to present fundamental principles and not a complete analytical treatment; nor has he attempted to give an exhaustive account of all the various inventions brought forward for improving the power factor of machines and lines, but has limited himself to a few devices which have been successful in practical work.

In the first chapter we have the usual explanations regarding power in an alternating-current circuit, power factor and its measurement, the vector diagram, and so forth. In the next chapter the influence of power factor on capital outlay on generating and distributing plant is explained, as is also the fact that low-speed motors have a worse p.f. than high-speed motors, and that a bad p.f. at the delivery end of a line decreases not only the kW, but also the kVA rating of the generator. This leads the author to the consideration of a supply tariff based upon p.f. and to a brief exposition of the Arno and Midland tariffs. At the end of the chapter the author says that the consumer should not be penalised for the "inherent defects of the induction motor." What precisely this means is not clear, and if the sentence were to be strictly interpreted, the book need not have been written.

When describing means for improving the p.f., the author uses analytical and vector methods, also tables worked out for the reduction of wattless current; and here we find a statement regarding the economical limit of correction not previously given in other books. A comparison is made between two methods of meeting an increased demand; one by simply adding to the existing plant, and the other by leaving it as it is, and augmenting its earning capacity by improving the p.f. The author says: "It is never economical to install power factor correcting apparatus if the ratio of the cost per kVA compensated and per kVA to increase the dimensions of the system is greater than the sine of the original angle of lag of the current." This law is scientifically correct, but the numerical example given is hardly consonant with actual finance. In one case the author assumes that the ratio of cost per kVA of the correcting apparatus to the cost per kVA of the whole undertaking is 0.2. Since even at the present time £3 per kVA of phase advancer is an outside figure, this would mean that the whole works from the coal bunker to the consumers' terminals could be put down for £15 per kVA!

For improving the p.f. of the system as a whole the two usual methods, namely, static and rotary condensers, are described. Here the business man might be told something of the financial aspect, but no cost per kVA is given. This could be done for the static condenser, because it is a standard article, although not for the rotary condenser, but in the latter case the author's assumption that the cost per kVA of generating and transmission plant is less than twice the cost per kVA of a rotary condenser is distinctly unfair to the latter, and, therefore, the conclusion that it only pays to use such a phase corrector where the line is very long and costly will not be readily accepted. On the other hand, the author fails to draw attention to the fact that the kW loss in the rotary condenser is going on all the time, whereas the amount of energy supplied varies. The financial efficiency is, therefore, less than the power efficiency calculated for full load. Nevertheless rotaries are in extensive use, especially in America, not only for p.f. correction, but for keeping the delivery voltage at a constant value. We learn that some rotaries up to 3,000 kVA are automatic, and that the largest non-automatic rotary is rated at 15,000 kVA, and is on the Los Angeles system. When dealing with improvement of p.f. of individual motors, the author explains why the kVA must be injected into the

rotor, and he describes both rotary and vibrating types. In discussing the question of power absorbed by the Scherbius, the author falls into an error when he states that the power necessary to drive this machine is only that spent on friction and windage. Although there is no stator to anchor the flux in space, yet the flux is anchored to the brushes and is cut by the armature wires, and the resulting torque must be supplied from outside. Several examples of the performance of vibrators are given, and the action of this advancer is clearly explained. A short account of Kramer's method of phase correction combined with speed control is also given. The book will be useful to customers of power supply works. GISHUR KAPP.

The Electrical Transmission of Photographs. By MARCUS J. MARTIN. Pp. xi+136; 73 figs. London: Sir I. Pitman and Sons, Ltd. Price 6s. net.

This book gives a simple and concise treatment of various methods for transmitting photographs electrically in wire circuits with notes also on the wireless transmission of photographs, and on television which is, of course, the highest development of phototelegraphy. The day will come when it is possible to see as well as to speak wirelessly to someone at the other side of the world. At present, however, the art of phototelegraphy is in a purely experimental stage, and the author's treatment of the subject will aid materially those who wish to experiment in this field. The author has had much practical experience in the work of which he writes, so that he has first-hand knowledge of the difficulties to be overcome.

The introductory chapters review the history of the subject and describe early systems for the electrical transmission of written characters and sketches—culminating in the well-known "Telewriter."

Chapter III describes the electrograph system, which has given very satisfactory experimental results in America. This system utilises a half-tone image etched on a zinc block, the space between the dots of the image being filled with insulating material. A stylus travels over the zinc plate and sends an intermittent current to line according to the occurrence and size of the dots in the image. The latter is reproduced at the receiving station by an electromagnetically operated pen.

Prof. Korn's selenium machines were the first to be used for commercial photo-telegraphy, and this system, which has been used successfully between London and Paris and between London and Manchester, is described in detail in Chapter IV. The author includes some useful information concerning his own experimental experience and apparatus, and this chapter includes some fine specimens of telautograph work which should convince the most sceptical reader as to the ultimate possibilities of phototelegraphy and television.

Amstutz's suggestion that a photograph in relief should be used to vary the resistance of an electrical circuit has been developed very successfully by Prof. Behn, whose telestereograph uses a stylus, travelling over a relief photograph, to vary the setting of a special rheostat (the rheomicrophone), and thus produce current variations which are recorded by an oscillograph. With this system perfect photographic transmission has been obtained between Bordeaux and Paris, a distance of 350 miles.

The Thorne-Baker Telegraph which is at present the simplest and most efficient system, depends upon electrochemical reproduction of current impulses obtained from a line analysis of the original image. The author describes very thoroughly the working of the system and the various difficulties which have to be overcome.

Chapter V deals with factors which are of importance in all systems of telephotography, such as the source of light to be employed, chromatic aberration, chemical inertia, and so forth. The fascinating nature of the research work awaiting those who seek for commercial systems of television and wireless transmission of photographs is shown clearly in the next two chapters of the book. Concerning radio-photography, the author states that he can now obtain good results over several miles, but that his apparatus needs simplifying before it can be used commercially.

In the final chapter the author gives full working drawings for a machine which he has used for experimental purposes for some years past. Obviously these drawings are most valuable in furnishing the beginner with practical experience, and with the certainty that he can start with something definite.

Electric Furnaces in the Iron and Steel Industry. By W. RÖDENHAUSER, J. SCHÖNHAAR, and C. H. VOM BAUR. Third edition. Pp. xxi+460; 137 figs. London: Chapman and Hall, Ltd. Price 24s. net.

This book was reviewed very fully in our issue of February 6th, 1914, when it was described as, "beyond all doubt, a standard work . . . full of valuable information from beginning to end." It is a thoroughly practical work, based on personal knowledge of the subjects with which it deals, and is fully illustrated. In the preface to the present edition, the translator and part author, Mr. Vom Baur, refers to the influence of the Great War in placing the electric steel industry on a solid footing, and mentions that one thousand steel furnaces are either built or building. In common with other industries, it has felt the depressing effects of the social

unrest and industrial difficulties of recent times, but the set-back is only temporary, and the lost ground will be fully retrieved when normal conditions return.

The bulk of the present edition is identical with the last, but numerous corrections and minor alterations have been made to bring the matter up to date. The description of the Thury regulator has been greatly extended, and new illustrations have been introduced in this and other sections. The Rennerfelt furnace is the subject of a new chapter, and the Greaves-Etchells, Snyder, Greene, Moore, Booth-Hall, Vom Baur, and Ludlum furnaces are described. In Part II, materials used in furnace construction, and the electro-metallurgy of iron and steel, considerable additions have been made as the result of experience that has been gained, particularly with regard to iron melting furnaces and steel-making direct from the ore, as well as the production of gray and malleable iron for castings. The work must be regarded as a classic in its special sphere, which is constantly increasing in importance and extent.

Engineering Steels. By LESLIE AITCHISON, D.Met., B.Sc., M.I.A.E. Pp. 396; plates 118; figs. 119. London: Macdonald & Evans. Price 25s. net.

Now that steel has superseded iron for well-nigh every purpose, this text-book should prove of value to all engineers, for after briefly describing the various methods by which steel is produced, the properties, and especially the mechanical properties of the product, are exhaustively dealt with, as are also the variations of those properties occasioned by heat or other treatment.

Electric steel melting in general, and by the arc and basic processes in particular, is discussed, as are also modern alloy steels. The classification of these alloys according to their mechanical properties, should prove a useful help in the selection of one suitable to any given purpose, as should also the author's expressed reasons for preferring one type of alloy to another in different applications. In this connection it is evident that the author considers the chemical composition of steel as being of secondary importance to the engineer, and preferably determines its value from considerations of strength, hardness, durability, toughness, &c., all of which qualities and means for their ascertainment are lucidly set out in the book.

In a series of appendices, the influence of sharp corners and scratches, Young's modulus of elasticity, and the properties of steels at high temperatures are separately considered, and various types of testing machines are illustrated and described.

The volume is well got up and profusely illustrated, and we should say of it, as does Professor Unwin in his "Foreword," that it is both scientific and practical, in the best sense of those terms.

Practical Testing of Electrical Machines. By L. OULTON, A.M.I.E.E., and N. J. WILSON, M.I.E.E., Assoc. Am.I.E.E. Pp. 258; 112 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 6s. net.

This volume, which is of handy size for the pocket, is a new and enlarged edition of a work originally published in 1909. In a very concise form it presents an account of the more common tests which are likely to be required on the usual types of electro-magnetic machines. Space has forbidden the introduction of any considerable amount of theory concerning the tests, a fact which perhaps somewhat limits the usefulness of the book from the point of view of students, but little is left unsaid concerning the actual tests themselves, which are accurately described, calculations and tables showing the complete working out of the test results being included.

In the original edition, tests on induction and synchronous motors, alternators, rotary converters, single-phase railway motors, and direct current motors and dynamos were described. In the present edition a chapter on the testing of transformers has been added, and a useful series of extracts from the British Standardisation Rules for Electrical Machines are also included.

The older portion of the book might, perhaps, have been modernised with advantage, thus we find little reference to machines with interpoles, and the method given for the determination of insulation resistance will not appeal to modern testers; they will prefer to make use of some direct-reading type of ohmmeter.

It is of the utmost importance that students and others should be impressed with the necessity of accurately labelling all quantities with which they are concerned, thus each column in a table should be headed both with the name of the quantity and the name of the unit, and the same remark applies to the axes of curves. In the book under notice, insufficient attention is paid to these points, the name of the unit only being frequently used. We feel that a bad example is set which may possibly ultimately lead to misunderstanding on the part of readers.

The book is likely to be useful to those engaged in testing machines, whether in the service of manufacturing firms or of supply companies, the more so as many useful diagrams of test connections are given.

(NOT YET PUBLISHED.)

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4.706. "Sensitive pressure relays for the amplification of sound waves and other purposes." F. W. Baynes and Mechanical Supplies, Ltd. February 1929. 1929. 167, 947.

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RECENTLY we were taken to task by a sceptical correspondent, who declined to believe that when we said that all should work, in order to rescue the country from the disaster to which it is drifting, we meant what we said. That such a comment should be possible, after we have preached for years that it is the duty of every fit man to work, is somewhat disheartening; but we are fain to believe that our critic is the solitary exception, and that our readers in general give us credit for sincerity. So firmly do we hold this doctrine, that we do not hesitate to say that those who do not work—when they have the opportunity—have no right to eat; and to this rule we admit no exceptions save those who are debarrd from working by physical or mental incapacity.

Now, what applies to individuals often applies with no less truth and cogency to nations; and we are led to consider how far our rule holds good in wider applications. First let us recall a statement made by Mr. Edgar Crammond, which we quoted in our issue of September 2nd; he pointed out that if, as he feared, we were to lose a great proportion of our foreign trade, this country could only support a population of some 20 millions, and the other 26 millions would be compelled to seek a livelihood abroad. Do we fully realise what this means?

Again, a powerful article on "The Industrial Situation" was contributed to *The Times* on Friday last by Sir Alfred Yarrow, whose firm has recently taken steps to obtain first-hand information regarding the industrial conditions obtaining in Europe, America, and the Far East. He says: "We only grow enough to feed us for two days in the week; for the remaining five days we are dependent upon supplies from abroad. . . . The principal means we have of paying for what we import is by giving manufactured goods in exchange, and if we fail to supply foreign countries with such goods, they will not send us what we want, scarcity will result, and prices will inevitably rise. . . . We must be able to supply our goods at prices that will compare favourably with similar goods obtained elsewhere. If we cannot do this, then we lose our foreign customers and are unable to pay them for the necessities of life." *Ergo*, we starve.

In the course of this most instructive article, Sir Alfred shows that the reason why we are outbidden by other nations in respect of cost of production is not high wages, but low output. High wages are now incompatible with low cost of production; and no rational employer would wish to see them reduced, if the output were high in proportion. Low wages and low output imply a higher cost of production than high wages and high output. Common sense, therefore, calls for the latter; and hard facts tell us that without low cost of production we cannot procure the means of subsistence from abroad.

Now, it is not within the power of any authority or Government to enact a law with regard to individuals that "he that will not work, neither shall he eat"; but in the economic world in which this nation dwells, that law holds sway regarding nations. *The nation that will not work shall not be supplied with food*.

Unless we work as hard as the Belgians, the Germans, the Americans, the Japanese, we shall inevitably lose our export trade—and starve.

It is a fact, established long ago, that there is no better worker in the world than the British workman; when he chooses, he can turn out a greater output than any other national, with equal effort. But he is saddled with restrictions imposed upon him by trade unions, trade customs, &c., and he fears that if he works hard, he will not only keep another man out of work, but his own job will soon be finished. We do not blame him for holding these views, sadly mistaken as they are; we blame his leaders, who, knowing the facts, have not the pluck to tell him.

It is as certain as anything can be that if we can quote low prices for exports, we shall experience a brisk demand for our products. Nations which produce food-stuffs in excess of their requirements want our goods in exchange for their surplus. The Germans are working very hard, and so far are they from "using up all the work" that out of their 90 millions there are fewer than one million unemployed. The Belgians, without the advantage of an excessively depreciated exchange, have been working hard ever since the Armistice—and they get plenty of orders. Hard work stimulates demand and reduces unemployment.

Another factor which increases costs of production, cost of living, and unemployment is the strike. This country has become notorious for strikes, which have had a most deleterious effect upon our foreign trade. We were glad, therefore, to see that the futility of continually striking had been borne in by experience upon some of the leaders of Labour, who, at the recent Trade Union Congress, set their faces against the practice and supported a resolution in favour of obtaining settlements by agreement.

It is, we think, of the utmost importance that employers should do all that is in their power to secure and retain the confidence of their employés, and to bring home to them the economic truths which dominate the industrial situation. This can only be done by making them conversant with the facts relating to the industry in which they are engaged, a task which calls for personal intercourse between the workers and the principals. In no other way can the fallacies be dispelled by which the worker's mind has been obsessed. The individual worker is no fool: if all the facts are placed before him frankly, he will draw the right conclusion. It is that which we have outlined above—that in order to live, this nation must work.

The Bakers' machinery at the Bakers', Confectioners', and Allied Traders' Exhibition.

Of the 20-odd firms that exhibited machinery at the Bakers', Confectioners', and Allied Traders' Exhibition and Market that was recently held at the Royal Agricultural Hall, London, only one or two showed electrically-driven examples. In the majority of cases the makers appear to build their machines with a view to their being belt-driven, a policy which adds to the difficulty of adequately protecting the operators and cleaners from the dangers which always attend moving machinery. Now, the advantages of the electric drive are too well known to need reiteration, but the whole thing seems to be governed by financial considerations: the provision of a motor adds enormously to the initial cost of the equipment as a whole—probably due to the fact that when an electric motor is supplied to drive, say, a dough-mixer, it is tacked on as an after-thought instead of being incorporated in the machine itself.

The latter method, however, is said to be not practicable in many cases on account of the difference in the speeds of the driving and driven machines, but the fact is overlooked that nearly always some form of gearing is incorporated in belt-driven machines, and even in the simplest arrangement the belt itself constitutes a speed-varying device. It is, therefore, suspected that the gear problem can be considerably simplified, and that it is not so real as it appears to be at first sight.

The true solution will be difficult to arrive at so long

as the makers continue to produce the two machines separately; each endeavours to produce a beautiful piece of apparatus of very high efficiency and reliability entirely independently of the other, whereas what is of prime importance is not so much the efficiency of either, but of the combination as a whole—that is, input of the electric motor to output of the driven machine. Moreover, it should be borne in mind that electric motors would be perfectly useless, and there would be no demand for them whatever, if there was nothing for them to drive.

Under the circumstances a better policy to pursue would seem to be to design and manufacture the motor as a component part of the machine which it is intended the former should drive, and it is to be regretted that nobody seems to have attempted to tackle the problem on the lines suggested, whereby it should not be difficult to effect a material reduction in the cost of the motor and also improve the general arrangement of the combination as a whole.

Electricity for All.

In our "Correspondence" columns to-day Mr. F. M. West outlines a scheme for the introduction of electricity into half a million small houses every year, by means of a wiring corporation operating in conjunction with the supply authorities and the leading electrical societies. His reference to "the old National Free-Wiring Co." is perhaps somewhat ill-omened, for the experience of that body is not likely to inspire enthusiasm in the breasts of those who are acquainted with its history; the present, also, is not a favourable moment for enlisting capital for such a venture. Nevertheless, the idea should not be dismissed altogether without due consideration; we look forward hopefully to the time when circumstances will be more propitious to the flotation of such a scheme, which, if it could be carried into effect, would undoubtedly be very advantageous to that enormous body of small householders which at present is debarred from the use of electricity in the domestic *ménage* by the excessive cost of installation.

In this connection our thoughts naturally turn to the Fixed-Price Light Co., Ltd., which for some 11 years has been carrying out on a modest scale a system not materially different from that outlined by our correspondent, with excellent results; the company has some four or five thousand consumers of the artisan class, in various supply districts, and appears to be very well satisfied with its business. From this precedent we infer that our correspondent's proposals—which practically mean an enormous extension of this class of business—are not inherently fallacious, and we commend them to the consideration of our readers.

Railway Electrification Standards.

The final report of the Advisory Committee of the Ministry of Transport on this subject, which we abstract elsewhere in this issue, follows the lines of the Interim Report published a year ago, in that it abstains from arbitrary decisions and not only sanctions the continuance in operation of the various existing systems, but leaves the choice of system for future construction very largely open. The additional regulations relate mainly to the method of supplying electricity to the trains, and permit either contact rails or overhead conductors to be used, the former being either of the top-contact or of the under-contact type. As we said of the Interim report, "Clearly, therefore, uniformity is and will remain a long way off." The only definite standards laid down in the Report are those relating to the position and arrangement of the contact rails and overhead conductors with regard to the track and the loading gauge: these data, it must be admitted, are of great importance. Many changes and improvements can be effected on the rolling stock as time goes on, without affecting the line construction

appreciably; but to alter the latter after it had been put into use would be a vastly different question, and it is absolutely essential to the progress of railway electrification that the relations of the conductors to the permanent way shall be fixed and maintained constant from the earliest possible stage of development.

The Interim Report, while permitting alternating current to continue in use and to be extended where it was already installed, explicitly recommended the adoption of the direct-current system. As we have pointed out in these pages, the superiority of d.c. is far from being an ascertained fact, and we may not have to wait many years before the verdict is reversed. But we cannot wait for the conflict to be settled for us elsewhere—we must proceed with the electrification of our railways as quickly as possible; whether the choice is the best possible or not is of less consequence than the immediate adoption of a definite policy. The Committee, obviously, has not been able to go very far on the road of standardisation, for fear of restricting progress and improvement, but so far as it has gone it has done good service, and we hope that its work will result in the early commencement of the great task of electrification with which so many of our railways are confronted.

Capital Expansion in Germany.

EVEN after having made due allowance for the enormous depreciation of the mark, the fact remains that a very considerable augmentation has taken place in the emissions of new capital in the electricity supply and manufacturing industry, particularly the former in the course of the present year. According to figures which have been issued in relation to the electrical industry and gas works combined for the eight months ended with August, 25 new companies were formed in this period with a nominal share capital of 690,800,000 marks; 45 existing companies made increases of 1,014 millions of marks in the share capital, and 15 made issues of obligations or bonds for over 1,148 millions of marks. In fact, as a German newspaper points out, the capital requirements of the electrical industry in the present year have been greater than those appertaining to any other industry or to banking, insurance and transport. The principal portions of the amounts issued apply to the great hydro-electric works in South Germany. Thus the Walchenseewerke, the Central Isar Co., the Bavarian works, the Baden works, and the Neckar Co. alone represent 605 millions in shares and 700 millions in bonds, while the Neckar Co. is just offering 350 millions in bonds. These figures, however, by no means fully cover the capital requirements of the hydro-electric works in the South. Yet when we are told that Germany is impoverished, such figures for eight months of the year give rise to serious reflections as to the financial capabilities of Germany.

Congestion at the B.A. Meeting.

THE Edinburgh meeting of the British Association concluded on Wednesday last, and it is safe to say that from every point of view it was a satisfactory gathering; quite up to the pre-war standard which, nowadays, is generally held to be a standard of excellence. The arrangements were all that could be desired in so far as accommodation, distribution of literature, and general facilities were concerned; in fact, we think the complaint we are about to make was the only "rift within the lute."

We were led to expect discussions on many of the papers, but, unfortunately, the programmes were so full, in most cases, that anything in the way of helpful comment or healthy criticism was precluded. Indeed, sometimes in addition to the arranged programmes, some of the Sections were asked to listen to unannounced papers which made discussion quite impossible, and occasionally upset members' plans. Several afternoon sessions were held by some of the Sections, but we do not think that members would like these to become a per-

manent feature of the meetings; if this were so the afternoon excursions, which add so much to the pleasure of the gatherings, would have to be abandoned.

We are therefore forced to the conclusion that either some of the papers must be published in advance, "taken as read," and discussed; the number of papers must be reduced; or the duration of the meeting must be extended. The last of these would be very acceptable to members whose business would permit of their staying, if every meeting was as pleasant as this year's has been.

The Wages Clause in Government Contracts.

ONE of the results of the Great War was to cause the introduction into an enormous number of Government and other contracts of a clause providing for the variation of price caused by higher wages. In some Government contracts the agreement or acceptance of tender provides that the price includes all increases in cost of labour or material to a given date, and that claims for increased costs of production due to Government awards of higher wages, or increase in the price of materials, shall be considered. The question what constitutes a Government award within the meaning of this provision has recently been considered by the Federation of British Industries in consequence of the refusal of the Admiralty to admit that the award of an Industrial Court is a Government award. The Admiralty, apparently, takes the view that an award of an Industrial Court is the outcome of a voluntary resort to arbitration by the parties concerned, and is not the result of an award authorised by Government. When appealed to, the Treasury refused to give any definite ruling on the matter, holding that it was for any party to take what steps he might think proper to enforce the terms of his contract. It is to be observed, however, that in a former contract with the Ministry of Munitions the following clause appears: "If during the currency of the contracts the cost of labour . . . shall have increased by direct Government action (as defined below) the contractor may claim and the Minister of Munitions shall repay any increased cost of production due to increased costs of labour, &c." The definition of "direct Government action" is in the case of wages:—"Any award as to wages made upon any reference for settlement under the Munitions of War Acts, 1915 to 1917, or any order or award as to wages made by the Minister or by any Tribunal appointed for that purpose pursuant to any Act of Parliament." The Industrial Courts Act, 1919, is stated in the preamble to be for "the establishment of an Industrial Court and Courts of Inquiry in connection with trade disputes, and to make other provision for the settlement of such disputes." It seems to be clear from this that under munitions contracts, at any rate, any advance in wages due to an award of an Industrial Court is the result of direct Government action; and it seems to be a technical distinction to say that the award of such a Court is not a Government award within the form of contract approved by the Admiralty. If it is not a Government award, what else is it? The employer who willingly accepts the award of an Industrial Court which has effect to keep up wages has yet to be found. Not only is he not a voluntary suitor at these tribunals, but he generally resents their interference with his business. A case recently came before a Court of Referees in the Metropolitan Police where a question arose as to the terms upon which a certain man had left his employment. It appears that his employer had been summoned and fined for not paying wages in accordance with the scale fixed directly or indirectly by Act or Parliament. He paid the fine, and it may be he was compelled to pay arrears of wages due; but being determined to pay no more, he forthwith discharged some fifty workmen, including the man whose case was before the Court. To argue that he had voluntarily submitted to the award which settled the wages would be absurd.

ELECTRIC RESISTANCE FURNACES.

By E. P. BARFIELD, A.M.I.E.E.

The heat treatment of steel by electricity opens a very wide field. Electric furnaces are equally as robust in construction as those heated by gas, oil, or solid fuel. They are also so simple and powerful in construction, that they are of interest to both the electrician and mechanical engineer to know more about their sphere of usefulness.

No one will deny that the best steel is produced by the electric furnace, and similarly it may also be stated without fear of contradiction that the best tools, needles, engine and motor parts, &c., are produced when also hardened in an electrically-heated furnace of the resistance type.

A steel-hardening furnace is quite a simple affair. Briefly, it usually consists of a chamber closely wound with a resistance wire of uniform section and uniformly spaced, thus all the necessary conditions for uniform heating are present, illustrating the extraordinarily valuable application of electricity as a heating agent.

In the heat treatment of steel, uniform heating is of the greatest importance. With gas and oil heating there are variations of pressure and calorific value; with solid fuel there are also difficulties in obtaining and maintaining uniformity. In an electric furnace a given and uniform temperature can *always* be obtained in a known period, or a known temperature in a given period. Another important feature of electric furnaces of this description is the entire absence of fumes, and as there are no flues and the lagging is efficient, heat losses are negligible.

In gas, coal, and coke furnaces, the products of combustion entering the heated chamber affect the tools, &c., but in an electric furnace as there are no such deleterious gases the work is kept clean, and there is a minimum of scale. Even this can be further reduced by dipping the tools in thin mineral oil previously to heating—the oil carbonises and forms a protective coating which is easily removed. Temperature control in these furnaces is effected by means of a regulating rheostat.

The term "electric furnace" often conveys the idea, even to a practical engineer, that this appliance for the heat treatment of metals, &c., involves an elaborate apparatus with a complicated arrangement of circuits, switch gear, and other accessories, all requiring careful adjustment and control as well as constant expert attention, whereas it is really one of the most simple pieces of apparatus to erect, install, and operate. Assuming the leads are run to a position adjacent to where a furnace is to be used, the whole work of erection and connecting can be carried out in under one hour; and as for working, an unskilled girl or youth, with a special type of furnace, can harden the most intricate articles with a certainty that outclasses a skilled hardener of many years' experience. The unskilled operator proves quite capable also of making any minor adjustments to the furnace that may be necessary now and again.

It is claimed that articles of steel hardened in an electric furnace are tougher, stronger, and better cutting than those produced in any other way, and numerous physical and wearing tests have undoubtedly proved this claim, whereas similar articles hardened in other types of furnace are not produced with any such certainty. Whilst they may be hard to the file, the hardness may have been, and too often is, obtained as the result of over-heating with a consequent loss of strength and useful life in the tools so treated.

The cost of electricity consumed is very low. Taking the average rate of 1000 units at 100 p.p.w. the cost of running a 1000-watt furnace for 10 hours, which would be sufficient to heat 1000 lbs. of steel, is only 10 p.p.w. for the electricity consumed.

One important feature in modern electric-furnace practice is the arrangement of the leads, or of the connections, so that the current at the furnace terminals is at a temperature and so

prevent damage in the event of an operator omitting the usual procedure of switching "off" a furnace when not in use. Refinements of this nature and other improvements introduced by various manufacturers of electric furnaces have not only rendered these furnaces "fool proof," but they have advanced their products to such an extent that to-day this country is the largest exporter of electric furnaces, and can compete in quality with any producers abroad. From these remarks it must not be inferred that the home or export business is enormous, for such is not the case, but its magnitude, in spite of the financial situation, is encouraging and steadily increasing.

The use of electric furnaces is not confined to steel hardening only; their industrial uses are numerous. For example, there are melting furnaces for use in the foundry, and rivet furnaces for correctly heating both iron and brass rivets; silver and gold annealing also offers a wide field. For dental work special furnaces are made for low-temperature work in the dental surgery, and a considerably higher temperature for the dental manufacturers in producing artificial teeth. Chemical furnaces are usually designed so that the heated chamber or container may be tipped and its contents emptied. Numerous other types of electric furnaces are made for different industries, and their adoption in place of gas-heated ones will certainly make far more rapid progress in this country when the commercial sides of electricity supply companies have a closer acquaintance with high temperature, and study the questions of heating applied to production in much the same way as the gas companies are doing.

The field for electric furnaces is not confined to large industrial centres; nearly every electricity supply company or corporation has a number of potential users, and from a purely electrical point of view the electric furnace load is well worth cultivating, as the power consumption for different-sized furnaces varies between 1½ kW and 20 kW, and larger sizes are in course of preparation. For night loads carburising or case-hardening furnaces should also be of interest to electricity supply authorities, these types of furnaces being usually charged with work during the day and switched on before the works close at night, and either switched off again first thing when the works reopen next morning or controlled by a time switch which comes into operation shortly before the works open. The operation of carburising in a furnace of this description is easier and far more certain in results than in gas, coke, or coal-fired furnaces.

All the pioneer work with regard to the introduction of electric furnaces to the consumer has been left almost entirely to the handful of manufacturers engaged in this branch of the industry. The Institution of Electrical Engineers has not yet recognised anything beyond arc steel-melting furnaces, which deal with the production of steel in tons, and are, of course, not applicable to ordinary engineering or similar industrial productions.

A large number of electrical engineers have never had facilities at their disposal to experiment in or obtain experience with high-temperature apparatus heated electrically, and consequently it is probable that they do not realise that muffle furnaces working at, say, 1,100 deg. C. are commercial productions used in numerous trades for various purposes.

It might be suggested that if commercial managers connected with the supply of electricity were to investigate the use of gas-heated appliances already installed in their consumers' premises, and communicate to manufacturers the size, purpose, output, and any other data available regarding the gas appliances used, in nearly every instance an electrically heated appliance could be substituted.

THE CONTRACTOR'S FUTURE.

By L. G. HAWKINS.

THE time has arrived when the future of the electrical contractor's business is being seriously challenged, and it must be decided immediately whether or not the electrical contractor is the right medium through which not only electrical labour-saving appliances, but all electrical supplies are to be sold and distributed, or whether other channels of distribution are to be chosen.

The actual answer rests entirely with the contractors;

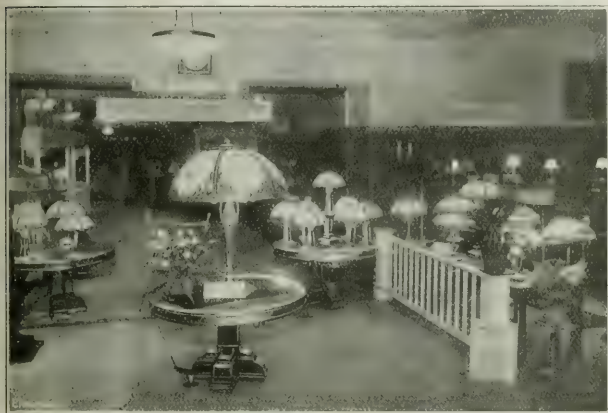
5. Prepare suitable printed matter.

6. Satisfy callers and secure all possible business, and educate the buying public to the use of electricity, &c.

How few electric shops in the British Isles are worthy of the name! But when one stops to think what a wonderful progress these few have made, it is surprising that before now some syndicate or other has not developed a chain of such shops throughout the country. It is a known fact that a large foreign manufacturing concern has opened its first electric shop in London, which is the first of many which are to be dotted in all of the principal centres to cater direct to the public—the idea being to give the British public the benefit of progress as far as the electrical shop is concerned. It is now up to the electrical contractors to be first in the field by getting busy immediately, and to develop before any outside organisation can scoop the market. Surely the Contractors' Association or the N.E.C.T.A. should immediately appoint a merchandising committee consisting of men of undoubted sales ability, and if necessary seek the aid and co-operation of men outside that Association. If once a chain of electric shops is established by foreign firms the local contractor's sales opportunities will be very poor,

even though he may then be willing to make a show and do the thing properly.

Financial cramp and lack of organisation often deter the enthusiastic contractor from running an up-to-date and successful sales department. Is there any other trade which is so badly financed? Quite frequently the total assets of a budding contractor are a few pounds, a



"MILLER" LAMP DEPARTMENT OF THE CHICAGO RETAIL ELECTRIC SHOP.

if they fail to recognise that the electrical installation side of their business is entirely separate from their sales side, they cannot hope to satisfy the public or manufacturers, which means that other sales outlets will be found.

A few years ago a similar condition existed in the United States. The condition was faced by a body of keen business men in the contracting world, with the result that to-day electric shops in America are the most up-to-date and attractive of any shops to be seen; they appeal directly to the womenfolk; they are always spotlessly clean; the goods are well displayed in attractively decorated windows; actual demonstrations or working models are usually in operation, and, above all, the sales assistants are practical men and women, who understand their jobs, and can demonstrate and explain the details of the apparatus in question. In other words, personality and knowledge in the electric shop plays just as important a part as in the hat or blouse shop. Sales assistants of this grade are not expected to clean windows, polish brass work, and at the same time to do sundry office jobs. To ensure the sales department being properly conducted and thus producing the maximum sales results, great attention should be paid to: (a) Displaying electric appliances; (b) popularising electric appliances by means of the following methods:—

1. Arrange proper demonstrations.
2. Arrange attractive window displays.
3. Prepare appropriate circular letters to consumers.
4. Arrange appointments for the outside representatives.



INTERIOR OF A U.S.A. ELECTRIC SHOP: AN EVERY-DAY SIGHT.

coil of wire, and a set of tools. How frequently he never gets beyond the starting stage. Even if he does, he is invariably in a more or less bad way. Would it not be a splendid thing if, in various centres throughout the country, contractors joined hands with their supposed rivals, and made one or possibly two contracting businesses with central offices and showrooms, from where the whole electrical business of the locality could be efficiently conducted, instead of possibly twenty small contracting businesses poked away in back alleys where

daylight has difficulty in penetrating, let alone the "lady of the house" who is out to be seen and out to see "things"? The advantage of such an arrangement would be:—

1. Pooled finances and central control, thus establishing a sound business.

2. Local co-operation between all contractors in one business instead of throat-cutting competition by twenty small concerns.

3. One efficient establishment; one set of books; one set of foremen and wiremen; one office staff; one telephone installation instead of twenty; in fact, a vast reduction in establishment charges all round.

4. The twenty contractors would become co-partners or officers of the one company, all seeking for work or carrying work through, or attending to sales as in the past, but with the tremendous advantage of knowing that their finances were in good hands and that the whole business was in a sound state.

5. Buying in bulk advantageously and being able to carry out contracts which small firms could not do, and which, therefore, would be passed to outside firms.

6. Properly catering for the electrical trade, and thus

satisfying the public as well as the manufacturers, and ousting the possibilities of outside competition.

7. An analysis shows:—

- (a) Efficiency.
- (b) Reduced cost.
- (c) Better buying.
- (d) Profitable prices.
- (e) Good local showrooms.
- (f) Increased profits and assured success.
- (g) Greater facilities for contracting.

There are disadvantages in every scheme, but these usually are overwhelmed by the advantages, if it is a good one. Remember that this is only a suggestion, put forward by one who is keenly anxious to see the contractors grasp what should be theirs, and develop a sound merchandising department to their businesses on the most efficient lines.

Any group of contractors or individuals seriously interested in the plan outlined herein should communicate with the author at 116, Charing Cross Road, or the secretary of the Electrical Contractors' Association, 11, Southampton Row, London.

The illustrations accompanying this article show the types of electric shops which are common in the United States.

ARMATURE WINDING AND INDUCTION MOTOR DIAGRAMS.

By C. SYLVESTER, A.M.I.E.E., A.M.I.Mech.E.

THERE are very few faults to find with the practice of the modern armature winding shop. The formers are excellent, when compared with the home-made formers of the small winding shop of a few years ago, and the heating presses certainly make a good solid job of a completed coil so that they do not have to be handled so gingerly, the latter being against the interests of efficiency as far as the armature winder is concerned. It may be said, however, that considerable scope exists for the improvement of armature winding diagrams, that is; if the armature winder is to thoroughly understand them. Some of the armature winding diagrams issued by several of our large electrical engineering companies may be compared with nothing more or less than a Chinese puzzle, and armature winders in vain try to trace definite paths through a winding.

I have seen a complete winding diagram which showed a lap winding connected up to a commutator of 260 segments. The whole of the coils and circuits through the complete winding were shown and, from the pitch of the coils, the armature was clearly intended to operate in a six-pole machine. The whole of this winding was contained on a blue print 12 in. long by 8 in. wide. Upon looking at this diagram the thought immediately came into one's mind: "How careful a winder must be, if he is to connect up these coils correctly." There would indeed be very small wonder if, when a winder was tracing the circuits through this armature with a pencil, he strayed from one line and picked up another one, thus finding himself up against a "dead end."

It may be argued that modern machine shop practice entirely eliminates the possibility of an armature winder making a mistake when he is connecting up the coil ends to the commutator segments. It may be pointed out that the modern former forms the coils so accurately that they will literally fall into the correct position on the respective commutator segments to which they are to be connected. This point may be further driven home by a remark that, since all coil ends are fitted with coloured stockings, there is no necessity for the armature winder to know anything about the job. Surely there are no greater fallacies in existence than these. An armature winder does not always practise his art under workshop conditions. In some workshops winders are continually engaged upon one class of winding for, sometimes, months at a time. If, however, they are placed upon an

entirely different type of armature, they experience some difficulty, for a time, in getting into the changed condition of affairs. Again, it is the practice in some winding shops for the shop foreman to place the first coil in its correct slots, and to lay the coil ends in the slots of the respective commutator segments. This, to a certain extent, makes things much easier for the armature winder, but not in the direction he most desires.

We will now consider the case of a large power plant, or traction system, situated some hundreds of miles from the factory where the electrical machinery was made. In almost every power plant will be found an electric motor which has been designed to meet special requirements. It may be a large motor for an air compressor with a very low speed, or it may be a motor designed to operate at full load under a very wide range

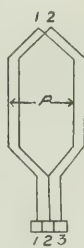


FIG. 1.

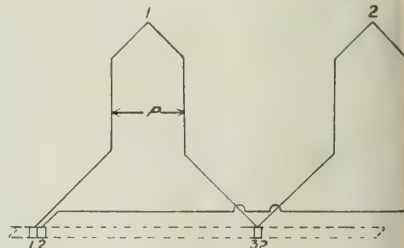


FIG. 2.

FIG. 1.—SIMPLE LAP-WOUND ARMATURE DIAGRAM.
FIG. 2.—WAVE-WINDING DIAGRAM.

of speed. The fact remains that such machines are called for, and manufacturers have to deviate from their standard practice, and a machine is produced to meet these exceptional requirements. This being so, if a breakdown occurs to the motor, special component parts have to be made to cope with the breakdown, and, since no spare motor is available, the repairs have to be carried out as quickly as possible. It is in a case like this in which the armature winder is in need of the utmost assistance. It may be that an armature is completely burnt out and has to be rewound on site. The coils are hurriedly made in the winding shop, and a diagram is got out,

similar to the one I have described above. The coils, diagram, and necessary insulation and banding wire, &c., are handed to the armature winder, and he is sent away to do a job upon the success of which the reputation of his firm depends.

Under these conditions, therefore, the armature winder should be given a winding diagram which will enable him to follow the circuits through the armature with a minimum risk of making a mistake.

In fig. 1, I submit what I consider is an adequate diagram for a simplex lap-wound armature. This diagram shows two coils in position and the connections of the coils to their respective commutator segments. Regarding P, the pitch of the coils in the slots of the core, the blue print should definitely state this briefly as follows: P = 1 to 8, or 1 to 12, as the case may be. If the pitch is 1 to 8, then it naturally follows that the remaining coils will be placed in slots 2 to 9, 3 to 10, 4 to 11, and so on. Regarding the connection of the coil ends to the commutator segments, it would not be superfluous to add a few figures to the details of P, as follows:—

Coil 1, segments 1 and 2; coil 2, segments 2 and 3; coil 3, segments 3 and 4; and so on.

In dealing with wave winding diagrams we are handling a much more difficult task owing to the fact that top and bottom coils have to be taken into consideration. For an armature of fairly large size, a complete wave winding diagram is one maze of full and broken lines. The former represent top coils and the latter bottom coils, according to the system or procedure of the designer. That such a diagram is known to be complicated is quite clear from the fact that some engineers show the brushes on the inner side of the commutator, in preference to their correct position, since the latter would cover several coil ends and so lead to further complications. In fig. 2, I submit a wave winding dia-

winder to rewind the rotor for which it is intended after a very brief consideration. The rotor has 48 slots. There are 4 poles with 4 slots per pole per phase. It will be noticed that the rotor is to operate on a 3-phase system. One phase is connected between A and A₁, the second phase between B and B₁, and the third phase between C and C₁. The position of the windings for the three phases is clearly shown, and all that is necessary is to indicate, by means of figures, the slots to which each end of the windings should be connected. There is obviously no necessity to draw a complete winding diagram as is often the practice nowadays.

Regarding fig. 4, which illustrates a stator winding diagram for 48 slots, 3-phase, 4 poles, 4 slots per pole per phase, the simplicity of this needs hardly any comment. As before the phase windings are between A and

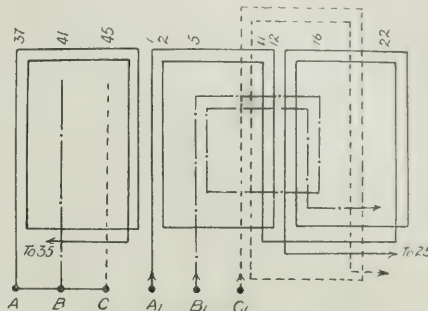


FIG. 4.—STATOR-WINDING DIAGRAM.

A₁, B and B₁, and C and C₁; A, B, and C are connected up for star operation, A₁, B₁, and C₁ being the ends of the windings to be connected to the three-phase supply.

The windings for larger motors may be treated in the same manner. It is merely necessary to lay out the positions of the windings as far as one pole in each phase. Beyond this, the use of figures should be resorted to, since these are much easier to understand than a mass of uncertain lines by the only person who really matters—the winder, who has to apply the diagram to his work.

Inter-Scandinavian Transmission of Energy.—The question of the electrical transmission of energy from Norway via Sweden to Denmark has been under discussion in the countries concerned for many years past, and has only now reached the stage of negotiations. These were begun at Christiania in the latter part of August, when Government commissions met for the first time to deal with the problem in its preliminary aspects. After the presentation of various reports on the question, the conference proceeded to appoint committees composed of two representatives of each country. The first committee is to investigate the electrical side of the problem of power transmission with regard to a line carried over Sweden, and as an alternative the laying of a cable under the Skager Rack. The second committee will deal with the legal aspect of the question, and suggest any legislative amendments which may be deemed necessary. When these points have been cleared up the purely business side of the question will be examined, and then the matter of organisation—whether the work will comprise an inter-State undertaking, be entrusted to a company, or be a combination in which the States themselves will participate. It appears that the Danish representatives have already put forward valuable information in favour of an alternative cable under the Skager Rack, while estimates for a land line *via* Sweden have been submitted both by Norwegian and Swedish authorities. Under the circumstances it is probable that many years will elapse before the scheme is carried into effect.

New Australian Cable Company.—A company has been formed by Messrs. Gibson & Sons, Sydney, with a capital of £250,000, to establish works near Sydney for the manufacture of telephone and electric transmission cables. The plant has been ordered and a staff engaged. The first unit is expected to be completed within a year. A contract has been placed with the company by the Commonwealth Postmaster-general's department for approximately £250,000 worth of cable. Most of the materials for the manufacture are produced in Australia.

gram which should make the connections quite clear to any armature winder. Here, as before, P represents the coil pitch. Two coils are shown in position with their ends connected to their respective commutator segments. The commutator is one of 61 segments. As with the previous diagram it is necessary to add a few figures to the details of P. In this case the following figures should be sufficient to give one a clear idea of the complete connections:—

Coil 1, segments 1 and 32; coil 2, segments 32 and 2; coil 3, segments 2 and 23; coil 4, segments 33 and 3; and so on. Is it not much better to use a few figures like these than to run the risk of straying from one line to another when tracing the circuits through an intricate winding diagram?

As with armature winding diagrams, those for induction motors need to be very easy for the "trouble man" to follow. The construction, or design, of the windings of induction motors is so varied, and it is possible that a winder may be sent to wind a rotor or stator which he has not seen before. In fig. 3, I show a rotor winding diagram which contains sufficient detail to enable any

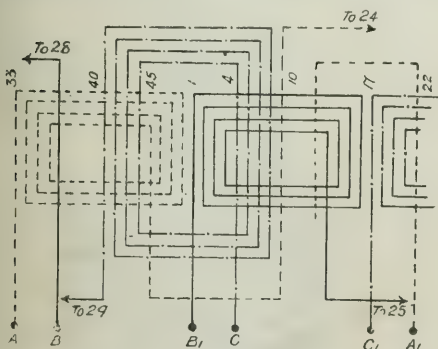


FIG. 3.—ROTOR-WINDING DIAGRAM.

THE SHIPPING, ENGINEERING, AND MACHINERY EXHIBITION.

EACH of the exhibitions held at Olympia under the same organisation since 1914 has been more successful than its predecessor. On the occasion of the last undertaking, in the autumn of 1919, the distinguishing feature was the extensive and interesting Dutch section, but owing to the large representation of foreign interests, Olympia was taxed to its uttermost, with the result that all the applications for space could not be satisfied. On the present occasion, therefore, while the international character of the exhibition has been maintained, preference has as far as possible been given to British manufacturers.

In the absence of the president (the Hon. Sir Charles A. Parsons) the exhibition was formally declared open by Capt. H. Riall Sankey on September 7th, and in order to facilitate inspection by the public of the displays of the 360 odd exhibitors, the exhibition will remain open for three weeks. Recognising the educational benefit of an undertaking of this character, the management is offering special facilities to members of engineering institutions, technical students, works' managers and foremen, &c., to visit the exhibition; a series of lectures, papers, and conferences on various subjects has also been arranged, and in the kinematograph theatre films will be shown daily dealing with electrical and engineering subjects. For the first time since the war the railway companies have arranged to run excursion trains up to London, and it is to be hoped that they, in addition to the cheap tickets which are available to employers and others, will be made full use of by engineers of all sections. The broad educative effect of a comprehensive exhibition of modern engineering practice of this kind is too valuable to be neglected.

It is pleasing to note that in default of an electrical show, an attempt has been made to secure as impressive as possible a display of electrical and allied exhibits. Electrically-driven winches, capstans, and other auxiliary gear occupy nearly as prominent a place as do ship-lighting sets, while electric welders, furnaces, and switch and control gear are well represented. It is especially gratifying to be able to record that makers of electric heating and cooking appliances have fully appreciated the opportunity that is presented by this exhibition for emphasising the merits of the electrical method on board ship.

In the course of his speech at the inaugural luncheon, over which Dr. H. S. Hele-Shaw presided, Commander Sir Trevor Dawson (vice-chairman and managing director of Messrs. Vickers, Ltd.) compared the present industrial position of England with that of Germany, which country he had visited about a month ago. While there he had investigated the labour position in two great workshops—one electrical and the other steel and engineering. Both were hives of industry in which labour worked harmoniously, and from which output was very high. The electrical works had been allowed to write down their shops and machinery during the war to the extent that they stood in the books at one mark. Moreover, there were no taxes such as the munitions levy or the excess profits duty, and consequently they had been able to collect working capital to enable them to progress with peace products without any financial embarrassments. When the above conditions were considered, together with the fact that the average wages paid in Germany were of the order of four marks per hour for an eight hour day, it was not difficult to realise how disconcerting was a comparison with the conditions obtaining in this country. [On Monday last the German mark fell in value to about 5d., the closing rate of exchange being 403½ marks to the British £. The pre-war value of the mark was approximately 1s., or 20.43 to the £.] Even during the stress of war Germany had studied and foreseen the economic position which would arise when hostilities ceased.

What follows is a brief review of the exhibits of an

electrical nature, but very little of a really novel character appears to be shown, except in minor matters; there is no outstanding attraction. Nevertheless, there is a great deal on view that engineers of all grades should not fail to see.

On the stand of MESSRS. ELECTRICAL UTILITIES, LTD., the "Tifty" current limiter, which has been described in our pages, is shown in conjunction with the "Sentinel" excess current indicator which consists of a resistance element, a portion of which is coated with urea crystals that are normally white in colour. If an excess current of about 2 per cent. passes, the coating will melt in from 15 to 30 minutes, and a permanent record of the passage of the overload is thus obtained.

The "Lightning" electric cooking oven that has been produced by the firm has been illustrated in our columns. It consists of a circular sheet-metal dome, inside of which, carried circumferentially, is the heating element extending from the top to the bottom, and is divided into three sections. The dome is attached to a counter weight, and can be easily raised or lowered.

The "Dim-Bright" adapter fitting shown on this stand is intended for use in conjunction with the new neon gasfilled electric discharge lamp. It consists of a polished brass globe with an adapter (to fit standard lamp holders) at the top and two lamp holders at the foot, the latter controlled by a cord-operated switch which puts one or other lamp in circuit. One night lamp and one bright lamp are inserted in the holders, and while the dim light can be alight continuously, consuming little current, a bright light is obtainable in a moment by pulling the cord.

Neon lamps in the form of signs, as described in our "Correspondence" columns last week, are also to be seen on the stands of the RAWPLUG CO., LTD., whose product is now well known in the electrical trade, and of MESSRS. THOMAS AND BISHOP, LTD., who demonstrate the qualities of "Cling-Surface," a material used for treating belting; leather and textile belting when treated therewith can be run easy or slack, instead of tight, without slipping. Gale's commutator compound is also shown on this stand, which is claimed to remedy spark-

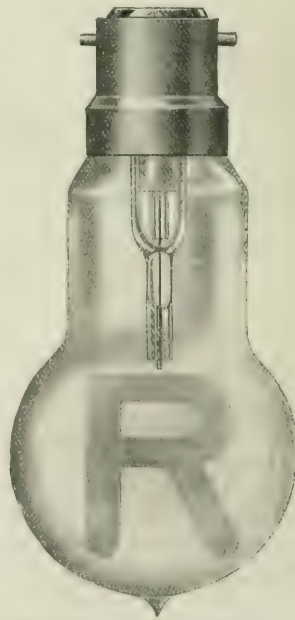


FIG. 1.—THE OSGRIM LETTER LAMP.

ing, keep commutators clean, prevent cutting, and will not gum the brushes.

To return to the neon lamps, these are obtainable from the GENERAL ELECTRIC CO., LTD., amongst others; they are a cheap means of lighting, and are very effective for sign illumination. As shown in fig. 1, each lamp contains a separate letter which glows with an orange colour. At present they are only obtainable for use on 200/250 volt circuits, but it will be appreciated that the problem of producing electric lamps of really low candle power and current consumption for use on ordinary

lighting circuits has at last been solved by the production of the "Osglim" (neon) lamp now in course of manufacture in this country. For such purposes as night lights, visual indicators, &c., at pressures of 200 volts and over the quocio has hitherto lain between the 20-watt metal-filament lamp and the 5 or 8-candle-power carbon lamp consuming more than 20 watts. The new lamps present a successful and very interesting solution to this problem, and the patents covering them are jointly owned by the British Thomson-Houston Co., Ltd., and the General Electric Co., Ltd. "Osglim" lamps consume 5 watts as a maximum and produce a light which,

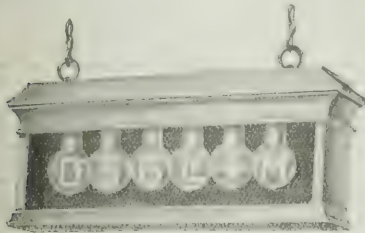


FIG. 2.—OSGLIM HANGING SIGN.

although of low intensity, is amply sufficient for the purposes mentioned above.

An entirely new principle in lamp making is involved in the design, which consists essentially of two metal electrodes

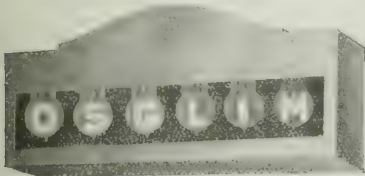


FIG. 3.—OSGLIM PEDestal SIGN.

sealed into a glass bulb containing rarefied neon gas. These electrodes are connected to an electric circuit (either d.c. or a.c.) by a bayonet cap and holder in the ordinary manner. The potential difference between anode and cathode

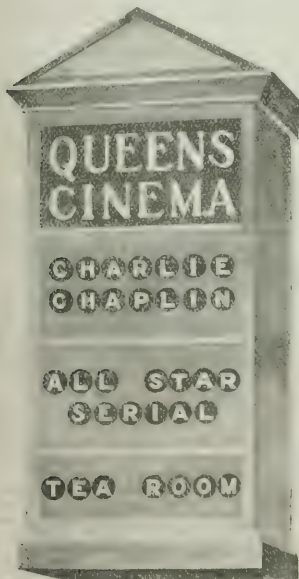


FIG. 4.—OSGLIM THEATRE SIGN.

produces an electrical discharge across the rarefied gas, and as a result of the ionic bombardment, a glow of a characteristic reddish-orange colour is produced as a luminous haze surrounding the cathode.

The construction of the lamp is simple, and the absence

of a filament does away with the weakest part of an electric lamp. The mechanical strength is, therefore, very great, being limited only by the strength of the glass bulb.

At present two distinct patterns are made: The "letter" type (Fig. 1) has the cathode made in the form of a small letter, numeral, or other simple device about 1½ in. high. This is principally used in simple signs for displaying a word or words which, by the way, are nearly as conspicuous in daylight as in the dark. The other type, for use where merely an indicator or safety light is required, has the cathode made of a thick wire spiral wound tightly into the shape of a beehive.

The glow is produced both on direct current, when the cathode only shows the glow, and on alternating current, when both electrodes are luminous. Some modifications introduced into the d.c. lamps, however, make them less effective on a.c. circuits so that in practice two separate types of this lamp are made. The letter lamps are made suitable for use on either kind of circuit.

The possibilities of the "Osglim" lamp are almost unlimited, and the many uses to which they may be put will be obvious.

The lighting lamps are primarily intended for dim illumination; they make excellent nightlights in nurseries, &c.; and in domestic illumination they have been used with good effect to add a touch of colour to the lighting scheme.

The General Electric Co. has designed an attractive range of signs for use with these lamps. Typical examples are shown in figs. 2, 3, and 4. A universal adjusting device is fitted to each lampholder so that individual lamps may be turned, raised, or lowered, to bring them into correct alignment.

MESSRS. SIEBE, GORMAN & CO., LTD., again exhibit their diving apparatus and smoke helmets, giving demonstrations several times daily in water and gas tanks, including the use of underwater illumination and the use of telephones by the diver while submerged.

Telephone apparatus is exhibited by, amongst others, the BRITISH L.M. ERICSSON MANUFACTURING CO., LTD., which has on view several types of instruments, switchboards, and accessories, as well as magnetos suitable for use on four-cylinder engines, and the RELAY AUTOMATIC TELEPHONE CO., LTD., whose exhibit consists of a complete installation for an inter-departmental automatic system giving facilities for the connection of 50 telephones. It comprises the automatic switchboard, power board, two sets of 24-volt batteries, and instruments all connected up for use so that visitors can grasp the method by which the use of human operators is eliminated. A special feature of the system which will attract attention is the fact that there are no working parts as generally understood; the only movement is that of the armatures on the relays, which have an almost imperceptible movement when operations are going on. There is an entire absence of all electro-mechanical switches, and the great advantages which are obtainable by the use of this system include absolute secrecy, instantaneous connection or disconnection, and high speed of operation.

A further important feature is the fact that only two wires are needed from the switchboard to each telephone, and great saving in accommodation can be effected by its use.

MESSRS. EVERSHED & VIGNOLES, LTD., besides a selection of their standard instruments, exhibit an electrical helm or rudder indicator, which was originally introduced in 1893, and serves to indicate at any desired control position the degree of helm or angle of inclination of the rudder to the axis of the ship. By means of the hand-operated transmitter of the steer-

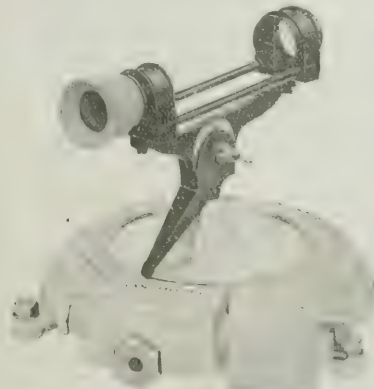


FIG. 5. THE DIRECTION-OF-OBJECT TRANSMITTER

ing telegraph (an adaptation of the above indicator) at the control position the degrees of helm required can be signalled to any desired position, such as the engine room or steering flat. Needham's revolution counter and pulsator system of speed control and measurement has been described in our

pages, while Kilroy's stoking indicators have been in use since 1902; they are used to regulate the stoking of boiler furnaces and aid considerably in economising coal consumption.

The object of the Kilroy system of turret danger signals, which was introduced in 1907, is to provide on modern war-ships, in which the gun turrets have large arcs of training, a means of giving characteristic warning to those in charge, when the training of their guns is such that it would be dangerous to fire. The principle of the system is the completion or interruption, by the movement of the turrets or guns, of circuits supplying current to apparatus situated in the turrets, in such a manner as to operate a signal in a particular turret whenever the relative positions of that turret and the

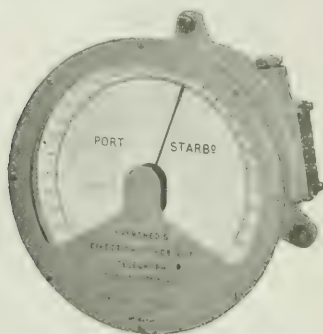


FIG. 6. THE LOOK-OUT RECEIVER.

object which may be endangered are such that it is dangerous for the turret to fire. The operation of the signal always means "Don't fire," and it is only given in the endangering turret. In British ships the danger signal is made by a trumpet worked by alternating current, adapted to give a loud and characteristic note whenever the circuit is completed. It gives also a visible indication. The alternating current is provided by a motor alternator run from the ship's electric lighting circuit.

The direction-of-object indicator or look-out telegraph, of which the transmitter is illustrated in fig. 5 and the receiver in fig. 6, enables a man in the crow's nest or forecabin of a ship to indicate at the bridge or other control position the bearing of an object at sea; it runs off a d.c. supply, and is independent of voltage variations.

The exhibits of some eight firms are of interest to electric welders. On the stand of ALLOY WELDING PROCESSES, LTD., is displayed a wide variety of welded articles and numerous types of coated electrodes, in addition to two improved sets of arc-welding plant. One is a completely self-contained petrol-driven set, and the other a motor-generator outfit, which has been designed to meet the needs of tramway engineers. Both sets are enclosed in sheet-metal covers and water-tight instruments, switchgear, and cable plugs are fitted to the ends of the steel enclosure; thus the whole presents a compact appearance, and can be used in the open without further covering. All the plant is shown in operation, as is also "Daysohms" a.c. plant, the special advantages of which are that the voltage used is only 50 and its high efficiency combined with light weight—namely, 34 cwt. complete. An early form of this machine has been described in our columns, but it has since been improved upon, and MESSRS. DAYSOHMS, LTD., have recently been obtaining some surprising and extremely important results. Incidentally, it may be said that successful welds have been made with 45 and even 35 volts a.c. Hitherto the problem has been how to maintain the arc when using a low open-circuit voltage, but this has now been overcome. Moreover, in the past welds have been judged by their mechanical strength, but it is a well-known fact that a large majority of welds are much stronger mechanically than they need be. Now, if the voltage can be reduced and therefore also the kVA required without impairing the mechanical strength of the resultant weld, the subject will assume an entirely different aspect. This is the line on which Mr. Davies is working, and he has succeeded in increasing the weight of metal deposited per kWh consumed in an astonishing manner. The chief of the subject assumes much importance when it is realised that the cost of actual welding may thus be considerably reduced.

MESSRS. G. F. PERKINS & CO., LTD., show various railway and tramway fittings, and also apparatus for plastic arc welding on the water system, by the use of which it is claimed to be possible to electrically weld any grade of cast iron, including malleable iron. The firm supplies a single-phase portable outfit that has sufficient capacity for cutting. It is driven by a 25-hp. petrol engine, and the generator is a compound-wound 37-volt D.C. machine, above which the control board is mounted vertically. A similar set, but capable of supplying two arcs and having a capacity of 200 amperes, is also available, while the "Transformer" set is obtainable in a variety of sizes.

The welds to be seen on the stand of the BRITISH ARC WELDING CO., LTD., have all been submitted to tests, the results of which can be seen in the sample specimens themselves. In tensile tests of welds in mild steel Lloyd's tested plate, over 100 per cent. strength was obtained in the weld, and a welded pressure vessel, 12½ in. external diameter, made from ¾-in. ship's plate is shown, which has withstood a pressure of 4,500 lb. per sq. in. A large weld in 11/16-in. boiler plate was successfully made with the two sections securely riveted to an angle framework; this interesting weld of a rigid structure is exhibited.

THE PREMIER ELECTRIC WELDING CO., LTD., demonstrates arc-welding plant both of the internal-combustion engine-driven and motor-generator types. The sets shown are of the single-operator pattern, and the firm claims to have entirely done away with the use of wasteful series resistances in the welding circuit. Samples of electrodes are also on view, each class being of a distinctive colour, in addition to resistance welding machines.

The latter type of machine is also exhibited by the A.I. MANUFACTURING CO., and is suitable for spot, seam, and butt welding, no flux or other foreign matter being required for the process. The stand is an exceptionally interesting one, and houses several machines for each of the three purposes mentioned above; their operation is demonstrated in conjunction with the use of special jigs, and special attention is drawn to the fact that the human element is practically eliminated in the working of the machines—they function correctly on repetition work under the supervision of unskilled labour. Of the several butt welders shown, two are semi-automatic, and a particular feature of the exhibit is that the furniture is in part welded; the fence enclosing the stand is made up of samples of spot, seam, and butt welding in a variety of applications, and the small table on which samples of work are laid out will also repay inspection.

Electric resistance-welding machines are also to be seen in operation on the stand of MESSRS. PERKIN & CO., LTD., and a "single-operator" generator designed for metallic electrode welding to a maximum capacity of 175 amps. is shown by the METROPOLITAN-VICKERS ELECTRICAL CO., LTD. It is a motor-generator set with the starting and control gear panel mounted on iron brackets attached to the bedplate; the arrangement is designated semi-portable, being suitable for easy transportation between different parts of a works or shipyard. A selection of "Cosmos" domestic appliances, lamps, &c., is shown in addition to a 120-kVA, 3-phase ship's lighting geared turbo-alternator set mounted on a combined bedplate. The control of the 30-h.p. motor that is direct coupled to the winch exhibited is by means of push button automatic contactor gear, and the derrick is provided with a limit switch to prevent over-winding.

MESSRS. GUTHRIE PRODUCTS, LTD., demonstrate the protective, insulating, and waterproofing properties of their products; their anti-corrosive paint resists the action of acids and alkalis, and is non-conductive, two coats being sufficient to withstand 1,550 volts as certified by the National Physical Laboratory. Samples of solid insulating material are also on view.

The exhibits of MESSRS. SIEMENS BROTHERS & CO., LTD., include engine-room telegraphs, which are shown in operation. The supply of electricity for actuating the apparatus is derived from a primary battery, arranged to be left in circuit continuously so as to be available at all times. The distance from the bridge to the engine room does not affect the operation of the telegraphs or diminish their positive action. Loud-speaking telephones for ships meet the need for means of communication between the bridge and various parts of the ship, including the engine room, and the helm indicator supplies a reliable means for indicating direct from the rudder to the bridge or wheelhouse the position of the helm. Means for testing the voltage of the battery and for checking the accuracy of the instrument are included in the apparatus. The navigation lights indicator forms a useful means for ascertaining whether the navigation lights of the ship are burning correctly. On the front of the case containing the apparatus is shown a plan of the deck having small circular windows in positions corresponding to those of the navigation lights. Indication that the lamps are burning correctly is given by means of small lamps situated behind the windows. Should one filament of a two-filament navigation lamp break the brilliancy of the indicator lamp diminishes, but the light is not quite extinguished; when both filaments are broken, or if from any other cause the circuit is interrupted, the indicating lamp is completely extinguished and, at the same time, a bell rings to call attention.

The water-depth indicator is a convenient means of ascertaining the depth of water in the various tanks of a vessel. The instrument comprises a transmitter which is operated by the pressure due to the height of water in each tank, an indicator, and a selector switch for enabling any one of the transmitters to be connected to the indicator. The distance of the tanks from the central position where the readings are taken does not affect the accuracy of the instrument.

Forbes's ship's log and speed indicator gives the distance travelled by the ship as well as the actual speed through the water at any moment. The transmitting portion is fixed in the ship's bottom, and consists of a valve through which can protrude, when indications are required, a bronze tube having one opening facing forward for the admission of the water

as the tube is carried forward by the ship, and another facing aft for the exit of the water. Between these openings is a propeller operating the transmitting mechanism, so designed as to make a definite number of revolutions while the ship travels one nautical mile. The tube can be drawn into the interior of the ship and removed for examination at any time. The receivers can be fitted in any desired position in the ship, and are operated electrically.

Wireless telegraph installations for ships, a distance pyrometer and thermometer apparatus, samples of cables and wires, and a selection of batteries and lamps are included in the exhibit.

(To be continued.)

A LONDON "TOLL" TELEPHONE EXCHANGE.

THE volume of traffic passing over the trunk telephone system to and from London has for some years past been increasing at the rate of approximately 10 per cent. yearly, and is, in fact, fast approaching the limit of the capacity of that exchange, and the provision of relief arrangements has become a paramount necessity. The Post Office has therefore separated the longer from the shorter distance traffic and has allocated an exchange for the express purpose of handling the latter on more economical and expeditious lines. A building in Norwich Street, Fetter Lane, which had been acquired in 1914 for use as a relief exchange was available, but it was not possible to commence the erection of the new exchange until the end of last year. The exchange will be known as the London Toll Exchange, and is expected to be in full operation by September 17th.

In the process of designing the switching apparatus opportunity has been taken to introduce new facilities for the operation of the calls, so that connections to the provincial towns which are served by the exchange may be obtained on demand. Under the existing system a London subscriber desiring to call any town outside the London local service area asks for "Trunks," whether the town is situated just beyond the borders of the London area, or in the remotest parts of the United Kingdom. The caller's local operator then connects him to the London trunk exchange, which records his call and passes it on to a switching position, where it takes its turn with others which are awaiting connection. Under the new system a subscriber wishing to call any provincial town within a distance of approximately 25 miles radially from the centre of London, will ask for "Toll," instead of "Trunks." He will be connected to the London toll exchange, where the telephonist who answers him, besides recording particulars of the number, will herself establish the connection to the desired subscriber. In the majority of cases the call will be completed whilst the caller waits on the line, as in the local service.

In order to provide this improved service, the trunk lines from London to the provincial towns served by the new exchange have been rearranged in such a way as to place them all within the reach of every telephonist in the exchange. This has been achieved by the introduction of a multiple system, i.e., repeating the switching jacks of all the lines around the exchange. A number of cables to provide additional lines are being laid where necessary on the provincial routes, to meet the traffic requirements and to ensure a reasonable probability of a trunk line, or toll line, being available to cope immediately with every demand. Many of these lines will be ready when the new service commences. When a call cannot be connected on demand, owing to the lines being engaged, a subscriber's application will be booked and completed as soon as the telephonist is able to find a free line, when the subscriber will be rung as in the case of a trunk call; but on the completion of the various cabling schemes delays of this nature should be infrequent.

At the date of opening the existing lines will be increased by 20 per cent. and the lines provided on the more important routes should be sufficient under present conditions for the immediate disposal of all traffic. In addition to the traffic originating from London the Toll exchange will deal with the traffic incoming from the provincial towns involved in the London Toll scheme; the arrangements for operating this traffic should speed up the service materially.

The total number of exchanges and rural call offices included in the London Toll area is 270. In the Toll exchange accommodation for 424 outgoing and 600 incoming toll lines to the provinces and for 500 outgoing and 600 incoming junctions to the London local exchanges has been installed. At the date of opening some 300 outgoing and 230 incoming toll lines and 347 outgoing and 221 incoming junctions will be connected, and in arranging the disposition of the toll lines at the switchboard allowance has been made for the connection of new lines, which will become available when the new cables are ready.

Special arrangements to assist the operating staff in "routing" the various calls have been made, and devices provided to reduce the operating time on the calls.

The success of the London toll service will depend not only on the staff of the telephone service, but also on the co-opera-

tion of the public. Before applying for calls to places outside the London local area subscribers should ascertain whether "Trunks" or "Toll" should be asked for. This may easily be done by consulting the list of exchanges in the toll area, which will be set out in circulars and the telephone directory.

THE ELECTRIFICATION OF RAILWAYS.

FINAL REPORT OF THE ADVISORY COMMITTEE.

LAST October an interim report was issued by the Electrification of Railways Advisory Committee appointed by the Minister of Transport (ELEC. REV., October 8th, 1920).

The Committee has now issued its final report, dated June 30th, 1921, in which it confirms the recommendations of the interim report, and supplements them. With regard to contact rail collection of current, the Committee points out that the conductor rails must be so arranged that the same trains shall be able to run on railways employing a 1,500-volt supply and on those using 600 or 750 volts. The top-contact rail is generally used for the lower voltages, but the under-contact rail is also in use, and possesses advantages with regard to interference by the accumulation of ice and snow, and also with regard to the protection of men working on the track. Suitably designed shoes can be run interchangeably with either the top or under-contact type of rail. The Committee does not recommend the exclusive use of either type, leaving the door open to improvement in the design of either or both.

The Committee considers that a standard position outside the tracks should be defined within certain limits for the contact surface of the contact rails in relation to the position and level of the running rails, and recommends that in respect of new electrically-operated lines and extensions to existing lines the following regulations should be issued for securing interchangeability of running:—

- (1) The contact surface shall be in the horizontal plane.
- (2) The gauge measured between the centre of the horizontal contact surface of contact rails and the gauge line of the nearest rail of the corresponding track shall be 1 ft. 4 in.
- (3) The vertical height of the contact surfaces above the plane of the top table of the running rails shall be:—

(a) for top-contact rails	3 in.
(b) for under-contact rails	1½ in.
- (4) The vertical height of the contact rail (including, where required, the protection over the top of the rail) above the plane of the top table of the running rails shall be such as to provide the necessary clearance from the load gauges from time to time in use.
- (5) The under-contact rail, where employed, shall provide for the engagement of the contact shoe being made from the side nearest to the running rails.
- (6) Above the level of the under-contact surface (3) (b) no part of the contact rail construction shall be at a less distance than 1 ft. 1½ in. from the gauge line of the nearest track rail, and below the level of the under-contact surface (3) (b) at a less distance than 1 ft. 7½ in. from the gauge line of the nearest track rail.
- (7) The vertical distance between the under side of any contact shoe in the free position and the plane of the top table of the running rails shall not be less than 1½ in.

Existing equipments which do not conform to the above may be continued in use and may, subject to the approval of the Minister, be extended.

Similarly with regard to overhead collection, the following recommendations in respect of new lines and new electrical equipment of existing lines are made:—

(1) The standard clearances, after allowance has been made for curvature and super-elevation, including any movements of the live wire or conductors and lateral movements of the collectors, under any circumstances likely to arise, shall be:—

- (a) Between the underside of any overhead live wire or conductor and the maximum load gauge likely to be used on the line:—
 - (i) In the open, 3 ft.
 - (ii) Through tunnels and under bridges, 10 in.
- (b) Between any part of the structures and the nearest point of any live overhead wire or conductor, 6 in.
- (c) Between rail level and overhead conductors:—
 - (i) At accommodation and public road level crossings, 18 ft.
 - (ii) At places where there is a likelihood of men in the conduct of their duties having to stand on the top of engines or vehicles, 20 ft.
- (d) Between any part of the collector gear and any structure, 3 in.

In the case of the electrical equipment of existing lines the dimensions stated in (a) (ii) and (b) may each be reduced to 4 in. as a minimum; cases of exceptional constructional difficulty may be considered by the Minister as special cases, and existing equipments which do not conform to the above may be continued in use.

(2) The horizontal distance of the contact wire from the plane through the centre line of the track and perpendicular to the surface of the track rails shall be within the following limits:—

- (a) At a height of 18 ft. above rail level, 1 ft. 3 in.

(b) At a height of 4 in. above the maximum load gauge likely to be used on the line, 1 ft. 9 in.

(3) The weight and construction of the contact wire and supports shall be suitable for the passage of collectors exerting an upward pressure of from 25 to 40 lb.

(4) The width of the renewable contact surfaces of the collectors at right angles to the track shall not be less than 4 ft. and the extreme width over the horns of the collectors shall not exceed 7 ft. 6 in.

In the case of those railways that have already equipped any or all of their lines with overhead contact wires which do not conform to the above recommendations, the employment of these may be continued in use and may, subject to the approval of the Minister, be extended.

Having regard to the practicability of further standardisation of equipment by regulations, the Committee confirms the views expressed in the interim report to the effect "that such regulations should put no avoidable difficulties in the way of the adoption in future, with the approval of the Minister, of any improvements in methods or appliances which may from time to time become available with increasing knowledge and experience," and does not consider it desirable, in the interests of railway electrification, that further regulations (other than those recommended in this report) should be issued for the time being.

In October, 1920, the terms of reference were extended to cover the questions (1) whether any regulations should be made to limit the drop of potential in an uninsulated return conductor on electrically-operated railways; and (2) if any such limits are desirable, what limits these should impose, and under what conditions. On these points the Committee says:—

(1) The evidence given by the railway companies operating electric railways indicates that the cases of harmful effects due to a drop in potential substantially in excess of that allowed by Tramways Acts in earthed railway conductors have been few and unimportant, and readily corrected by the railway companies themselves on their own initiative.

(2) The clauses for the protection of observatories inserted in the Acts of railway companies applying for powers to operate their railways electrically have had, and continue to have, a retarding effect on railway electrification. The committee having heard in evidence officers concerned with the observatory instruments likely to be affected by the operation of electric railways, is of the opinion that the interests of

observatories would in any case be sufficiently protected if the scope of the clauses referred to were limited to the portions of electric railways within the vicinity of the observatories.

(3) Some railways, by virtue of the wording of their Acts, are under no necessity to apply for new powers for electrifying their systems, and are therefore not placed under the disadvantage with respect to limitation in the drop of potential by their Acts as in the case of the other companies.

Having regard to these considerations and to the views expressed in the interim report, as well as to the difficulties in imposing any definite limit to the voltage drop owing to the variety of conditions which present themselves along different portions of any railways, the Committee recommends that:—

(1) It is not desirable that regulations should be issued to limit the drop of potential in an uninsulated return conductor on electrically-operated railways.

(2) In cases where it is found impossible to dispense altogether with the present obligations which are imposed upon railway companies by the protective clauses inserted by the Board of Trade and other authorities into the Acts of the companies, these obligations should be specified definitely in each particular case.

The various recommendations are thus summarised:—

Standard System of Power Generation.—Three-phase alternating current.

Standard System of Power Distribution.—Direct current.

Standard Pressure.—1,500 volts at sub-station bus-bars; in special cases a multiple or sub-multiple of 1,500 volts, if approved by the Minister.

Standard Collection.—Contact rail and/or overhead contact wire.

Contact Rail Standards.—Top-contact or under-contact rail, with the contact surface in a horizontal plane installed at a gauge of 1 ft. 4 in. from the gauge line of the nearest track rail.

Overhead Contact Wire Standards.—Installed normally over the centre of the track at a height of 3 ft. above the maximum load gauge likely to be used on the line, and at a maximum height of 20 ft. above track rail level.

Limitation of drop in Earthed Return Conductors.—No regulations to be issued.

Diagrams showing the suggested positions of contact rails and wires are appended to the report.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Féry Cell.

The self-depolarising cell invented by M. Ch. Féry, which has been previously described in this column, has been considerably improved. In a note presented to the Académie des Sciences, and reproduced in *La Revue Générale de l'Électricité*, the author points out that the oxygen of the air enters into solution at the surface of the liquid, but in ordinary Leclanché cells the zinc rod extends to the surface, and being oxidised, it combines with the dissolved oxygen and robs the solution of the depolarising gas, besides itself suffering local corrosion. Hence he places the zinc at the bottom of the cell in the form of a flat plate. The carbon, on the other hand, must be close to the zinc to reduce the internal resistance of the cell, and must also reach the surface of the solution, where

and is bathed with an oxygenised liquid above, becomes in effect a short-circuited gas cell; by dividing the carbon it has been demonstrated that a current actually flows between the two ends of the carbon, and thus depolarises the element.

It is claimed that the cell possesses great constancy, high efficiency (there being no local action), and freedom from "creeping," and as no manganese dioxide is required, it is cheaper than the Leclanché type, whilst it has a much longer life.

A Heating Stove for Soldering Irons.

As an alternative to the electric soldering iron, which does not suit every operator, the ELECTRIC HEATING CO., George Street, Croydon, has designed an electrically-heated stove for heating ordinary soldering irons (fig. 2). The company asserts that the usual type of soldering-iron stove is inefficient, owing to the fact that a large proportion of the heat has to pass across a considerable air gap before it reaches the iron, with

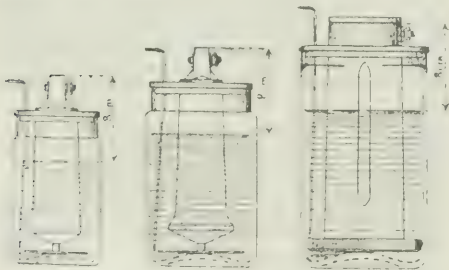


FIG. 1.—THREE TYPES OF FÉRY CELL.

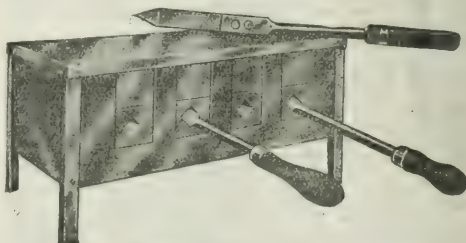


FIG. 2.—A HEATING STOVE FOR SOLDERING IRONS.

the depolarising oxygen is found; hence the carbon takes the shape of a vertical cylinder, prism, or tube, as shown in fig. 1. When the cell is in operation, chloride of zinc is formed and remains at the bottom of the cell. The ammonium ions form with water ammonia, and hydrogen is liberated on the lower part of the carbon. When the cell is again on open circuit, the carbon element which is covered with hydrogen below

a consequent waste of heat and loss of time. The chief object of the new stove is to overcome this defect. It is so constructed that the heat is transmitted to the iron direct through a pair of V-shaped jaws closed at the rear, one of which is movable so as to provide an expandable heating chamber which can be varied in size to suit irons of different sizes, the arrangement being such that, no matter what size iron is to be

heated, the jaws will open and make direct surface contact immediately. The channels in the jaws can be made any shape to suit any iron, so as to ensure the maximum area of contact. The stove is made to take any number of irons at one time and each pair of jaws is lagged with heat-resisting material. The connections inside the back of the stove are made of corrugated strip nickel, so as to permit of easy movement of the jaws without damage to the connections.

One of these stoves is shown on stand No. L210 at the Shipping, Engineering, and Machinery Exhibition at Olympia.

The Foot-Candle Meter.

For economic and other reasons it is not possible to use electric light *ad libitum*, and it is therefore necessary to see that, while there is no waste, there is sufficient illumination for easy and accurate vision. A simple, convenient, and scientifically accurate means of measurement is afforded by the foot-candle meter, by the use of which the amount of light at any point on any surface can be measured quickly and easily. On the front of the instrument there is a screen consisting of a sheet of glass and two thicknesses of paper, one of which is perforated with round holes. This screen is illuminated from within by a small electric lamp fixed at the right-hand end. When the lamp is lighted the round spots to the right naturally appear brighter, and those to the left darker than the surrounding parts of the screen. The hole which is neither lighter nor darker than the surrounding screen, indicates the intensity in foot-candles of the external illumination on the face of the instrument.

The general view of the foot-candle meter (fig. 3) shows the graduated scale at the top, the voltmeter (bottom left), and the rheostat switch (bottom right). The locking pin in the switch handle prevents the lamp from being accidentally switched on, and also prevents the instrument from being put in the case when the switch is on. The total weight with the case is 4 lb., and the outside dimensions of the instrument are 7½ in. x 6 in. x 1½ in.

The dry battery supplying current to the lamp should be changed when difficulty is experienced in setting the volt-

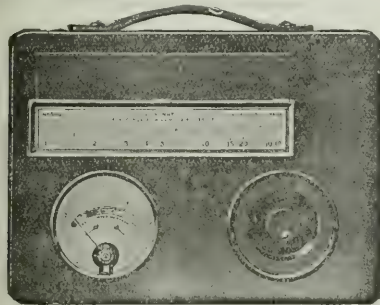


FIG. 3.—THE FOOT-CANDLE METER.

meter pointer to the arrow mark; any battery of the same size and type may be used as a replacement. The rheostat consists of a resistance in series with the switch, and by turning the switch handle until the voltmeter pointer is over the arrow mark on the dial, the resistance is so adjusted as to ensure correct voltage at the lamp. To use the instrument is simplicity itself; the meter is simply placed on the table, bench, counter, or wherever the illumination measurement is to be taken. After raising the hinged cover of the screen, the locking pin in the switch handle is lifted, and the handle turned to the right until the pointer of the dial on the left comes to rest at the arrow. A look at the screen will then enable the user to determine easily which of the round spots matches the background; the figure at the selected round spot gives the foot-candles. Thus the intensity of light may be measured as readily and accurately as a thermometer measures temperature.

The meter shows exactly what amount of useful illumination there is at the point where light is wanted; it does not measure the power of the lamp or the efficiency of the reflector—except by implication—but simply the final result. It enables the ordinary man to measure his lighting and say definitely whether more or less is needed, and provides that exact knowledge which is the first and most important step in the direction of true lighting efficiency. The meters are obtainable from the BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, E.C.4.

REVIEWS.

Electrical Engineering. By T. F. WALL, D.Sc. Pp. x+491; 463 figs. London: Methuen & Co., Ltd. Price 21s. net.

The exact delimitation of the boundary line between textbooks on theoretical electricity and magnetism and on electrical engineering is a matter upon which there may be wide divergence of opinion; the compromises suggested by such terms as applied electricity, technical electricity, and electro-technics are a tacit admission of the difficulty. But it is not often that we find a book affecting so practical a title as "Electrical Engineering" devoted almost entirely to theoretical principles. Dr. Wall has certainly been unfortunate in his choice of a title for his book, for, while the fundamental principles of electricity, magnetism, and electromagnetic phenomena have been given clear and exhaustive treatment, the application of these principles to the generation, transmission, and utilisation of electric power, which is what one commonly understands by electrical engineering, has received but a very small share of the author's attention. We say this at the outset in no spirit of carping criticism, but rather in fulfilment of what we conceive to be one of the essential functions of a review, namely, to enlighten prospective readers as to the exact scope of the book.

In his preface the author summarises the fundamental experimental facts of the science of electrical engineering as follows:—

1. Coulomb's inverse square laws for electric charges and magnetic poles.
2. Faraday's law of electromagnetic induction.
3. Ohm's law of electric resistance.
4. Faraday's laws of electrolysis.
5. Ampere's laws of the equivalence of electric currents and magnetic shells.
6. Joule's law of the heat energy of the electric current.

Special emphasis has been placed on the importance of these laws; the book is, therefore, based upon very sound and orthodox foundations, and the care which has very obviously been bestowed on the explanation of first principles goes far to ensure that their application shall result in an equally satisfactory superstructure. But, to pursue the simile, in laying such sure foundations, the author appears to have utilised all his available building material.

We may illustrate our meaning by reference to section 1 which deals with static electricity. Dr. Wall mentions the fact that this subject usually finds but cursory treatment in electrical engineering books, and that the static electricity as dealt with in text books of physics is hardly as convincing to the electrical engineering student as it might be. With all of this we are in hearty agreement, and we turn to the chapter on this subject with considerable anticipation. We find, however, that after a discourse of 98 pages quite as theoretical, and in no wise more convincing, than the familiar "elements" of J. J. Thomson we arrive at a description of the Dolezalek electrometer. The electrostatic voltmeter, one of the most valuable applications of electrostatics to engineering goes unmentioned, and out of these 98 pages only the eight or ten devoted to cable dielectrics can be regarded as being in any way covered by the term "electrical engineering."

While the earlier portions of the section on magnetism suffer from the same academic style, the chapter on magnetic force and the magnetic properties of iron and steel is of a much more practical character. Even here, however, the tendency remains, and instead of following up a paragraph on "the pull between two magnetised iron surfaces" by the obvious practical application in Thompson's permeameter the author passes on to deal with the "change in direction of magnetic lines of induction when passing from one medium to another"—a no doubt very interesting, but far less practical matter.

The section on direct current electricity opens with a chapter on first principles in which the treatment is straightforward and elementary. The chapters on electric resistance, electrolysis, and thermo-electricity are excellent. In the first there are some useful tables of electrical constants and also a paragraph on the graphical determination of pressure drop in cables; in the second accumulators are treated in a brief but satisfactory manner; while in the chapter on thermo-electricity brief mention is made of pyrometers and the thermogalvanometer. In every case the author makes much of the underlying principles, and introduces these technical applications by way of illustrating the principles rather than allowing a brief statement of the fundamental laws to preface a thorough-going account of their applications to electrical engineering practice.

Electromagnetism is dealt with under three headings: Magnetic effects of electric currents, electromagnetic induction, and electrical measuring instruments. In the first of these chapters the usual theorems are demonstrated, and considerable stress is laid upon the magnetic shell method of making investigations on the magnetic effect of currents. The magnetic circuit is also dealt with very sensibly at this point. Starting with Faraday's experiments and Lenz's law, the chapter on electromagnetic induction treats very thoroughly of the dynamo and motor and of self and mutual induction, while in the last chapter of this section galvanometers, the fluxmeter, oscillograph, wattmeters, ammeters, voltmeters, and frequency meters are discussed. The absence of any

Metal Working in Germany.—It is stated that arrangements are being concluded between the A.E.G. and the Hirsch Copper and Brass Works Co., relating to the working of metals in so far as works or departments of the two companies are affected in manufacturing and sales.

reference to Irwin's oscillograph and the scanty paragraph on hot-wire instruments rather spoil a chapter which is in many respects admirable.

The chapters on alternating currents are much less conventional than those in the other sections of the book. The treatment of simple a.c. circuits naturally follows along well-worn paths; this is followed by a very complete account of single-, two-, and three-phase a.c. systems. In this chapter numerical examples are frequently worked out in illustration of the text, and a much more practical atmosphere pervades this part of the book than is evident in the earlier sections. It is true that the doctor draws his academic robe about him again when he proceeds to deal with harmonic analysis and the use of complex quantities (both, by the way, delightful little studies in mathematical physics), but he gets back to essentially practical things again in the chapters on magnetic fields due to a.c. currents and transients.

A very careful reading of Dr. Wall's attempt "to meet the demand for a complete survey in one volume of the principles of electrical engineering" convinces us that to cover all the ground that may be regarded as fundamental from the first experiments with glass rods and pith balls to the investigation of a.c. circuits by means of complex quantities in one volume necessitates so academic a type of treatment with consequent lack of the practical atmosphere as to render it of doubtful utility. The powder of "principles" and "theory" is so thinly covered with the jam of practical application in Mr. Wall's book that he was unwise to give it so tempting a label as "electrical engineering."—P.H.S.K.

Heating Systems: Design of Hot-water and Steam-heating Apparatus. By F. W. RAYNES. Pp. 324; 158 figs. London: Longmans, Green & Co. Price 21s. net.

The author of this work is the head of the Department of Heating and Ventilating at the Royal Technical College, Glasgow, and his treatment of the subject is very thorough. The in-

troductory chapter gives a survey of many systems of ventilation and heating, and the only two references to electric heating occur here. The author seems to be very favourable towards it, but objects to the cost. He thinks more might be done to lower the price of electricity for heating, especially in places where the period of minimum load coincides with the time that heating is required. This, of course, is by no means an isolated opinion.

A great deal of attention is paid to systems of piping for hot water circulation, and methods of ascertaining velocities are explained in minute detail. Many types of valves and joints are illustrated and commented upon. Chapters are devoted to hot-water gravity apparatus, small-bore gravity apparatus, accelerated circulating systems, and forced hot-water circulation. Steam heating occupies a much greater part of the volume, and it is probably the section most likely to appeal to central station engineers. The systems dealt with are classed under various heads. The first part deals with the use of steam at low pressures, then the expansion of pipes and the methods by which this is provided for are given a chapter. Atmospheric systems of steam heating follow, and the use of exhaust steam for heating purposes is discussed. The author reviews the arguments for and against this method as compared with steam taken direct from boilers, and is of the opinion that a great deal depends upon the distance the steam has to be conveyed. The heat value of exhaust steam is worked into formulae in which a large number of factors are taken into account. Electrically-driven pumps are recommended for use, under certain circumstances, in the return of condensate to the boilers. Vacuum and "vacuo-vapour" in the systems of steam heating are given two chapters. In the remainder of the work the subjects treated upon include heating surfaces, heat losses from buildings, boilers, and the temperature control of buildings.

An appendix contains 22 tables, which give information on properties of metals, properties of steam, hydraulic memoranda, pipes and flanges, and many other subjects. A fairly full index is included, as well as lists of plates, tables, charts, and formulae.

BUSINESS NOTES.

Bankruptcy Proceedings.—M. WATKINSON, H. WATKINSON and A. WATKINSON (Watt & Co.), electrical and mechanical engineers, Sheffield.—Receiving order made September 8th, on debtors' own petition.

F. BARRACLOUGH, electrical and mechanical engineer, late of Eastcliffe, Lightcliffe, Halifax.—First meeting, September 22nd, at the Official Receiver's Office, Byrom Street, Manchester. Public examination, October 12th, at the Court House, Salford.

C. F. M. DOWNIE (P. Downie), electrical engineer and factor, Southend-on-Sea.—Application for discharge to be heard at Shire Hall, Chelmsford, October 17th.

B. E. THOMAS, electrical engineer, 12, Castle Meadow, Norwich.—First and final dividend of 1s. 3d. in the £, payable September 17th at the Official Receiver's Office, 8, Upper King Street, Norwich.

Catalogues and Lists.—THE FALKIRK IRON CO., LTD., Falkirk, N.B.—An illustrated leaflet (No. 264), giving a specification, prices, and details of the "Falco" electric cooker.

MESSRS. L. G. HAWKINS & CO., 116, Charing Cross Road, W.C.2.—An illustrated folder advertising "Universal" electric grills and other appliances.

X-RAYS, LTD., 11, Torrington Place, Gower Street, W.C.1.—A folder giving particulars of X-ray photographic films and a leaflet announcing reductions in the prices of plates and films.

MESSRS. COWLISSAW WALKER & CO. (1920), LTD., 14-16, Cockspur Street, S.W.1.—Two booklets and a leaflet dealing with "Out-Put" bar and chain coil cutters and their advantages.

THE ISIS ELECTRICAL CO., 57, Albert Road, Aston, Birmingham.—A price list of stage arc lamps and accessories.

MESSRS. R. B. HODGSON & CO. (SHEFFIELD), LTD., Sentinel Steel Works, Sheffield.—Catalogue S, giving exhaustive particulars of the properties and applications of "Pinnacle" steels.

EBONESTOS INSULATORS, LTD., Excelsior Works, Rollins Street, Canterbury Road, S.E.15.—A circular letter giving prices of various sizes of "Ebonestos" conduit tube ends.

AUTOMATIC & ELECTRIC FURNACES, LTD., 281-283, Gray's Inn Road, W.C.1.—A well-illustrated publication dealing with various aspects of "Wild-Barfield" electric furnaces for the automatic hardening of carbon steel. Also "Heat Treatment Bulletin," No. 29, "The Perfect Hardening of Carbon Steel."

MR. CHARLES SELZ, 83, George Street, Portman Square, W.1.—A booklet illustrating, in colour and black and white, a variety of silk shades; also three leaflets upon the same subject.

MESSRS. CHARLES CHURCHILL & CO., LTD., 9-15, Leonard Street, Finsbury, E.C.2.—Publication C.P.L. 4, an illustrated list giving full particulars of "Carson" precision lathes with accessories—foot-power treadles, three-speed countershafts, &c.

MESSRS. RAYNER & HEALD, LTD., Duke Street, Derby.—Stock list of 2- and 3-phase induction motors.

DAYSONS, LTD., P. & O. House, 14-16, Cockspur Street, S.W.1.—Bulletins Nos. 5, 6, and 7, dealing with patent regulators and arc welders for a.c. circuits; illustrated.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—An illustrated sheet dealing with "Triple-Purpose" illuminated signs.

MESSRS. C. A. PARSONS & CO., LTD., Heaton Works, Newcastle-on-Tyne.—Pamphlet No. 11 S.T., giving very full details and illustrations of end-tightened reaction blading.

MR. O. N. BECK, 11, Queen Victoria Street, E.C.4.—An illustrated leaflet describing the "Paragon" boiler-tube loosener.

ENTERPRISE MANUFACTURING CO., LTD., Gun Street Electrical Works, Bishopsgate, E.1.—A price sheet of ironclad switchgear, motors, starters, cables, &c.

MESSRS. GUY CHANTRILL & CO., 6, Norfolk Street, Strand, W.C.2.—List No. 52, an illustrated price-list of transformers of from 3 to 2,000 kVA; also blotters advertising "Viking" motors and transformers.

Catalogues Wanted.—The Hull Electrical Construction Co., electrical and mechanical engineers, Williamson Street, Hull, would be pleased to receive catalogues of electrical goods, particularly heating, welding, and X-ray apparatus.

Investment Companies in Germany.—The directors of the Electric Light & Power Investments Co., of Berlin, and of the Electricity Investments Co. have entered into an agreement under which the entire business management of the latter will be carried on for the account of the former as from the beginning of the current financial year, and shareholders in each company will receive the same rate of interest. An interchange of shares is also to be undertaken, and the Light and Power Co. will increase its share capital by 10,000,000 marks to 70,000,000 marks, and at the same time issue 5 per cent. debentures for 30,000,000 marks. A second company is to be similarly absorbed by the Light & Power Co.

The Stand Against German Dumping.—The shareholders in the Rheydt Electrotechnical Works of Max Schorch & Co., of Rheydt, have just authorised an increase in the share capital from 10,500,000 to 15,000,000 marks, and at the same time decided to relinquish their preferential right of subscription in favour of new interests which are taking over the shares at the price of 190 per cent., and also paying the cost of the issue. In return, these interests have undertaken to supply the company with orders. The directors in explanation of this procedure stated that otherwise it was very difficult for the electrical industry to obtain sufficient orders, as the export trade was almost entirely in a state of stagnation owing to the high import duties imposed both by former hostile nations and by neutral countries.

International Electrical Exhibition at Amsterdam.—It has been decided to hold an international electrical exhibition in the Paleis voor Volklijft, Amsterdam, for one month, extending from November 25th to December 26th. The exhibition is being organised by the Amsterdam branch of the Netherlands Association of Electrotechnical Employers in order chiefly to gain a great advertisement for the many applications of electricity so as to assist in bringing the electrical industry out of its present state of depression. Although organised purely by private interests, and without application to the Government or local authorities for subsidies, the exhibition has secured the honorary patronage of the Ministers for Home Affairs, Public Works and Education, the Mayor of Amsterdam, &c. The members of the Honorary Committee include the names of the directors of large electricity works, a representative of the State railway board of supervision, the chief engineering director of State telegraphy, &c. According to a Dutch contemporary, the administration of the exhibition is composed as follows and in the order stated:—M. Vorstman, director of the A.E.G.'s head office for Holland (president); J. C. Mollerus, administrator of the Netherlands Association of Electrotechnical Employers (secretary); W. Haaxmann, director of the N.V. Electrotechnical Bureau, late W. Haaxman & Co.; J. Dias Santilhaus and J. W. Borkus. It is further stated that Dr. v. Roosegaarde Bisschop, of London, is bestirring himself to secure the representation of English firms at the exhibition, while many inquiries are said to have already been received from other countries.

Book Notices.—"Lighting in Factories and Workshops."—Welfare pamphlet No. 7, issued by the Home Office. London: H.M. Stationery Office. Price 4d. net.

The Benjamin Electric, Ltd., of Brantwood Works, Tariff Road, Tottenham, N. 17, informs us that it will be pleased to forward a copy of the above pamphlet free by post to any interested reader.

"Robertson's Universal Method for Export and Import Trade," for computing and converting all the commercial trade quotations and exchanges of the world direct from the currency, and the weights and measures of one country, to those of another in one simple sum. Scott, Armstrong & Co., 79, Coleman Street, E.C. Price 2s. 6d. net.

Science Abstracts (A & B), Vol. XXIV, part 8, August 31st, 1921.—London: E. & F. N. Spon, Ltd. Price 2s. 6d. each.

Circular of the Bureau of Standards, No. 112, Telephone Service.—Washington: Government Printing Office. Price 65 cents.

"The Metropolitan-Vickers Gazette," Vol. VI, No. 101, August, 1921. Price 1s., post free.—Among the many interesting articles in this issue are, "Electrolytic Lightning Arresters," by W. A. Coates, M.I.E.E., and "High Efficiency Steam Turbines."

"Aggregation and Flow of Solids," by Sir G. Beilby, F.R.S., pp. xvi+256; 106 figs. London: Macmillan & Co., Ltd. Price 20s. net.

"High Frequency Apparatus," by T. S. Curtis. Pp. 14+270; 160 figs.—London: Page & Co. Price 9s.

"Radio Review," Vol. II, No. 9, September, 1921.—Wireless Press, Ltd. Price 5s. net.

"Proceedings of the Physical Society of London," Vol. XXIII, Part 5, August 15th, 1921.—London: Fleetway Press, Ltd. Price 6s. net.

Excess Profits Duty.—The Montevideo Telephone Co., Ltd., having made application to the Commissioners of Inland Revenue for an increase of statutory percentage as regards the business of supplying telephone service throughout the Republic of Uruguay, the Board of Referees has ordered that the statutory percentage shall be increased:—

1. In the case of any trade or business carried on or owned by a company or other body corporate to $\frac{7}{10}$ per cent.

2. In the case of any other trade or business to $\frac{7}{10}$ per cent. plus 2 per cent.; except that for the purposes of sub-section (2) of section forty-one of the principal Act the statutory percentage shall be $\frac{7}{10}$ per cent. plus 1 per cent; with the addition, for the purposes of sub-section (1) of section 41 of, and paragraph 4 of part II of the Fourth Schedule to, the principal Act, of 3 per cent. for accounting periods ending after the 31st day of December, 1916, and before the 1st day of January, 1920, and of 5 per cent. for accounting periods ending after the 31st day of December, 1919.

For Sale.—By direction of the Disposal Board, the following sales by auction of machinery, electrical and other plant, will take place: September 26th and following days, at the R.E. Stores, Abbey Mills, Cady Road, Canning Town, conducted by Messrs. Bradshaw, Brown & Co.; on October 6th and 7th, at 46, Commercial Road, Portsmouth, by Messrs. King & King; on October 12th and 13th, at Holbrook Lane, Coventry, by Mr. C. E. Odell; on September 20th, at the Grilo-Oleum Works, Greenwich, by Messrs. Fuller, Horsey, Sons & Cassell; on October 5th and following day at Antree, near Liverpool, by Messrs. Abram & Mitchell; and on October 6th, at Templeborough Stores, Tinsley, Sheffield, by Messrs. Eadon & Lockwood. (See our advertisement pages.)

On September 21st, at 119-121, Newington Causeway, Assets Auctions Co., Ltd., will sell the remaining stock of an electrical goods factor. (See our advertisement pages.)

Official Provincial Tour of H.M. Senior Trade Commissioner in South Africa.—Mr. W. G. Wickham, His Majesty's Senior Trade Commissioner in South Africa, is engaged on an official tour of this country for the purpose of discussing with firms the possibilities and conditions of United Kingdom trade with the Union of South Africa. The first part of his tour includes the following towns:—Leicester, on September 19th to 21st, Nottingham on September 22nd to 23rd, Sheffield on 28th to 30th, Leeds on October 3rd to 5th, Bradford on October 6th to 11th. Firms in these centres desiring to interview Mr. Wickham should communicate immediately with the Secretary of their local Chamber of Commerce. Arrangements to visit other industrial centres will be made and notified in due course.

A "Mazda" Window Display.—We have received from the British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C. 4, particulars of a "window display" which they offer on loan to a limited number of contractors and dealers. The accompanying illustration indicates the nature



of the exhibit, which includes a variety of items capable of arrangement in many different ways; the display can be installed in a few minutes, and the window need not be cleared for its reception. The colour scheme has been carefully chosen, with Wedgewood blue and orange chrome predominating, and the design is calculated to arrest the attention of those who pass by the window. The displays are lent for a fortnight to dealers who stock Mazda lamps.

New Krupp Group.—Westphalian newspapers, says the Berlin correspondent of the Exchange Telegraph Co., report that the new trust formed by Krupp's, the General Electricity Co., the Rhenish Metal Works and the Wolf Co., has further big plans, which include the absorption of four new coal and engineering concerns, thus making the trust equal in magnitude to the Stinnes' electro-mining concern.

After the war the Rhenish Co. had less success than Krupp's in adapting itself to peace production, with the exception of the locomotive branch, in which it again became a competitor of Krupp's. It now employs 17,000 men. The General Electricity Co. is also producing steam as well as electrical locomotives, and it recently acquired an interest in the Linke-Hofmann Works, of Breslau, one of the greatest of German locomotive concerns. More than half of Germany's locomotive production is concentrated in the new Krupp group.—*Financier.*

Lead.—In their report, dated September 10th, Messrs. James Forster & Co. state:—Board of Trade returns for August are as follows:—Imports, 10,845 tons; exports, 1,982 tons; leaving for home consumption, 8,863 tons. In addition to this, stocks in public warehouses have decreased by 871 tons to 11,515 tons, which would suggest a total home consumption of 9,734 tons on the month. Now that the considerable arrivals of lead at the end of last month and the first few days of this have been disposed of, there is again a periodical shortage of prompt lead, and premiums are being offered for immediate delivery. This position should be only temporary, however, sufficient supplies arriving in the near future to fill all present requirements.

A Floating Exhibition.—According to present plans a specially designed Exhibition Ship under the title of "British Industries" is to sail from the Thames in the summer of 1922, for the four ports of the world. She will proceed to South America, South Africa, Australia, New Zealand, and Hong Kong, via Japan, returning by the Straits Settlements, India, and the Mediterranean. During a voyage of 18 months' duration, a succession of about 100 places will be covered, and 34 important trade centres visited. The time table allows for a stay of from a week to a fortnight at each place, showing a total of 346 days during which the Exhibition will be open.

This British Trade Ship will be specially constructed for the purposes of an exhibition, and every detail of her equipment, from the engines to the fittings and furniture, will itself be an exhibit of British workmanship at its best. She will be as large as a first-class liner, having a gross tonnage of 20,000 tons, and in her internal arrangements will differ from any ship that has ever been floated. There will be eight decks, four of which will be devoted to the exhibition proper. On the other decks, besides the numerous cabins set apart for the trade representatives who will undertake the journey, there will be a large reception hall, offices, an inquiry bureau, a bank, an insurance office, interpreters' offices, telephone exchange, writing rooms, cloak rooms, and a restaurant capable of seating and dining 500 persons. A reception and ball room with domed roof extends nearly the whole length of the boat deck. A cinema, which can be used for exhibition purpose, and for showing processes of manufacture, is installed at one end. At the after end is a verandah café. On the shelter, bridge, and promenade decks are committee and private reception rooms, a spacious library, writing room, and smoking room.

The ship is to be specially built to the order of a company styled the British Trade Ship, Ltd., with registered offices at 12, Grosvenor Gardens, S.W. 1. The venture is likely to be of great benefit to the export trade of the British Empire, and should make a strong appeal to our merchants and manufacturers.

Swedish Telephone Business Abroad.—Speaking at the special meeting held in Stockholm recently of the shareholders in the Allmänna Industri Aktiebolag H.T. Cederberg, when it was decided to amalgamate with the L.M. Ericsson Co., Mr. Winerantz, one of the directors, is reported to have stated that the agreement with the Polish Government had been approved by the latter in principle, and there was great probability of good results being achieved. As to the orders expected from Spain, the director mentioned that the company's representative in that country had reported that the exchange in Barcelona would be ready for conversion to the automatic system in December, and the telephone directors intended to entrust the work to the Swedish company. Concerning the English company, the director stated that it earned profits amounting to £13,000 in the whole of last year, whereas the profits realised by the company in the first half of 1921 reached £49,000. The Mexican subsidiary possessed very favourable prospects on account of the increase in the subscription rates. At present the Stockholm company had orders on hand for 13,000,000 kr., and the turnover for the year was expected to be 18,000,000 kr., or the largest figures yet attained in any single year.

Our Foreign Trade.—August figures. The following were the values of imports and exports of electrical goods and machinery during August, 1921.

	August, 1921.	Inc. or dec. 8 months, 1921.
	£	£
Imports.		
Electrical goods, &c.	91,972	+55,872
Machinery	676,199	+1,111,812
Exports.		
Electrical goods, &c.	675,920	+2,665,810
Machinery	1,152,705	+15,746,125
Re-exports.		
Electrical goods	11,825	+863
Machinery	185,527	+17,687

Swiss Imports.—The Expert Commission for the restriction of imports has resolved to recommend the Federal Council to impose limitations on a further number of articles, including electrical apparatus.

The Entz Electric Transmission.—In our issue of December 26th, 1919, we published a description by Mr. F. H. Hutton of the Entz electric transmission system used in the Owen magnetic car. We now learn that arrangements have been made to produce in this country two models of cars, one of which is known as the "Magnetic" car, they will consist of a four-cylinder 15.9-h.p. and an eight-cylinder in-line model of 30/50 h.p., the bore and stroke in each case being 100 mm. The type of the specification are single-sleeve valves, Zenith carburettor, and M-L magneto, while in addition to two mechanical brakes on the back wheels, a two-speed electrical brake is incorporated with the transmission. The cars are being made by the Magnetic Car Co., under licence from the Magnetic Transmission Co., which owns the British patent rights for the Entz system. The new cars will be entirely of British construction. It is said that they will be ready for exhibition at the forthcoming Olympia Show.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries:—

Eureka. No. 414,491. Class 8.—Electric voltmeters and ammeters, fitted electrical switchboards for use on motor vehicles, and for the like purpose, &c.—Joseph Toney and Sons, Ltd., Manor Glass Works, Catherine Street, Aston, Birmingham. April 21st, 1921.

Duplex. No. 416,248. Class 10. Mechanical and electrical clocks. Gent & Co., Faraday Works, St. Saviour's Road East, Leicester. June 8th, 1921.

Reflex. No. 416,249. Class 10. Mechanical and electrical clocks. Gent & Co., Faraday Works, Catherine Street East, Leicester. June 8th, 1921.

Nega. No. 410,500. Class 4. Carbons for electrical purposes.—Eugen Conradt, trading as C. Conradt, 9, Spilertorgasse, Nuremberg, Germany. December 8th, 1920.

Snow. No. 411,936. Class 6. Electrically-operated grinding machines for millstones.—R. G. Haskins Co., 27, South Despatch Street, Chicago, U.S.A. January 25th, 1921.

Dictograph (lettering and design). No. 409,041. Class 8. Telephone instruments and apparatus.—Dictograph Telephones, Ltd., Dictograph House, Denman Street, London, S.E.1. October 23rd, 1920.

Gramag. No. 412,527. Class 6. Permanent magnets, being parts of machines other than agricultural or horticultural machines.—Edward A. Graham, St. Andrew's Works, Crofton Park Road, London, S.E.4. February 15th, 1921.

Clem. No. 414,337. Class 13. Electric filament lamps.—Midget Lamp Co., Ltd., 2, Bothwell Street, London, W.6. April 14th, 1921.

Greenbat. No. 414,226. Class 22. Electric trucks.—W. Goodyear & Sons, Ltd., Churchfield Street, Dudley. April 12th, 1921.

Kaleaner. No. 413,329. Class 50. Impregnated electric insulating tape.—Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C. April 11th, 1921.

Pensor. No. 414,915. Class 13. Incandescent electric lamps (ordinary).—Alfred N. Greening, 15, Clifford's Inn, London, E.C.4., May 5th, 1921.

Fire.—The British and Allied Electrical Agency, Ltd., state that their business is not interfered with by the fire which occurred at their address in Charterhouse Street, E.C., their offices being left untouched.

Electrically-heated incubators.—With reference to the note in our issue of September 2nd, regarding the equipment of incubators and brooders with electric heating devices in America, Messrs. Automatic & Electric Furnaces, Ltd., inform us that for some considerable time they have been equipping these devices in England with heating elements and their Wild-Barfield automatic temperature regulator. With this device they can regulate the temperature to within half a degree either way.

German Export Prices.—The German Foreign (Export) Trade Control Department points out that the recent further depreciation of the mark has led to the conditions that inland prices are frequently lower than the world market prices. This difference naturally is an incentive to increased exports. While larger exports are desirable just now at a time of unfavourable activity, the Department says that sales at prices far lower than world market quotations operate prejudicially on the market situation abroad and on the relation with foreign countries. The proof of this is afforded by the large increases in Customs duties which have been made in the meantime. German exporters must, therefore, it is said, endeavour to follow the fluctuations in prices, and with a falling mark demand higher prices or sell in foreign currency at the outset. As, however, a number of merchant firms, in the effort to take advantage of the present situation for themselves, do not follow this system, electrical manufacturers have expressed a wish for greater protection against these conditions, especially producers of electrical conductors, in which a keen price contest is proceeding between various groups in the home market, and makers of primary batteries. Under the circumstances, it is suggested by makers that works' delivery certificates, which show sale prices and destination of export orders, should be reintroduced, as these would doubtless largely put an end to cheap exports.

Germany's Trade.—The September report of the Prussian Ministry of Trade states that the manufacturing boom is continuing in almost all branches of production, says the *Evening News*. Although home prices continued to rise in August the fall in mark exchange attracted large foreign orders, and home buying was also extremely active. The iron industry has abundant orders for months to come, and the Rhenish-Westphalian iron and steel concerns are refusing to take any further orders for fulfilment this year. The buying public is actuated by the belief that the impending taxes will further raise prices, and is therefore in a hurry to lay in supplies. Home business in the engineering industry is good only in some branches, but export orders are increasing. The improvement in the electrical branches continues, and there is a good demand for motors and installation material, but the cable branch is depressed.

Copper and Lead Prices.—Messrs. F. Smith & Co., and Messrs. James & Shakespear report September 14th: No change in last week's quotations.

Musical Advertising.—After music in education at the B.A. meeting, music in advertising. The St. Helens Cable and Rubber Co., Ltd., has just published, in connection with its band tires, "The Driver's Rosary," four verses set to music. As a new departure in advertising we think it worthy of inclusion in our "Business Notes."

Rumanian Samples Fair.—The Rumanian Legation states that the opening of the Samples Fair and Exhibition at Bukarest, which was to have taken place on September 12th, has been postponed until September 16th.—*Reuter.*

Transmission at a Million Volts.—According to a Reuter dispatch, the American General Electric Co. reports that on September 13th for the first time in history it "generated and transmitted an excess of a million volts pressure by a transformer equipment designed along standard lines with current at 60 cycles per second." "The physical laws applying to the behaviour of high voltages," it continues, "were found to hold good at this enormous pressure. It was found possible to confine and send the current over the wires without prohibitive waste due to leakage into the air. The test has confirmed the belief that it is commercially feasible to use a considerably higher voltage in the transmission of power, and indicates an extent of long-distance transmission beyond the limits hitherto believed to be possible."

Dransfield's Special Voltmeter.—Referring to the note on page 317 of our issue of September 2d, describing "Dransfield's Special Voltmeter," Messrs. Ferranti, Ltd., inform us that they hold the selling rights of this instrument, and send us a copy of their List Ga200, which illustrates and describes the instrument.

LIGHTING AND POWER NOTES.

Australia.—SYDNEY.—The report of Mr. Justice Wade, who was given a Royal Commission to inquire concerning the cost of producing electric light and power within the City of Sydney is available. His Honour states that the City Council claimed that the cost of generating and supplying electricity had increased since 1915 by .6762d. per kWh. Each increase of one one-tenth of a penny per unit means £40,000; consequently, in money terms, the claim, if granted, would provide additional revenue of £240,000. Worked out in pence, representing the cost per unit, the production price in 1915 was 1.1760d., and in 1921 1.8522d.

Figures produced on behalf of the Electric Light Corporation showed substantial increases under the same three heads, and his Honour accepted the first two as fair and reasonable. The first two showed an increase in the six years of 4.104d. per unit.

His Honour therefore declares an increase to the City Council in production cost of five-tenths of a penny per unit, representing an additional charge to the consumer of £200,000; and to the Light Corporation of four-tenths of a penny, representing a further charge on the consumer of £14,648. "The additional revenue," he says, "is sufficient to enable each of these bodies to meet the increased cost of production, also to maintain their undertakings in a sound financial position, and present a surplus finally in excess of what is necessary to meet liberally their present obligations."—*Daily Telegraph.* (Sydney).

Aylesbury.—LOAN.—On September 1st, Col. E. T. Ekin, on behalf of the Electricity Commissioners, held an inquiry into the application of the Town Council for sanction to borrow £27,632 for electricity extensions. The town clerk reviewed the financial position of the undertaking, and stated that the present loan would be spent upon plant of the capacity of 1,500 kW. The present capacity of the works was 1,400 kW, while the connections amounted to 840 kW, with a prospect of an immediate additional 200 kW. Mr. H. P. Bartlett opposed the Council's application; he said that the undertaking was constantly making demands upon the rates, and the prices charged for energy were too low. The Inspector pointed out that postponement was impossible if the plant was to be installed in time to meet the 1923 demand. The result of the inquiry will be made known in due course.

Ashington.—PUBLIC LIGHTING.—The Urban District Council has entered into an agreement with an electric lighting company for the lighting of the district, for a period of ten years, at a cost of £7,040. The scheme provides for 703 lamps which it is considered will meet adequately the requirements of the district.

Birkenhead.—LOAN SANCTIONED.—The Electricity Committee has received the sanction of the Electricity Commissioners to borrow £15,000 for mains and £5,000 for services.

Bishop's Castle.—PRICE INCREASE.—The Town Council has consented to the Electric Light Co. increasing its charge for electricity from 9d. to 1s. per unit, for a period of six months.

Barrow.—FUEL TIME RESUMED.—The Electricity Committee recently reported to the Town Council, that an interview had been given to a deputation from the local branch of the Electrical Trades Union, with reference to the working of short time, and it had been resolved that the working of full time be resumed as from September 11th, in view of the fuller use of electricity by consumers in autumn and winter, and the necessity for efficiency at the works.

Bradford.—PRICE REVISION.—Mr. Thomas Roles, the city electrical engineer, has written us with reference to a number of "alarmist" reports as to the financial position of his department which have recently appeared in the lay Press. The rumours arose out of a recommendation that the charges to power consumers should be revised. Mr. Roles states that a considerable number of these consumers have not yet paid 50 per cent. above the pre-war rates, and, prior to the last increase, not more than 3½ per cent. Long-hour consumers, however, have been called upon to pay 100 per cent. increase or more, and it was accordingly recommended that all consumers, as nearly as possible, should be charged on a basis of 75 per cent. above the 1914 rates. It will thus be seen that no attempt to enforce exorbitant charges is being made, as has been suggested by the newspapers referred to above. The new maximum charge will only be 3½d. per unit. In a statement to the Council, the Chairman of the Electricity Committee admits that a loss was incurred during the coal strike, but the statement that the deficiency amounts to thirty or forty thousand pounds is absurd.

MOTOR-HIRING CHARGES.—The Master Bootmakers' and Repairers' Association is to send a deputation to the Corporation, with a request for a reduction in hiring charges for motors for boot repairing work. It was stated that when the matter was raised early in the year the association was told that the question would receive favourable consideration so soon as the cost of motors and renewal parts came down, and the association contends that the cost of such parts, owing to a reduction of the price of materials and in engineering wages, is now about half what it was at the beginning of the year. In view of an expected increase in charges for power, it is also contended that the matter depends on the cost of motor parts and not on cost of electricity production, and therefore the reduction should be made.

Continental.—FRANCE.—Bouches-du-Rhône, the Department of France in which the town of Marseilles is situated, proposes to undertake in the near future a number of costly public works. His Majesty's Consul-General at Marseilles (Mr. E. Vicars, C.B.E.) has summarised for the information of the Department of Overseas Trade, an account of these works given by the chief engineer of the department.

The first scheme will involve the construction of a small dam on the Durance, from which the water, calculated at an average volume of 150 cu. ft. per second during the six months of high water, although considerably less during the remainder of the year, will be deflected to a power-station at Movrargues, where it is estimated that an average of 32,000 kW will be generated. After leaving this station that water will be carried by a canal to a second one, situated at St. Christophe, also with a capacity of 32,000 kW in normal conditions. The power generated at the Meyrargues station will be utilised for pumping water to the arid plain of the Crau, and for drawing off the salt water from the adjoining Plain of Camargue. The St. Christophe power station will, on the other hand, be used to supply electricity to Marseilles and the Department of the Bouches-du-Rhône for various public services, any surplus available when these needs are satisfied to be placed at the disposal of electric light and power companies. It is estimated that the power generated at these two stations on the Durance will be cheaper than that produced by the private electric companies of the district.

A second scheme projected includes the electrification of the Departmental light railways, and the construction of new lines.

The third scheme is for the construction of waterworks at Fontaine l'Eveque (Var).

The cost of those schemes is estimated as follows.—

	francs.
Power stations on the Durance and laying of power-lines	• 160,000,000.
Works on Crau and Camargue	36,000,000.
Extension and electrification of departmental railways	80,000,000.
Fontaine l'Eveque Waterworks	245,000,000.
Total	521,000,000.

These ambitious projects have not passed beyond the preliminary stages, but now that the department has taken them up and given them publicity, it may be assumed that it is intended to carry them into effect with as little delay as possible.

GERMANY.—Owing to a strike of the employés of the municipal electricity and tramway departments Berlin was deprived of lighting, power, and transport on September 12th. The trouble was due to a rearrangement of the salaries of a number of higher-grade employés. It was later announced that the strike was settled on the following day.

Chipping Norton.—**INQUIRY.**—The Electricity Commissioners recently held an inquiry into the application of the Chipping Norton Electric Supply Co. for permission to increase its maximum charges for electricity to ls. 8d. per unit for lighting and to 7d. per unit for power. The managing director of the company said that the cost per unit sold had risen from 1.9d. in 1914 to 9.2d. in 1921. The Inspector asked if the latter figure was justified; was there any reason to suppose that the cost in 1921 would be 50 per cent. above that of 1920? The managing director said there was, and also thought that to give the shareholders a fair return the price should be ls. 5d. a unit. On behalf of a number of consumers, Mr. T. H. Pettipher asked for a six months' adjournment; he said that the company's application was based entirely on this year's figures, rendered abnormal by the coal strike.

Coleraine (Co. DERRY).—**WATER POWER CONCESSION.**—At a recent meeting of the Urban Council, it was intimated that the Honourable Irish Society had consented to lease the water power at the Salmon Leap on the Bann, near Coleraine, to the Council, at a nominal rent, for the purpose of generating electricity for the district.

Dover.—**BARRACK LIGHTING.**—The Town Council has arranged with the War Office to supply electricity to the Western Heights Barracks, which have hitherto been lighted by gas.

Electricity District.—**MID-LANCASHIRE.**—After discussing the future supply of electricity in Mid-Lancashire for 18 months, last week's Conference of Local Authorities was unable to devise a scheme satisfactory to all parties, and the conference has been adjourned *sine die*. The Electricity Commissioners have now asked for schemes to be prepared. It is not clear what will be the next step taken, whether local authorities will decide to act together or in part, or whether the Commissioners will come forward and submit a scheme of their own.

Glasgow.—**POWER IN DOCKS.**—At the Prince's Dock power station, progress is being made with the replacing of steam-driven pumps by direct-coupled turbine pumps. The transformer house is erected, and one electric turbine pump is already in operation. At Plantation Quay the steam-driven plant for pumping out dry docks is being replaced by electrically-driven pumps. A rotary converter has been installed for the supply of electric power and lighting on board vessels in the graving docks.

Halifax.—**EXTENSIONS.**—By taking in hand immediately schemes which had not been intended to be touched for some time to come, the Corporation Unemployment Committee hopes to provide work for about 500 men. The schemes concerned involve electricity and tramway work as well as work in the gas department, sewerage, and road widening. The work is to be carried on through the Borough Engineer's office.

India.—**OOTACAMUND.**—A meeting was recently held at the Municipal Office to consider the scheme put up by Mr. H. P. Gibbs for introducing electric power in advance of the Kunda scheme which has been held up owing to the state of the financial market. When the big scheme is carried out, power from it will be connected up with the distribution mains in Ootacamund, and the temporary plant dismantled. The majority of the municipal councillors of Ootacamund are reported to be strongly in favour of this scheme. The temporary plant will be steam-driven, for which the Municipal Council is in a position to command an abundant supply of fuel. Mr. Gibbs, on behalf of the Tata Engineering Co., inspected the Ootacamund area last year and worked out the preliminary details.

The work is estimated to cost approximately Rs. 3,60,000. The temporary plant will be put down by the Nilgiri Power Syndicate (which is about to be formed) consisting of Messrs. T. Stanes & Co., Coimbatore, Messrs. Tata & Sons, Ltd., of Bombay, Mr. G. Laird, manager for India of the Metropolitan-Vickers Co., London, Mr. C. Chetty, a prominent Indian gentleman of Coimbatore, and Mr. H. P. Gibbs. The syndicate will carry on and complete all investigations and designs in connection with the Kunda project, and when the Nilgiri Power Co. is floated, the concession will be transferred to that company. The temporary plant will be erected in 18 months.—*Indian Textile Journal*.

Ikley.—**GOVERNMENT PLANT.**—A four-day trial run was made by the plant recently purchased from the Government. This new 1,000-kW. Phoenix generator direct coupled to a 225-h.p. "Garrett" superheated steam engine with condenser. The plant was unused, having been made for an aeroplane factory but never installed.

Keighley.—**LOAN SANCTIONED.**—The Electricity Commissioners have sanctioned the borrowing by the Corporation of £27,374, for electricity purposes. This is only part of the amount applied for, the balance of £26,252 being held over for further information.

Market Drayton.—**PUBLIC LIGHTING.**—The Urban District Council has accepted the tender of the Electric Light Co. for the lighting of 65 or more lamps during the period October

1st next to April 30th, 1922, from sunset to 10 p.m., at £4 10s. per lamp, subject to a reduction in the event of a fall in the cost of coal, &c.

Manchester.—**BARTON STATION.**—The new Barton power station is going to be an expensive project. Two years ago £1,810,500 was considered necessary for its construction, whereas now, the Electricity Committee is asking for power to borrow an extra sum of £1,466,743 to complete the scheme, thus bringing up the total to £3,277,243. The Finance Committee states that no charge will fall upon the revenues of the undertaking until such time as the generating station becomes revenue producing.

There was considerable criticism of this proposal at a meeting of the City Council last week. Councillor Judson said they were told the scheme would cost two million pounds, and now it was to cost another million and a half. Someone had blundered. Sir Edward Holt said the scheme should be put back for six months, in view of falling prices. Ald. Dagnall, chairman of the Electricity Committee, stated that two million pounds had already been spent, and it was not business to let that capital stand idle for another six months. Ald. West denied any blundering in the estimates, and said that no engineer in 1919 could correctly estimate the prices that would rule in 1921. The Council agreed to the borrowing of the amount.

Melbourne (Derbyshire).—**STREET LIGHTING.**—The Urban District Council has accepted the tender of the Electric Light Co., for street lighting at £3 11s. per lamp, for four 300-watt lamps, and £1 9s. 3d. each for 63 ordinary lamps.

Monaghan.—**STREET LIGHTING.**—The Monaghan Lighting Co. recently offered to light the town with 60 lamps at 10½d. per unit, and desired a guarantee that the Council would continue to take the light for seven years. To this the Council replied that it could only guarantee to take energy for two years, as it would go out of office in 1923. The company has replied that it can make no departure from its original proposal.

Motherwell.—**PRICE REDUCTION.**—The Town Council has decided to reduce the price of electricity for public lighting in the Wishaw area from 5d. to 3½d. per unit.

Nottingham.—**SUB-STATION SITE.**—The difficulty of obtaining a site for the proposed sub-station in the Meadows district has been surmounted by taking over a piece of land at Bruce Grove, from the Public Libraries Committee.

Nelson.—**PRICE INCREASE.**—The Town Council has increased the charges for electricity for lighting by ½d. per kWh, and for power, by ½d.

Northwich.—**DISTRICT EXTENSION.**—The Electric Supply Co. has intimated to the Urban District Council its intention to apply to the Commissioners for a special order extending its district. The clerk has been instructed to report fully upon the matter to the General Purposes Committee.

Newport.—**LOAN.**—The Corporation is applying for sanction to borrow £1,000 for the purchase of land for the extension of the East power station.

Oldham.—**NO PRICE INCREASE.**—Owing to the depressed state of industry, the Electricity Committee has decided not to increase the charges for electricity as proposed.

Perth.—**EXTENSIONS APPROVED.**—The Electricity Commissioners have consented to the extension of the generating plant at the electricity station, at a cost of £15,000.

Peterborough.—**YEAR'S WORKING.**—The 1920-21 accounts of the city's electricity undertaking (engineer: Mr. H. A. Nevill) record a total income of £25,452, as against £18,382 in the previous year. Working expenses totalled £22,057, as against £13,185, leaving a gross profit of £3,395 (£5,197). The net result was a loss of £3,580; there was a deficit of £688 in the preceding year. The number of units sold rose from 1,113,005 to 1,280,563.

Redditch.—**YEAR'S WORKING.**—The accounts of the Council's electricity undertaking (engineer: Mr. R. N. Mayne) for the year ended March 31st last, show a total revenue of £34,638 as compared with £31,152 in 1919-1920. Expenditure on revenue account totalled £28,980, as against £22,796, leaving a gross balance of £5,658 (£8,356). The net result, after payment of all capital charges, was a deficit of £1,203, but this was covered by a balance of £13,169 brought forward, and £11,966 was carried forward to the next account. The preceding year's net result was a profit of £2,427. The number of units sold fell from 2,762,033 to 2,574,378.

PRICE INCREASE.—As from October 1st, the charges for electricity will be increased as follows: Lighting: factories, 7d. per unit, theatres, &c., 6d., and ordinary consumers, 8d. Power, cooking, and heating, 2½d. per unit, subject to decrease or increase with fluctuations in the price of coal.

Southport.—**EXTENSION OF SUPPLY.**—The chairman of the Electricity Committee states that it is hoped to have the whole of the township of Ainsdale electrically lighted for the winter. It is hoped that the cables will be laid and the sub-stations completed by the end of the month. The work is being so carried out that should the Corporation at any time decide to take over the lighting of Birkdale, that business will be facilitated.

South Shields.—PRICE REDUCTION.—In view of the electricity undertaking having shown a profit of £16,438 during the past year, the Town Council has agreed to a 12½ per cent. reduction of charges.

Stafford.—NEW SCALE OF CHARGES.—The Town Council adopted on September 6th a new scale of tariffs for the Corporation electricity undertaking, with the object of popularising the use of electricity. The consulting engineer, Mr. Arthur Ellis, of Cardiff, in a report pointed out that the Corporation was committed to a very heavy additional capital expenditure, which it desired should become remunerative, and the undertaking self-supporting, at the earliest possible date. The present system of charging, he observed, was altogether inconsistent and, in his opinion, there was no justification whatsoever for its existence at all, it was not fixed upon any businesslike basis. The scale adopted by the Council provides for a flat rate of 8d. per kWh. consumed in the case of private residences—the minimum quarterly payment to be 7s. 6d., or alternatively at the request of the consumer 15 per cent. of the rateable value of the premises supplied, and in addition 2d. per kWh. consumed. In the case of hotels, shops, offices, and other business premises, a flat rate of 8d. per kWh. consumed is to be charged—the minimum quarterly payment to be 13s. 4d., or alternatively at the request of the consumer £2 10s. per kW per quarter of maximum demand, and in addition 2d. per unit consumed. The Electricity Committee proposed to charge 8d. per kWh. for lighting with a minimum quarterly payment of 7s. 6d. in the case of churches, but after discussion the Council agreed to fix the rate at 4d. per kWh. consumed, the same as for places of amusement. The rate for d.c. power supplies was fixed at £2 per kW per quarter of maximum demand, and in addition 1d. per unit consumed; for l.p. a.c. power supplies £2 per kVA per quarter of maximum demand, and in addition 1d. per unit consumed. In the case of factory and workshop lighting where the plant is electrically driven the consumer will be allowed to use 7½ per cent. of the total power consumption for lighting at power rates.

Swansea.—YEAR'S WORKING.—The borough treasurer's abstract of accounts of the electricity undertaking for the year ended March 31st, together with the report of the electrical engineer (Mr. J. W. Burr), shows that the net income was £106,062, as compared with £77,329 for the previous year, and the working expenditure £80,199, or 75.62 per cent. of the income, as against £56,190, or 72.66 per cent. for the previous year. The gross profit amounted to £25,863, or 24.38 per cent. of income, as against £21,139 or 27.34 per cent. for the previous year; loan charges were £21,987, or 20.73 per cent., as against £16,733, or 21.64 per cent. for the previous year, leaving a net profit of £3,876, or 3.65 per cent. of income, as against £4,406, or 5.70 per cent., the previous year. The gross profit still represents over six per cent. upon the gross capital outlay, which the borough treasurer thought was very satisfactory. The net expenditure upon capital account during the year was £39,125, bringing the total expended up to £364,316 (excluding stock issue expenses). The total amount paid to date into the Reserve Fund, including interest, amounted to £29,389, of which £25,052 has been expended upon works which otherwise would have involved loans. The balance at the end of the year was £4,003.

The engineer's report on the 20th year of working, states, that the output of electrical energy from the works shows an increase of approximately 9 per cent., as compared with the previous year. The overall price per ton for coal for the year ended March last was £1 19s. 7d., as against £1 10s. 3d. for the previous year. An analysis of the working costs per unit for the year compared with the previous year shows: 0.69s. per kWh for coal, as against 0.52d.; oil waste, water, and stores, 0.05d., as against 0.01d.; wages, 0.30d., as against 0.21d.; repairs and maintenance, 0.34d., as against 0.26d.; rent, rates, and taxes, 0.10d., as against 0.12d.; management expenses and miscellaneous, 0.14d., as against 0.10d., making the totals 1.62d., as against 1.22d. The number of consumers connected to the mains during the year was 366. The highest number connected in any previous year was 261.

Wrexham.—PRICE INCREASE.—At a special meeting on September 6th the Town Council decided to abolish the 2½ per cent. discount, and to add 5 per cent. to the existing charges for electricity. It is hoped that by this means the loss of £2,000 incurred during the first part of the current financial year will be made good.

Walton-on-Naze.—WATER POWER.—The District Council is considering the utilisation of an old mill pond for the generation of electricity. It is stated that it would be possible to produce electricity to sell at 2d. per kWh.

York.—BULK SUPPLIES.—As a consequence of the special supply rates granted by the Corporation to Messrs. Rowntree and Co., a number of other large consumers have asked for supplies on similar terms. This has led the Corporation to consider supplying electricity in bulk. The North-Eastern Railway Co., is one of the applicants. The company already has an extensive plant of its own, but the *Yorkshire Herald* considers it possible that the whole of the company's needs may eventually be supplied by the Corporation if the terms are acceptable, and the company's own plant will be shut down. The adoption of the bulk supply scheme would, no doubt, entail considerable plant extensions.

TRAMWAY AND RAILWAY NOTES.

Bradford.—YEAR'S WORKING.—The report of the general manager of the Corporation tramways (Mr. R. H. Wilkinson) for the year ended March 31st last, shows that the total revenue was £718,539, as compared with £608,991 in 1919-20. Working expenses amounted to £653,905, as against £501,534, leaving a gross profit of £64,636 (£107,457). After payment of all capital charges a net loss of £22,245 was the result. In the previous year the sum of £30,000 was contributed to the city fund in relief of rates. The number of car miles run increased from 5,648,370 to 6,347,404; the number of passengers carried rose from 86,469,014 to 88,865,557. The adverse financial result is attributed by the manager to the increased cost of labour and materials, and also to the institution of a holiday scheme for the men.

RECONSTRUCTION OF TRACK.—The Tramways Committee recommends to the City Council that reconstruction of the private track be proceeded with on the Eccleshill section, from Idle Road to the terminus, at an estimated cost of £16,623, and on the Wyke section, near Odsal Top, at an estimated cost of £9,523. The Committee asks the Council to apply for power to borrow so much of these sums as would properly be met out of capital account having regard to the time which has elapsed since the existing track was laid.

A dispute has arisen between the Tramways Committee and the local branch of the United Vehicle Workers' Union in the matter of the recent discharge of a number of men who were taken on temporarily. The men discharged numbered 85, of whom 26 were reinstated; 19 obtained other work. The Tramways Committee, on being approached by the men's union, offered to take the men back on short time and pay for work done, but the union declined this, though it agreed to waive the guaranteed 48 hours' week in the case of these particular men, if they were reinstated on a 24 hours' agreement subject to the usual service conditions. The Committee was unable to promise the usual conditions of service, with the "privileges" of such service, and said that their employment must be accepted as temporary.

Continental.—SWEDEN.—The Swedish State Railway administration, referring to the proposed electrification of the railway between Stockholm and Gothenburg, states that the two committees which are engaged on the examination of the question of the system to be adopted and the measures to be taken to prevent disturbances being set up in telegraph and telephone lines, are expected to complete their reports by the end of this year, when it will be possible to start the work of conversion. The expenditure on the whole scheme, including the electric locomotives, has been considerably reduced, from the former estimate of 105,000,000 kr. to about 65,000,000 kr. As the value of the steam locomotives which will be set free through the electrification can now be reckoned at 22,500,000 kr., the entire cost of undertaking the work will be only 42,500,000 kr. As a consequence the estimate of 23,000,000 kr. already sanctioned represents slightly over one half of the total calculated outlay, and no further grant will be required in 1922 if the work of electrification is started during that year.

NORWAY.—Included in the recent Norwegian Budget is a sum of 2,500,000 kr. for the electrification of the Ofoten Railway.

Darlington.—ACCIDENT.—An electric tramcar and a motor wagon were proceeding in the same direction in Parkgate, last week, when the wagon, overtaking the car, drew in front too suddenly, and the tramcar driver's platform was smashed and the windows of the car broken. No personal injury resulted and the car was capable of returning to the depot under its own power.

Glasgow.—TICKET ECONOMY.—In a letter to the *Daily Mail* it is pointed out that the Corporation makes a yearly profit of over £500 on used tramway tickets. Boxes are fixed above the footboard into which passengers drop their tickets as they alight. It is an offence to throw used tramway tickets into the street.

Gosforth Park.—LIGHT RAILWAY.—At a meeting of the Newcastle-on-Tyne City Council on the 7th inst., the agreements with the High Gosforth Park Co., Ltd., and the Tyneside Tramways and Tramroads Co., as to the light railway through Gosforth Park, were submitted.

Ald. R. Mayne, in moving that they be approved, said under the agreement with the Park Co. the Corporation obtained a perpetual easement for practically 1½ miles of double track through the park without any capital payment, and also a right to lay an additional 200 yards of single-line siding. The method of construction of the railway was subject to the approval of the company's architects, subject to a right of arbitration in case of difference. In return the Corporation would pay one-third of the net profits upon cars run over the railway after deducting all capital charges and working costs. The agreement with the Tyneside Tramways Co. simply carried out the arrangement already approved. Under it the Corporation was prohibited from extending the light railway northward, or alongside the North Road; and the Corporation undertook, if the Tyneside Co. desired, to put in two junctions between the Corporation tramways in Benton Road, where the Tyneside lines crossed the road and intersected the Corporation tramways. The agreements were approved.

Java.—**RAILWAY ELECTRIFICATION.**—The authorities of the Dutch East Indies State Railways have decided on the electrification of the Batavia-Weltevreden and Buitenzorg-Landjong Priok lines.

London.—**NEW L.C.C. CARS.**—In about eight weeks' time deliveries of the new L.C.C. trams, 125 of which were ordered in June, will begin, says the *Evening News*. These will have many improvements as compared with the present cars, and will be faster than any of the present trams. There will be seats for 75 passengers, and those in the vestibule on the top of the car will be rearranged to give more knee room. Greatly improved lighting is also promised, and the ceilings upstairs and down will be painted white. The new cars are to cost approximately £4,000 each.

THE BREAKDOWN.—Four trucks, part of a repair train whose crew was taking up the under-river line of the City and South London Railway and relaying it by night, became derailed and jammed soon after 2 a.m. on September 9th. One of the trucks sank into the line bed and could not be moved for some time, so that the whole of the under-river section of the line had to be closed.

On October 9th and following Sundays it is intended to reopen all stations on the Underground electric railway system for the whole day with the exception of Cannon Street, Covent Garden, York Road, and Aldwych stations.

Maidstone.—**YEAR'S WORKING.**—The annual report of the Light Railways Committee for the year ended March 31st last shows that the total revenue of the tramways was £25,478, and working expenses £21,253, leaving a gross balance of £4,365. The payment of capital charges resulted in a net deficit of £123.

Salford.—**STRIKE.**—On Sunday last, at midnight, the employees of the Corporation tramway department ceased work as a protest against the secession of a number of inspectors and clerks from the United Vehicle Workers' Union. As a relief measure the Corporation has started running charabancs.

Southport.—**EXTENSION OF TIME.**—The Minister of Transport has extended the time until August, 1922, of the Southport Corporation Act, 1913, for the completion of the electrical equipment for the working of trolley vehicles.

York.—**SHORT-TIME WAGES.**—A recent decision of the Tramway Committee not to accede to an application for full bonus for tramway employees during the time they were working short-time owing to the coal strike, has been reconsidered by the Traffic Committee, and a report is to be made.

TELEGRAPH AND TELEPHONE NOTES.

China.—**TELEPHONE DEVELOPMENTS.**—Extensive telephone improvements and extensions, embracing both long-distance and local services, are under way in Kiangsu Province, but will not be fully completed for some time. It is planned to connect all important cities in the Province by long-distance services. Connections between Shanghai and Nanking will probably be completed by the end of 1921. The total cost of the changes now being effected in the Province will amount to approximately \$1,000,000, of which \$425,000 will be expended in the city of Nanking in a complete reorganisation of the local system, including \$100,000 for new buildings, \$150,000 for interior, and \$150,000 for exterior equipment. It is understood that the exterior materials are being purchased through the Sino-Japanese Electric Co., and the interior from a Chinese-American company. The service between Nanking and Pukow, located across the Yangtze river, is also being extended. The submarine cable with only two wires, which now connects these two cities, will be replaced by a new cable providing for 26 wires, which it is thought will meet all requirements at present and in the near future.—*Eastern Engineering*.

Czecho-Slovakia.—**TELEPHONE EXTENSIONS.**—In less than two years the telephone lines in Czecho-Slovakia have been increased by 6,250 miles.—*The Times*.

France.—**ACCIDENT AT WIRELESS STATION.**—It is reported that one of the masts of the La Doua wireless station, on the outskirts of Lyons, collapsed on September 10th, killing one and injuring another man.—*Reuter's Trade Service* (Lyons).

Germany.—**WIRELESS TELEPHONY.**—According to the *Deutsche Allgemeine Zeitung*, highly successful experiments in wireless telephony have recently been carried out between Berlin and Copenhagen.—*Reuter's Trade Service* (Berlin).

Greece.—**NEW TELEGRAPH SERVICE.**—Direct telegraphic communication between Athens and Broussa (in Asia Minor, 57 miles south-south-east of Constantinople) has been established, says the *Daily Mail*.

Italy.—**WIRELESS TELEGRAPHY.**—The first meeting of the Commission recently nominated by the Associazione Elettrotecnica Italiana to study questions related to telegraphy, telephony, and radiotelephony was held in July, when the use of wireless telegraphy by industrial companies possessing electric plant was discussed as one among several means of extending the employment of wireless telegraphy generally.

In Italy hitherto wireless telegraphy has been limited to the naval and military services and to a few shipping concerns. To carry out the Association's plans, three sub-committees have been appointed, whose duty will be to find out the machines best suited for wireless purposes, to fix standards for the various parts, to ascertain what dielectric rigidity is required, to settle the earth insulations of dynamos and transformers, the choice of a direct-current type of machine able to work with sudden and frequent changes of load, the tendency of short-circuiting and sparking at the collector, the insulation of conductors, protection against lightning, safeguarding of neighbouring networks against disturbance, &c. Also an attempt will be made to induce the Government to extend the teaching of wireless telegraphy in all polytechnic and technical schools, to appoint those fitted to grant certificates, and what prerogatives these will confer on the recipients. The most delicate part of the sub-committees' task will be to advise on the steps to be taken to induce the State to relinquish its monopoly and to throw open unrestrictedly wireless telegraphy to private firms. This is the only course, it is contended, that will serve for the proper development of wireless telegraphy in Italy. The question, however, bristles with so many difficulties that it was decided to reserve its consideration for a future meeting, when absent members of the Association would be present.

PRESS TELEGRAMS.—The Postmaster-General announces that on and from September 15th, Press telegrams at the reduced rate for Italy will be accepted at post offices, on the usual conditions, between 6 p.m. and 12 noon.

TELEPHONE EXTENSIONS.—The Italian official journal has published the text of laws providing for an extraordinary expenditure of 166,000,000 lire for the improvement of the telephone and telegraph networks.

Russia.—**NEW WIRELESS STATION.**—A large wireless telegraph station is being erected near Moscow, says the *Daily Mail*, the purpose of the Russian People's Commissariat of Posts and Telegraphs being to install apparatus that will enable Moscow to speak simultaneously to every place on the face of the earth. The apparatus is being made in the big radio laboratory and works at Nijni-Novgorod, under the supervision of a band of Russian scientists. During Russia's recent years of isolation her radio progress has been remarkable. Most of the experts are not Bolsheviks, but are enthusiasts for research and eager to develop the possibilities of wireless. Russia is covered by an efficient network of 597 wireless stations (about six times as many as in the British Isles), which keep Moscow in instantaneous touch with what is going on all over the country and in Siberia and Turkestan.

The Telephone Service.—**STORM DAMAGE.**—During the night of September 11th-12th a thunder storm did considerable damage to the telephone system; over 2,500 lines were "down" in London alone, and to add to the trouble a water main burst at Tottenham, causing some damage by the flooding of cables.

In Tottenham alone 178 subscribers' lines and 235 junctions were out of operation. By Tuesday evening, however, 2,238 lines in the London area had been restored.

Strenuous efforts are being made by the Post Office to complete the system of underground telephone cables, but according to the *Daily Chronicle*, laying an underground wire in towns is an expensive process. Recently, in London, one 1,000 ft. long was laid to relieve the Avenue Exchange, and it cost over £3,000.

REVENUE.—Statistics published in the *London Gazette* show that the estimate of Post Office revenue for the year 1921-22 was £60,000,000, while five months' actual business had yielded only £18,500,000, suggesting at this rate a deficit on the year of £41,500,000. The increase during the five months over the corresponding period of last year is only £250,000. The figures represent revenue paid into the Exchequer, but not total revenue. One important point is that there has been a change in telephone accounting, whereby accounts are rendered quarterly instead of monthly. The figures, therefore, do not include full telephone receipts, which will be given in late returns.—*Daily Telegraph*.

CONTRACTS OPEN AND CLOSED.

The date given in parentheses at the end of the paragraph indicates the issue of the *ELECTRICAL REVIEW* in which the "Official Notice" appeared.

OPEN.

Argentina.—October 21st. State Railways. Twelve months' supply of electrical stores.

The Commercial Secretary to H.M.'s Legation at Buenos Aires states that the State Railways invite tenders to be presented early in November for one year's supply of railway signal material, including telephone and telegraph materials, &c. Specifications, tender forms, &c., are expected to arrive early in October, and will be available in the Inquiry Room of the Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W.1.

Australia.—MELBOURNE. Victorian Government Railways. October 26th. D.C. arc welding plant (Cont. No. 34,377). Armature banding machine with electric motor and starting gear (Cont. 34,378). *November 2nd. Electric storage battery complete for automatic telephone exchange (Cont. 34,223). *

January 4th. Victorian Government Railways. 150 electric train sets operated by a single-phase induction motor. One set of electric pyrometer equipment for measuring temperatures of 350 to 2,000 degrees Fahrenheit.—*Reuter's Trade Service* (Melbourne).

ADELAIDE.—October 12th. Postmaster-General's Department. 2,750 yds. telephone cords, 120 hand sets, 160 jacks. *

Belfast.—September 19th. Electricity Department. E.h.p. and l.p. switchgear for the new harbour power station. (See this issue.)

Brighton.—September 20th. Board of Guardians. Electrical fittings, &c., for three months. H. Burfield, Clerk, Prince's Street.

Bulgaria.—SOFIA.—October 7th. Department of Posts and Telegraphs, 100,000 porcelain insulators. *

Eastbourne.—September 26th. Electricity Department. One water-tube boiler, fan and chimney, boiler-feed pump and piping; one 2,500-kW turbo-alternator with condensing plant and pipework. (September 2nd.)

Fort William.—September 17th. Electric lighting in connection with 12 houses. Particulars from Mr. J. G. Falconer, architect, Fort William.

Glasgow.—Tenders for lighting North Woodside Road lodging house by electricity are to be asked for by the Corporation.

London.—BERMONDSEY.—September 23rd. Board of Guardians. Six months' supply of electric lamps. Mr. H. Reeve, clerk to the Guardians, 283, Tooley Street, S.E.

Morocco.—September 19th. Post and Telegraph authorities at Rabat, 86 tons of copper wire 3 mm. diameter.

Nottingham.—October 21st. Electricity Department. Three 10,000-kW turbo-alternators with exciters, condensers, auxiliary plant, &c. One 1,000-kW combined turbo-generator-alternator with condenser, auxiliary plant, &c. Six water-tube boilers with mechanical stokers, superheaters, forced draught fans, &c. (See this issue.)

New Zealand.—WELLINGTON.—November 29th. Public Works Department, Mangahao electric power scheme; three water wheels, three 6,000-kVA and two 3,000-kVA a.c. generators, two 3-unit exciter sets, seven 4,000-kVA, single-phase transformers, insulators, lightning arresters, switchboard, &c. *

October 15th. Corporation. Two water-tube boilers with feed-water heaters, superheaters, stokers, &c.; one 5,000-kW turbo-alternator with condensing plant. (September 2nd.)

Portsmouth.—September 21st. Board of Guardians. Electrical fittings, for three months. Mr. E. H. Mitchell, clerk, St. Michael's Road.

South Africa.—JOHANNESBURG.—November 7th. Rand Water Board. Two 350-kW steam-driven electrical generating sets, complete with switchboards and all accessories. *

Uxbridge.—Board of Guardians. Tenders for converting the electric power plant at the Institution, Hillingdon, from 100 V d.c. to 200 V single-phase, 50 periods, and supplying machinery for same. (September 9th.)

Warrington.—September 27th. Board of Guardians. Electrical goods for three months. Mr. A. Bottomley, Bewsey Chambers.

Workop.—Urban District Council Electricity Department. Supply and erection of an overhead transmission line, complete with underground connecting cables, distance approx. 2,200 yds., pressure 6,600 V. (See this issue.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CLOSED.

Barking.—Electricity Committee:—

Electric light installation, New School Buildings, £205.—Lund Bros.

Bradford.—Electricity Committee. Plant at Valley Road works.

Water supply pipes for No. 4 boiler house.—Stanton Ironworks Co., Ltd. Steel pipes for supporting pipes to No. 9 and No. 10 cooling towers.—H. Barrett & Sons, Ltd.

Switchboard for No. 4 boiler house and extension to switchboard for transformer chamber.—Bertram Thomas.

Electric side-tipping truck.—Electromobiles, Ltd.

Automatic centrifugal sump pump.—Holden & Brook, Ltd.

Crewe.—Accepted:—

Electric light installation, Linden Grange and Maternity Home, £150.—Carrington & Butten.

Darwen.—Corporation. Accepted:—

For the installation of telephones connecting the various departments.—Mr. W. V. Fairhurst.

Glasgow.—Corporation. Recommended:—

Electric main for transformer to exhaustor house at Proven Gas Works. Callender's Cable Co., Ltd. Circulating engineering water at gas works for three months.—Ed. Black & Langmuir, Ltd.

Corporation. Accepted:—

Electric lighting of Mount Road Bridge and Avenue, 4173.—Johnston, Park and Co.

Newcastle-on-Tyne.—City Council.

4,000-kW turbo-alternator and surface condensing plant for the Marine Station, £33,700.—A. A. Parsons & Co., Ltd.

FORTHCOMING EVENTS.

Institution of Production Engineers.—Stratford, September 17th. At the Institution of Mechanical Engineers, Strand, S.W. At 7 p.m. Paper on "The Manufacture of Ball and Roller Bearings," by Mr. J. D. Seale.

Ideal Homes Exhibition.—Monkay, September 19th, to Saturday, October 8th. At the Kelvin Hall, Glasgow.

NOTES.

Stage Lighting.—Science has already done much in the way of stage effects; however, it still holds in reserve wonders even more startling than those we know of. On September 9th, for instance, a private view was given at the London Hippodrome of a development in the domain of electric lighting which, granting it can be economically applied, should, it is claimed, go far to solve the problem of how to accomplish an instantaneous and complete change from one scene to another. The novelty is the work of Adrian Samoiloff, a young Russian.

The illusions, he declares, are produced by the use of light rays, of many shades, coming from all parts of the stage and controlled and blended by a tiny instrument invented by himself. The device is to become a standing feature at the Hippodrome in "The Peep Show," in a short series of scenes to be called "The Valley of Echoes." The public will thus be enabled to judge for themselves of the effects it is capable of accomplishing.

Finsbury Technical College Old Students' Association.—The annual general meeting of the above association was held at Finsbury Technical College on September 5th, the president, Professor G. T. Morgan, O.B.E., D.Sc., F.R.S., occupying the chair. A report was read of the progress made since the association was resuscitated in the early part of 1920, and reference was made to the great success of the dinner and smoking concert held last season.

The fact that the college is being kept open, owing in no small measure to the efforts of old students of the college, should impress on all old students the necessity of the association, and should ensure a steady influx of new members. Students who have recently completed their course will be well advised to apply for membership at once if they have not already done so.

The annual dinner this year has been arranged for Saturday, November 12th, and the smoking concert for Friday, January 27th, both these functions being held at the newly opened Engineers Club. The first number of a *Bulletin*, which it is proposed to issue quarterly, is in course of preparation and all old students are requested to forward immediately an account of what they are now doing for inclusion therein. Application forms for membership and all particulars of the association may be obtained from the Hon. Secretary, Mr. H. P. Guy, 209, Northumberland Park, Tottenham, N.17.

Educational.—NORTHAMPTON POLYTECHNIC INSTITUTE.—For the full-time courses in engineering and technical optics a special entrance examination is to be held at the end of September. The 1921-22 session opens on October 3rd for day courses; evening classes commence on September 26th. A volume of "Announcements—Educational and Social" has been issued, and this gives full details of all subjects included in the numerous courses as well as particulars of the social and recreative side of the Institution.

THE POLYTECHNIC, Regent Street, W. 1.—A special course of lectures on "Cost Accounts" will be delivered by Mr. R. G. Legge on Fridays, commencing September 30th. Full particulars are given in our advertisement pages to-day.

MANCHESTER UNIVERSITY.—The Faculty of Technology has issued its prospectus for session 1921-22. Full details as to times and subjects are given for the various courses. These courses include mechanical, electrical, and municipal and sanitary engineering, and many branches of applied chemistry. The first term of the session (Michaelmas) opens on October 6th. Other particulars given are scales of fees and general information regarding graduation, &c.

BATTERSEA POLYTECHNIC INSTITUTE.—The next session commences for day courses on September 27th, and evening courses on September 26th (enrolment commences September 20th). An abridged calendar of evening classes can be obtained gratis on application to the principal.

Appointment Vacant.—Electrical engineering draughtsman (£150 + war bonus), for the Metropolitan Asylums Board.

Fatality.—An inquiry was held on the 7th inst. into the cause of the death of Frank Edward Plum, an electrician at Messrs. Armstrong, Whitworth & Co.'s naval yard at Walker-on-Tyne. On September 1st, it was stated, he was instructed to cut away some loose cables which were "dead," and it was while doing this work in the sub-station that he was killed. After the accident it was found that there were pier marks on a live conductor, showing that deceased had attempted to cut it in error. The pressure was 255 volts. Plum was an efficient man, and had been responsible for the maintenance of all the electrically-driven plant at the south end of the yard.

New X-ray Process.—An important scientific discovery will, according to the daily Press, be disclosed at the annual exhibition of the Royal Photographic Society this month. The discovery is reported to be the outcome of researches carried out by the Society, and will, it is claimed, enable operators to take a photograph of the object showing, not only what it is, but also "its exact location, depth, and position." It is also said that the new process will considerably reduce the risk of X-ray dermatitis. Several other discoveries will be shown, one of which is in connection with autochrome photography, making it possible to take coloured pictures.

Bread Baking by Electricity.—The loaves which won the first prize for white bread at the Armstrong Gardens Association's annual show at Heaton, Newcastle, were baked in an electric oven. The prize-winner was Mrs. J. J. Watson, who used the oven of her ordinary electric cooking range to bake the bread. A success like this in an open competition substantiates the claim that electricity is a most efficient method of cooking, combined with absolute cleanliness and economy.—*Newcastle Daily Journal*.

INSTITUTION NOTES.

Institution of Electrical Engineers.—LONDON STUDENTS' SECTION.—With the return to more normal conditions the London Students' Section has had a very active session. A full account of the meetings, visits, and social functions is detailed in the committee's report for the 1920-21 session, during which eleven general meetings and the annual general meeting were held at the various technical colleges in London. The average attendance was 39, the highest recorded being 75. The opening address to the Section was delivered by Mr. C. C. Patterson, O.B.E., and by invitation of the Graduates' Association of the Institution of Mechanical Engineers a joint meeting of the London Students' Section and the above Association was held on November 8th at the Institution of Mechanical Engineers. In response to this, members of the Graduates' Association were invited to the I.E.E. Students' meeting on December 3rd. During the year eleven visits were paid to various works, and five social functions were held during the session. The revival of the summer tour for the Section was greatly appreciated by students; the visit to Glasgow was arranged for the week commencing July 25th, 1920, and the programme included meetings, visits, &c. As the tour to the Glasgow district proved a great success, the committee decided to make more ambitious plans for this summer. Arrangements for a tour in Switzerland are now practically completed, and it is expected that a large number of students will be present.

On the occasion of the visit to the works of Messrs. Everett, Edgcombe & Co., Ltd., on February 11th, 1921, Major Edgcombe very kindly offered two prizes for the best description of the works. The first prize, value £2 2s., was awarded to Mr. H. S. Petch, and the second, value £1 1s., to Mr. F. La L. T. Budgett.

The Council is to make a grant to the London Students' Section to cover the expenses of publishing advanced abstracts of students' papers for distribution to students before or at the meetings. The grant will cover the cost of producing about twelve such abstracts per annum. The Students' Section has also been very fortunate in having several of its papers published in the B.E.A.M.A. Journal.

Faraday Society.—A general discussion of "Catalysis, with Special Reference to newer Theories of Chemical Action," will be held on September 28th at the Institution of Electrical Engineers. Tickets of admission from the Secretary of the Faraday Society, 10, Essex Street, London, W.C.2.

Manchester Association of Engineers.—The Association has just issued a booklet setting forth the objects of the Students' Section. These appear to be the usual aims of an engineering society, viz., the improvement of members' professional knowledge by the reading and discussion of papers on subjects connected with their work.

Wireless Society.—The Glasgow and District Radio Club, which is affiliated with the Wireless Society of London, held its first "field day" on August 20th in Bellahouston Park, Glasgow; it was a great success, as were also the other

meetings which were held during the past session. The 1921-22 session will commence with the annual general meeting on September 28th.

Birmingham and District Electric Club.—The opening meeting of the winter session was held at the Grand Hotel on September 10th. A paper was read by Mr. Norman Deykin on his recent experiences in Canada. The lecturer gave an interesting and enjoyable account of the many cities, towns, and natural scenery of the great Dominion, giving much information about Canadian electrical development and practice.

Institution of Production Engineers.—A general meeting of the Institution will be held on Saturday, September 17th, at the Institution of Mechanical Engineers, at 7 p.m. Mr. J. D. Scaife will deliver a paper on "The Manufacture of Ball and Roller Bearings," illustrated by lantern slides.

National Association of Supervising Electricians.—On Tuesday last a meeting was held at St. Bride's Institute, at which the new president, Major T. Vincent Smith, M.C., delivered his inaugural address.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

We heartily congratulate Sir PHILIP DAWSON, M.P., on the result of the Lewisham Parliamentary election. Sir Philip received 9,427 votes, the other candidates following with 8,560 and 6,211 votes respectively.

Mr. J. Y. MACKERSIE, A.M.I.E.E., resident engineer at the Summer Lane power station of the Birmingham Corporation Electric Supply Department, is leaving this month to take up an important electrical appointment in Calcutta. On 6th inst. he was presented with a canteen cabinet from the technical staff, by the chief engineer, Mr. R. A. Chattock. Mr. Mackerisie has been held in the highest esteem during the past 15 years by the Birmingham staff, a large number of whom assembled to wish him success in his new sphere in India.

With reference to our note of last week with regard to his claim against the Edinburgh Corporation for loss of office due to the amalgamation of Leith with Edinburgh, Mr. A. FEDER RUTHERFORD informs us that no award has yet been issued.

Mr. T. L. ROGERS has recently left the service of the English Electric Co., Ltd. He has had an exceptionally lengthy connection with the electrical industry. He joined the old Anglo-American Brush Electric Light Corporation in 1883, and continued the connection until 1908, when, on the advent of the tantalum lamp, he joined Messrs. Siemens Bros. Dynamo Works, Ltd., which was taken over by the English Electric Co. in March last.

Mr. GEOFFREY C. JAGGER, who has for some years past held the post of chief draughtsman with Medway's Safety Lift Co., Ltd., has joined the Titan Lift Co., Ltd., of 20, High Holborn, W.C.1, as chief engineer.

Mr. R. H. WILLIS, M.I.E.E., owing to illness and the need of a long rest, has resigned his position as manager of the Manchester office of Messrs. Crompton & Co., Ltd. His address is 24, Darley Avenue, West Didsbury, Manchester.

Obituary.—MR. B. NEWGASS.—The death took place on Thursday last week, at Frant, Sussex, of Mr. Benjamin Newgass, aged 83, of Messrs. B. Newgass & Co., merchants, Gracechurch Street. He was a director of the Yorkshire (West Riding) Tramways Co., Ltd., and of the San Luco (Mexico) Tramways and various other companies.

SIR SALTER PYNE.—We regret to record the death, which occurred at Exmouth last week at the age of 61 years, of Sir Salter Pyne, who as an engineer went to Afghanistan in 1885 and took up an appointment at Kabul in the service of the Ameer. The Ameer entrusted to Sir Salter very extensive engineering operations and industrial enterprises for the good of the country, and the deceased gentleman became a personage of great importance in the Ameer's councils.

NEW COMPANIES REGISTERED.

Myriad Display Co., Ltd. (176,630).—Private company. Registered September 5th. Capital £1,500 in 1,000 preference shares of 21 each and 10,000 ordinary shares of 1s. each. To acquire and turn to account certain patents for improvements in lamp shades, particularly applicable for advertising or decorative purposes, and to adopt an agreement with W. J. Raine. The subscribers (each with one share) are: W. J. Raine, 11, Gerrard Street, W.1, artist; T. A. C. Eady, 3, Hedden Street, Regent Street, W.1, manufacturing jeweller. The permanent directors are: W. J. Raine, T. A. C. Eady, C. H. A. Eady and G. F. Joseph. Registered office: 11, Gerrard Street, W.1.

British Automatic Telephone Installation Co., Ltd. (176,640).—Private company. Registered September 3rd. Capital £10,000 in 21 shares. To carry on, maintain, and work, so far as they lawfully can or may, private or other telephones or telegraphs, &c. The permanent directors are: G. W. Tempest, 59, Rugby Road, Brighton (managing director); G. C. Tidman, 20, Triton Road, West Dulwich, S.E. (chairman); J. Hunter, Bethany, Ballyholme Road, Bangor, Co. Down; A. Channing, 21, Vasey Place, Kingstown, Ireland. Qualification, £250. Registered office: 59, Victoria Street, S.W.

Meridian Electric Co., Ltd. (11,856).—Private company. Registered in Edinburgh September 6th. Capital, £4,000 in £1 shares (3,500 ordinary and 500 deferred). To carry on the business of electrical engineers, factors, sheet ironworkers, mechanical and general engineers, iron and brass founders, copper and tin smiths, plumbers, millwrights, &c. The first directors are: G. R. Jamieson, Richmond House, Bonness, electrical engineer; A. Haggie, 183, Meadowpark Street, Glasgow, electrical engineer. Qualification, 100 shares. Registered office: 29, Renfrew Street, Glasgow.

Clear Hooters, Ltd. (176,641).—Private company. Registered September 6th. Capital, £3,000 in £1 shares (3,000 participating cumulative preference). To carry on the business of manufacturers of, agents for, and dealers in electric motor and other horns and hooters, electrical, mechanical and other signalling devices, sparking plugs, and general motor and other accessories, &c. The first directors are: W. A. Crosbie, Abbey Hotel, Malvern; J. H. Mills, The Green, Castle Bromwich; W. J. Spicer, The Spinney, Mount Lane, Monkspath, Shirley, Birmingham; T. S. Rogers, 25, Edmund Road, Salfrey, Birmingham (all permanent). Secretary: T. S. Rogers. Registered office: Hooterland, Highgate Square, Camp Hill, Birmingham.

Portham Separators, Ltd. (176,698).—Private company. Registered September 8th. Capital, £5,000 in £1 shares. To acquire and turn to account any invention relating to the use and application of steam separators or apparatus, and to carry on the business of mechanical, electrical, motor car, textile or woodworking engineers, boiler and pipe makers, &c. The subscribers (each with one share) are: W. L. Waite, 26, Wallingford Avenue, North Kensington, W.; clerk; A. H. Hawthorn, &c., Sutton Dwellings, James Street, Bethnal Green, E.3, clerk. The subscribers are to appoint the first directors. Qualification, £1 share. Remuneration as fixed by the company. Solicitors: Nicholson, Graham and Jones, 24, Coleman Street, E.C.

Richard Whiffen, Ltd. (176,605).—Private company. Registered September 8th. Capital, £15,000 in £1 shares. To take over the business carried on by R. G. Whiffen and R. Attwater at Excelsior Works, Carriage Street, Old Trafford, Manchester, as Richard Whiffen, and to carry on the business of electric insulation, india-rubber, asbestos, gutta-percha, flax, hose, flax and cotton bolting, and ship and engineers' stores manufacturers, &c. The first directors are: R. G. Whiffen, 186, Stamford Street, Old Trafford, Manchester; R. Attwater, Carleton House, Lower Bank Road, Fulwood, Preston (both permanent governing directors, subject to holding 1,000 shares). Remuneration of R. G. Whiffen as governing director shall, whilst he devotes the whole of his time and attention to the company's business, be £1,000 per annum, or 50 per cent. of the net profits, whichever is greater. Registered office: Excelsior Works, Carriage Street, Old Trafford, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Monometer Manufacturing Co. (1918). Ltd.—Particulars of £9,000 debentures authorised September 30th, 1921; whole amount issued; charged on company's property, present and future, including uncalled capital.

Russels (Manchester). Ltd.—Particulars of £12,000 and of £8,000 debentures authorised September 30th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

D. Huilett & Co., Ltd. (169,979).—Return dated August 11th, 1921. Capital, £5,000 in £1 shares. 4,420 shares taken up. £330 paid. £4,100 considered as paid. Mortgages and charges, nil.

Tudor Accumulator Co., Ltd. (54,080).—Return dated July 21st, 1921. Capital, £100,000 in £10 shares (8,000 "A" and 1,200 "B"). All shares taken up. £23,000 paid (being £10 per share on 2,600 "A" and £2 10s. on 1,200 "B"), £71,000 considered as paid (being £10 per share on 1,200 "B" and £10 10s. and £7 10s. on 200 "A"). Mortgages and charges: Day-to-day bank overdraft not exceeding £50,000.

CITY NOTES.

German Companies. The *Brandenburg Carbid und Elektrizitäts Werke A.G.*, of Berlin, reports net profits of 807,000 marks for 1920-21, as against 325,000 marks in the preceding year, and dividends at the rate of 10 and 7 per cent. in the two years respectively.

The directors of the *Elektra A.G.*, of Dresden, report that a further improvement in the working results of the supply works and tramways in which the company is interested took place in 1920-21. After making provision for depreciation, the accounts show net profits of 726,000 marks, as against 238,000 marks in the previous year, and the dividend rises from 5 per cent. in 1919-20 to 6 per cent. last year on a larger share capital.

The accounts of the *Isaria Zähler Werke A.G.*, of Munich, makers of meters, and closely associated with the Swiss Brown, Boveri & Co., show net profits of 7,897,000 marks for 1920-21, as compared with 1,778,000 marks in the preceding year. It is proposed to pay a dividend and bonus of 40 per cent. on share capital of 11,000,000 marks, being the same rate as in 1919-20, on capital of 2,750,000 marks. The report states that exceptional profits on exchange were obtained in the export business.

French Companies. The report of the *Société des Ateliers de Constructions Electriques du Nord et de l'Est* (Jeumont) for last year shows a net profit of 4,619,912 fr. It is proposed to distribute this as follows: 5 per cent. (230,573 fr.) to legal reserve, 153,846 fr. to the directors, 923,078 fr. to the preference shareholders, 3,300,030 fr. to the ordinary shareholders, and to carry forward 12,536 fr. The directors in their report state that the works may now be said to have been entirely reconstituted after the war, and that the productive capacity is greater than before the hostilities. So far they have not been affected by the industrial crisis. Although the orders on hand will keep the works going for some considerable

time, a slight falling off in new demands has, however, been experienced. In view of the many railway electrification schemes at present projected in France, a proposal that the concern should be amalgamated with the *Société des Forges et Ateliers de la Longueville* is to be submitted to the shareholders.

The *Compagnie Continentale Edison*, of Paris, reports a loss of 65,565 fr. for the last financial year, reducing the credit balance in the balance sheet to 60,505 fr.

The accounts of the *Compagnie Française des Câbles Télégraphiques* for 1920 are reported to show net profits of 10,991,000 fr., as compared with 6,596,000 fr. in 1919. In the latter year the dividend was at the rate of 23.63 fr. per ordinary share, and an increase is expected for 1920.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Melbourne Electric Supply Co.—£37,451 consolidated ordinary stock and 30,000 8 per cent. first cumulative preference shares of £5 each, fully paid (Nos. 1 to 10,000 and 80,001 to 100,000).

Application has been made to the Committee to allow the following to be officially quoted:—

Penambuco Tramways and Power Co., £500,000 eight per cent. Prior Lien Debentures, Nos. 1 to 5,000 of £100 each (bearer).

Dundee, Broughty Ferry & District Tramway Co.—The profit for the year ended July 31st, including £509 brought forward, was £6,682, less interest on debenture stock £1,199. Dividend on ordinary shares at the rate of 7 per cent. per annum, less tax, to reserve £1,500. Carry forward £474.

Still Engine Co., Ltd.—According to the *Financier*, the balance sheet of this company at March 31st, 1921, shows issued capital of £220,000; sundry creditors and credit balances, £1,209; total, £221,209. Credit: Goodwill, patents, and other assets acquired, £154,074; plant and machinery, £10,102; furniture, £1,000; stores, £1,030; experimental and research expenditure, £23,251; head office expenses, after deducting deposit interest, discount on Treasury bills and transfer fees, £6,469; preliminary and formation expenses, £3,126; underwriting commission, £3,750; sundry debtors and debit balances, £1,069; Treasury bills, at cost, £9,850; cash at banks and in hand, £7,438; total, £221,209. According to the same contemporary, the company is about to create £75,000 8 per cent. debentures, redeemable in 12 years at 110 per cent. Part will shortly be issued to shareholders at par.

Austria.—The report of the A.E.G. Union Elektrizitäts Gesellschaft, of Vienna, for last year shows a profit of no less than 13,540,000 kr. as compared with only 2,210,000 kr. in the preceding 12 months. The dividend is being increased from 8 per cent. on a capital of 24,000,000 kr. to 12 per cent. on 100,000,000 kr. The directors also propose that the capital should be again increased to 225,000,000 kr.

British Aluminium Co., Ltd.—A dividend at the rate of 5 per cent. per annum, less tax, on ordinary shares for the six months ended June 30th.

New Issues.—Messrs. *Lazard* have purchased debenture stock from the Newcastle-upon-Tyne Electric Supply Co. (£633,109 4½ per cent. first mortgage and £100,000 5 per cent. second), and are offering this to the public at 73.

The financial Press states that a block of £130,000 5½ per cent. debenture stock of the *Yorkshire Electric Power Co.* has just been privately placed.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—Interim dividend on ordinary of 6d. per share, less tax, and usual dividends on preference.

Stewarts & Lloyds, Ltd.—Interim dividends for the half-year ended June 30th, at the rate of 6 per cent. per annum, on the preference at the rate of 10 per cent. per annum, on the preferred ordinary.

Globe Telegraph and Trust, Ltd.—Quarterly interim dividend of 3s. per share on preference, less tax, and 5s. per share on ordinary.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Interim dividend for the quarter ended June, 5s. per share free of tax.

Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less tax for the quarter ending September, on the preference stock, and a second quarterly dividend of 2½ per cent. on the ordinary stock free of tax.

Western Telegraph Co., Ltd.—Dividend of 5s. per share, making a total of 10 per cent. free of tax, for the year ended June 1921.

Browett, Lindley & Co., Ltd.—Interim dividends of 6 per cent. on the preference shares and 4 per cent. on the ordinary, less tax, are announced in the *Financier*.

Lancashire Dynamo & Motor Co., Ltd.—Interim dividend of 9d. per share, tax free, on ordinary.

Clarke, Chapman & Co., Ltd.—An interim dividend of 5 per cent., less tax, is announced on the ordinary shares.

Mackay Companies.—A dividend of 1½ per cent., less tax, for the quarter is announced.

STOCKS AND SHARES.

TUESDAY EVENING.

THE latest development through across the path of Stock Exchange business is the renewed stamp in the value of the German mark and the French franc. The movements occurred simultaneously. The stamp in the value of the marks, which has made it worth 20 to a shilling, is declared traceable to the latest payment of German indemnity. One indirect result is the fact that, with the mark about 100 to the pound, German manufacturers are able to quote prices for electrical machinery, &c., at levels which greatly under-cut those asked by British manufacturers. Several of the big users of machinery have notified their intention of waiting until British prices come down before they make the purchases which should assist the employment of British workmen, but those to whom prices are an immediate object are placing orders in Germany now.

Shares in the electrical manufacturing companies are not much influenced one way or the other by such trade developments. Some of the stocks and shares are, indeed, a little better. Edisons have risen 1s. 6d. to 7s. 6d. Electric Construction Debenture at 52 is 2 points up; Metropolitan-Vickers Preference at 113.16 have recovered the half-down which they shed last month. General Electrics and other similar shares keep fairly steady, and there is still a good demand for well-secured debenture and sound preference issues.

North Metropolitan Electric and Metropolitan Electric Debenture stocks are both 8½ premium. Thames Valley Electric Power 6 per cent. Debentures have improved to 1½ premium, and the similar Southland Electric Debentures—both these issues are guaranteed by the New Zealand Government—stand better at 1½ premium. The General Electric new debenture stock has gone back to 97—the cumulative dividend price. Amongst engineering issues, Baldwin 7½ per cent. debentures, which came out at 95, have risen to 1½ premium. The iron, coal and steel group shows a disposition to dulness, owing to several disappointing dividends which have recently been declared. Armstrongs, for instance, have announced an interim dividend of 6d., as against the 1s. per share this time last year. The price is accordingly a little lower at 18s. There is some talk of the company having secured a huge contract which will provide work for a couple of years. This may be merely gossip, but the steadiness of the price suggests that there may be something in the rumour. Babcock & Wilcox dropped to 27.10.

Electricity supply issues are again a good market. In fact, it is difficult to get the offer of stock. People who want to buy such shares as County of London Electrics, for instance, will find themselves met with the report that jobbers are buyers only, and have no shares to offer. The same state of affairs obtains in a number of shares in this market. City of London ordinary, however, can still be bought about 28s. 9d. A demand for Bournemouth & Poole ordinary discovered the market bare of stock. The shares have not changed hands for five months, and the last recorded deal took place at 5½, the 4½ per cent. preference shares having been done a month earlier at 5½. This last is still the nominal quotation of the shares, but, as with the ordinary, there are none to be obtained. Westminster were done at the end of last week at £5 18s., and Metropolitans are up ¼ to 4.

A further issue of Newcastle-upon-Tyne Electric Supply debenture stocks, of both classes, is being offered at 73. Yorkshire Electric Power 5½ per cent. debenture is now quoted ex the dividend payable in October, and the price is 83 free of stamp and fee. At this, the return comes to £6 12s. 6d. to the buyer, or, allowing for redemption in 1944 at par, the yield is raised to just over 7 per cent. on the money. English Electric 8 per cent. six-year Notes are offered at 97, giving a return of 8½ per cent. flat. These are redeemable in 1927 at 103, or after 1923 at the same price. Calcutta Electric Supply 5 per cent. 1st mortgage convertible debenture stock can be bought at 98. The return at this price is £5 2s. 6d. per cent. net, the interest being paid free of tax. The right of conversion entitles holders of the debenture stock to exchange 25 of this security for £7 10s. in ordinary shares between June, 1922, and June, 1925. The present price of the ordinary shares is 21s. 3d., so the conversion has no value for the time being.

Amongst the few preference shares on offer may be mentioned Notting Hill 6 per cent. non-cumulative £10 shares at 7½, with dividends in January and July, affording 8 per cent. on the money. Indian Electric Supply 7 per cent. non-cumulative preference at 16s. 6d. return 8½ per cent., and General Electric 7½ per cent. "B" preference at 18s. 9d. yield 8 per cent., which is 11s. 6d. per cent. more than the return at the present price on the company's 6½ per cent. "A" preference shares. There are a few Charing Cross, West End 4½ per cent. preference offered at 3, which pay 7½ per cent. on the money, the dividends being due in February and August.

Owing to the manner in which the New York exchange has moved, there is a good deal of inquiry for securities the coupons on which are payable in London and New York. Most of the Mexican utility bonds are eligible in this respect. For instance, the coupons on Mexico Tramway Fives are payable in London, New York, Canada, Berlin and Switzerland.

The Mexican Light & Power coupons can be cashed in London, New York and Canada, and the same applies to the 5 per cent. first mortgage gold bonds of the Mexican Electric Light Co. Rio Tramway bonds of both classes, San Paulo Tramway fives and Shawinigan Water & Power issues are amongst these carrying coupons which can be cashed in London or Canada, several of them being payable also in New York. It need hardly be pointed out that the Mexican companies have only just resumed payment of interest after an abatement of about seven years. The feature amongst foreign stocks is the way in which Brazilian Tractions are recovering. The price has risen to 30½, and the demand appears to come from New York and Paris. The last dividend the company paid was in March, 1917, but the 6 per cent. cumulative preference shares have received their dividends throughout, and at the present price of 76½—the coupons being payable quarterly in London and Canada—the return works out to £7 16s. 6d. per cent. on the money.

Globe Telegraph ordinary shares at 16½ have arrived at the same level as Eastern Extension shares, while Eastern ordinary at 163½ is a point up. Marconis, after touching 1 15/16, went back to 1½, which still leaves them 1 1/16 higher on the week. United River Plate Telephones at 6 are ½ down. The Anglo-American list is steady, and other cable stocks and shares show little variation, except that some of the dollar stocks are better on balance.

Districts at 17 are ½ down, and Underground Electric Incomes at 75½ show a fall of a point, the railway market as a whole being drab and uninteresting. No improvement has occurred in the rubber share market, where conditions continue to fight against the producer. The latest burden which certain of the companies are called upon to bear is the imposition of heavy fresh taxation in the Dutch East Indies.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.									
	Dividend		Price						Yield.
	1919.	1920.	Sept. 13.						
Brompton Ordinary	12	12	6½	—	—	—	—	—	29 8 2
Charing Cross Ordinary ..	7	7	8 4	—	—	—	—	—	9 8 4
do. do. 4½ Pref. ..	4½	4½	8½	—	—	—	—	—	9 8 4
Chelsea	4	4	8½	—	—	—	—	—	9 8 4
City of London	18	14	182	—	—	—	—	—	10 8 0
County of London	8	8	175	—	—	—	—	—	9 17 2
do. do. 6 per cent. Pref. ..	6	6	92	—	—	—	—	—	8 15 4
do. do. 6 per cent. Pref. ..	6	6	92	—	—	—	—	—	8 15 4
Kensington Ordinary ..	7	7	92	—	—	—	—	—	10 16 4
London Electric	24	24	248	—	—	—	—	—	9 17 2
do. do. 6 per cent. Pref. ..	6	6	92	—	—	—	—	—	10 8 0
Metropolitan	6	7	94	—	—	—	—	—	8 15 0
do. do. 4½ per cent. Pref. ..	4½	4½	94	—	—	—	—	—	7 16 0
St. James' and Pall Mall ..	12	12	62	—	—	—	—	—	9 4 8
South London	6	7	96	—	—	—	—	—	10 13 2
South Metropolitan Pref. ..	7	7	159	—	—	—	—	—	8 17 10
Westminster Ordinary ..	10	10	62	—	—	—	—	—	8 13 10
TELEGRAPHS AND TELEPHONES.									
Anglo-Am. Tel. Pref. ..	6	6	86	—	—	—	—	—	6 19 6
do. do. Def. ..	14	14	172	—	—	—	—	—	8 14 2
Chile Telephone	6	6	102	—	—	—	—	—	5 14 3
Cuba Sub. Ord.	7	7	74	—	—	—	—	—	6 1 0
Eastern Extension	10	10	168	—	—	—	—	—	6 1 0
Eastern Tel. and Ord. ..	10	10	163	—	—	—	—	—	8 2 4
Globe Tel. and T. Ord. ..	10	10	168	—	—	—	—	—	6 1 0
do. do. Pref.	6	6	94	—	—	—	—	—	6 6 4
Great Northern Tel. ..	22	24	250	—	—	—	—	—	9 10 0
Indo-European	10	10	80	—	—	—	—	—	8 8 8
Marconi	25	25	124	—	—	—	—	—	8 0 0
Oriental Telephone Ord. ..	12	12	24	—	—	—	—	—	*6 16 8
United R. Plate Tel. ..	8	8	6	—	—	—	—	—	*6 13 4
West India and Panama ..	Nil	Nil	108	—	—	—	—	—	Nil.
Western Telegraph	10	10	168	—	—	—	—	—	*6 1 2
HOME RAILWAYS.									
Central London Ord. Assented ..	—	—	47½	—	—	—	—	—	8 8 6
Metropolitan	13	13	26	—	—	—	—	—	6 0 0
do. District	Nil	Nil	17	—	—	—	—	—	Nil
Underground Electric Ordinary ..	Nil	Nil	24	—	—	—	—	—	Nil
do. do. "A"	Nil	Nil	105	—	—	—	—	—	Nil
do. do. Income	4	4	75½	—	—	—	—	—	*3 19 5
FOREIGN TRAMS, &c.									
Anglo-Arg. Trams, First Pref. ..	54	12½	32	—	—	—	—	—	10 0 0
do. do. 2nd Pref.	14	14	176	—	—	—	—	—	10 0 0
do. do. 5½ Deb.	6	6	382	—	—	—	—	—	7 17 2
Brazil Tractions	Nil	Nil	304	—	—	—	—	—	Nil
British Columbia Elec. Rly. Pref. ..	6	6	60	—	—	—	—	—	8 6 8
do. do. Preferred	6	6	55	—	—	—	—	—	*11 2 2
do. do. Deferred	8	8	124	—	—	—	—	—	*11 3 2
do. do. Deb.	14	14	694	—	—	—	—	—	7 2 10
Mexico Trams 6 per cent. Bonds ..	Nil	Nil	95	—	—	—	—	—	+1
do. do. 6 per cent. Bonds ..	Nil	Nil	95	—	—	—	—	—	+1
Mexican Light Common	Nil	Nil	9	—	—	—	—	—	Nil
do. Pref.	Nil	Nil	164	—	—	—	—	—	Nil
do. 1st Bonds	Nil	5	454	—	—	—	—	—	10 6 0
MANUFACTURING COMPANIES.									
Babcock & Wilcox	15	16	27	—	—	—	—	—	8 11 2
British Aluminium Ord. ..	16	16	176	—	—	—	—	—	11 8 6
British Insulated Ord. ..	15	15	14	—	—	—	—	—	9 12 0
Callenders	15	15	174	—	—	—	—	—	10 8 8
do. 6½ Pref.	64	64	140	—	—	—	—	—	6 19 8
Crompton Ord.	14	14	146	—	—	—	—	—	13 16 0
Edison-Swan	10	—	7/6	—	—	—	—	—	+1/5
do. do. 5 per cent. Deb. ..	6	6	88	—	—	—	—	—	7 7 1
Electric Construction	10	10	169	—	—	—	—	—	11 18 10
English Electric	8	8	127	—	—	—	—	—	14 8 0
do. Pref.	6	6	84	—	—	—	—	—	8 11 6
Gen. Elec. Pref.	64	64	176	—	—	—	—	—	7 8 0
do. Ord.	10	10	200	—	—	—	—	—	10 0 0
Hewley	15	15	16	—	—	—	—	—	10 5 0
do. 4½ Pref.	44	44	82	—	—	—	—	—	6 18 6
India-Rubber	10	—	74	—	—	—	—	—	—
Mos. Vickers Pref.	8	8	14	—	—	—	—	—	*16 10
Siemens Ord.	10	10	8	—	—	—	—	—	*8 8 2
Telegraph Ord.	30	30	312	—	—	—	—	—	*6 18 1

* Dividends paid free of Income Tax.

THE BRITISH ASSOCIATION.—II.

On Wednesday afternoon, the 7th inst., prior to the inaugural meeting, Dr. E. J. Russell, F.R.S., of the Rothamsted Experimental Station, delivered a lecture to an audience of farmers and agricultural students upon "Science and Crop Production." The chemical aspect of the question was dealt with very fully, but only a passing mention was made of the use of high pressure electrical discharges for the improvement of production; the names of Miss Dudgeon and Prof. V. H. Blackman were mentioned in this connection.

An extremely large gathering at the Usher Hall in the evening heard with regret that, owing to indisposition, the President was unable to be present. Prof. W. A. Herdman, the retiring president, spoke of his satisfaction in appearing for a short time as President of the Association in his native city of Edinburgh, and briefly outlined the achievements of his successor, Sir Edward Thorpe, making special reference to the "Magnetic Survey of the British Isles," which he carried out with Sir Arthur Rucker (a former president) just prior to 1896. Sir Alfred Ewing, Vice-President, then read Sir Edward Thorpe's address. The reading ended, Lord Provost Hutchison moved a vote of thanks to the President and welcomed the Association to the city. Sir James Dewar seconded the vote, and Sir Alfred Ewing briefly responded.

A record of the Association's proceedings would be incomplete without mention of the valuable handbook issued to members. This is entitled "Edinburgh's Place in Scientific Progress"; it deals with all branches of science, and is an excellent record of the contributions of many famous Scotsmen to the advancement of knowledge. The mathematical section is particularly interesting, as it shows the connection of Edinburgh, through Michael Scot, the "Wizard," with science in the early days—the twelfth century. A number of portraits are included—the frontispiece being a likeness of the famous John Napier, the discoverer of the logarithmic function and the inventor of logarithms. The part devoted to engineering touches upon the works and inventions of such men as Nasmyth and Robert Stephenson. The volume is well worth the six shillings charged for it.

On Thursday the heavy programme of meetings in each section was commenced. The addition of two or three papers to the Physics Section's list caused congestion, and Mr. Campbell Swinton's paper (abstracted in our last issue) was read rather later than arranged. In this section business was resumed in the afternoon, when Mr. J. J. Dowling demonstrated a recording ultramicroscope, and Dr. Dawson Turner and Mr. Crombie conducted experiments with a pith ball in ionised atmospheres. In Section B—Chemistry, Dr. M. O. Forster, F.R.S., delivered his presidential address on "The Laboratory of the Living Organism." Sections F—Economics, J—Psychology, and L—Education, combined in a discussion upon "Vocational Training and Tests." Among the visits and excursions arranged for Thursday afternoon was an inspection of Messrs. Bruce Peebles' works at Granton Road. About two dozen members of the Engineering Section availed themselves of the opportunity, and members of the firm's staff conducted the visitors and gave a great deal of information. The power-house was first inspected, and there was seen the firm's original steam-driven d.c. plant running in parallel with a converter dealing with power from the Edinburgh Corporation's mains. The building-up of various types of machines was studied, and the visitors watched with interest the processes of coil-winding, commutator building, the stamping of laminations for poles and rotor cores, and the multitudinous other operations involved in this class of work. The visitors were shown two large shearing machines, capable of dealing with 1½-in. steel plates, one purely hydraulic and the other half hydraulic and half electric. A machine for forming boiler tubes was also seen. Upon the conclusion of

the visit, Prof. Bacon, on behalf of the Association, thanked Messrs. Bruce Peebles and the ladies of the party for a very instructive afternoon. In the evening the Lord Provost, Magistrates, and Council of the city held a reception at the Royal Scottish Museum.

The business of Section G on Friday morning was devoted exclusively to the study of water-power development and its problems. The President's address, which gave a very good idea of the potentialities both in the British Empire and outside it, is abstracted below. Prof. Baily dealt with the utilisation of very small water-power sources, and developed a scheme for linking these up to aid a large steam-driven central station, a system which would receive power from the central station in times of water shortage. Prof. Lea, who could not secure time to read his paper fully, confined his attention almost wholly to a study of the Severn scheme, giving a number of curves plotted from personal observations of the action of the tides in the estuary. It was found impossible to discuss these papers, for the morning had been fully taken up, but the President reiterated the appeal made, both in his own address and by the two last speakers, for the establishment of a special department or laboratory for the exclusive study of the proper utilisation of water power. The address of Prof. Richardson to the members of Section A—Physics, was acclaimed as a masterly exposition of the present state of the science of thermionic emission and its concomitants. Sir Oliver Lodge, in proposing a vote of thanks to the President, showed the bearing of thermionic emission on the differences of various authorities upon the question of contact electricity, giving examples of the action between pairs of dissimilar metals such as copper and zinc and bismuth and antimony. Sir Dugald Clerk seconded the vote, and spoke of the importance of the study of thermionic emission to the engineer, mentioning the views of Joule and Kelvin upon the subject of contact electricity.

In Section F—Economics, the morning was occupied by the reading and the discussion of Mr. Hichens's address. The discussion was opened by Mr. Austen Hopkinson, M.P., who gave it as his opinion that industrial arbitration was as futile as international arbitration. He thought that the Whitley principle was wrong in that it pre-supposed an existing conflict between capital and labour when such was not the case. These were not absolutely separate entities; their interests were bound up with one another. He spoke of his experience in connection with a profit-sharing scheme, stating that the employees concerned wished the business to be extended, but were told that the money which might have been used for this purpose had been distributed among them. The employees were not willing, of course, to find the funds themselves. Mr. H. F. G. Burgess, speaking from the employees' point of view, acknowledged the difficulty of fixing a standard wage in any industry. It seemed to him that a standard wage was one agreed upon after a conflict between employers and employed. This speaker caused some amusement by suggesting a standard wage for employers, adding that they should be made to earn it. Mr. Arnold Lupton said that arbitration was very often a failure, and instanced the case of a firm which had accepted a wages award made by a Whitley Council but had found itself unable to pay it, and as a consequence had had to shut down. Sir William Beverley urged greater publicity regarding profits, not necessarily those of individual firms, but principally those of whole industries. Lady Martin appealed for the better education of workers in the principles of economics. Section F also had a busy afternoon, when Mrs. B. Wootton read a paper on "Self-supporting Industries: an Inquiry into the Principle of Regulating Wages and Provision against Unemployment in Accordance with Industrial Capacity"; Prof. A. W. Kirkaldy spoke on "The Wages System and Possible Developments", and Sir

Josiah Stamp, K.B.E., dealt with "The Taxable Capacity of a Country." The visits made by the various sections on Friday afternoon included a trip to the Brunton Wire Mills by Section G, and members of Section A went to the Royal Observatory. On Friday evening, Prof. C. E. Inglis described the construction of the Forth and Quebec Bridges, and the evolution of cantilever bridge construction, in the Usher Hall.

Notes on Water Power Development.

PRESIDENTIAL ADDRESS, BY PROF. A. H. GIBSON, D.Sc.
(Abstract.)

Section G.—Engineering.

The extent to which the water powers of the world have been investigated and developed during the past decade forms one of the striking engineering features of the period; two-thirds of the water power at present in use has been developed within the last ten years. The technical development of electric generation and transmission has made it economically possible to utilise powers remote from any industrial centre, while a rapid increase in the demand for energy for general industrial purposes, combined with the world shortage of fuel, has been responsible for an unprecedented rate of development in most countries with available water power resources, and especially in countries normally dependent on imported fuel. Thus in France some 850,000 water h.p. has been put into commission since 1915, and the country now has 1,600,000 h.p. under control, as compared with 750,000 before the war. In Switzerland some 600,000 h.p. has been developed since 1914, or is in course of development, as compared with 880,000 h.p. before the war. In Spain, where the pre-war output was 150,000 h.p., the present output is 620,000 h.p., and about 260,000 h.p. is now in course of development, while the Ministerio de Fomento is considering the development of some 2,000,000 h.p. to be delivered into a network of transmission lines covering the industrial parts of the country. In Italy, schemes totalling about 300,000 h.p. are under way, and it is estimated that the total output will shortly amount to 2,000,000 h.p. Japan, which only very recently began to investigate her water powers, has, since 1916, developed over 1,000,000 h.p., or almost 20 per cent. of her available resources. In Canada and the United States many large schemes have recently been brought into service, and some extremely large installations are now in course of construction or are projected. In Canada the total development (2.3 million h.p.) in 1918 was almost three times as great as in 1910. In the United States of America the development has increased from something under two million h.p. in 1901, to 5.3 millions in 1908, and to nearly 10.0 millions in 1921.

Estimates of potential power are always to be accepted with considerable reserve, as there is as yet no standard basis on which potential power is computed. Estimates of potential power based on storage capacity are subject to a wide margin of error owing to the limited data available, and in a table given in the paper the potential water power is estimated on the basis of the maximum flow, and in terms of continuous 24-hour power. Adopting the figures in the table, it would appear that the available horse-power of the world is of the order of two hundred millions, of which approximately 25 millions is at present developed or is in course of development. With the noteworthy exceptions of Canada and New Zealand, practically nothing has been done, prior to 1915, by any part of the British Empire, to develop or even systematically to investigate the possibilities of developing its water powers. The Water-power Committee of the Conjoint Board of Scientific Societies has come to the conclusion that the total available water power resources of the Empire are equivalent to between 50 and 70 million h.p. Of the developed power in the Empire about 80 per cent. is in Canada. Throughout the remainder of its territories only about 700,000 h.p. is as yet developed, or only a little over 1 per cent. of the power available, a figure which compares with about 24 per cent. for the whole of Europe, and 21 per cent. for North America, including Canada and the U.S.A.

The Board of Trade Water Power Resources Committee, appointed in 1918, has carried out preliminary surveys of as many of the more promising sites as its limited funds allowed. As might be anticipated, Scotland possesses relatively greater possibilities than the remainder of the United Kingdom. Nine schemes examined by the Committee have an average output ranging from 7,000 to 40,000 continuous 24-hour h.p., and an aggregate capacity of 183,000 h.p. The aggregate output of the Scottish schemes is roughly 270,000 continuous h.p. It is probable that there are water-power sites in the country capable of developing the equivalent of 400,000 continuous h.p., or 1,500,000 h.p. over a normal working week. Owing to the general flatness of the gradients, there are, except possibly around Loch Lomond, no schemes of any large individual magnitude in England, but there are a large number of powers ranging from 100 to 1,000 h.p. which might be developed from river flow uncontrolled by storage. Investigations on a few typical watersheds throughout England and Wales appear to show that the possible output averages approximately eight continuous horse-power per square mile of catchment area, which would be equivalent to an aggregate of about 450,000 h.p.

In the report recently issued by the Irish Sub-committee of the Board of Trade Water-power Committee, it is estimated that approximately 500,000 continuous 24-hour h.p. is commercially available in Ireland. The capacity of the fuel power plants installed for industrial and public utility services in the United Kingdom in 1907 was approximately 9.8 million h.p. Allowing for an increase of 15 per cent. since then, and an average load factor of 35 per cent., this is equivalent to 32,000 million h.p.-hours per annum, or to a continuous 24-hour output of only 3.7 million h.p. According to Sir Dugald Clerk, the average consumption of coal per h.p.-hour in this country is about 3.9 lb., which, on the above basis, would involve a total annual consumption of 55 million tons for industrial purposes, not including railways or steamships. It thus appears that the inland water power resources of the United Kingdom are capable of supplying about 27 per cent. of this.

There is a probability that two of the larger schemes in Scotland will be developed in the near future. One of these—the Lochaber scheme—is capable of developing some 72,000 continuous h.p., which is to be utilised largely in the manufacture of aluminium. The second—the scheme of the Grampian Power Co.—is intended ultimately to develop upwards of 40,000 continuous h.p., which it is proposed to use largely for general industrial purposes. In view of their direct and indirect advantage to the community it would appear not unreasonable to advocate that financial assistance should be granted by the State in the earlier stages of such developments.

The consumption of coal in the best modern steam plant of large size, giving continuous output, would be about nine tons per h.p.-year, and on this basis the world's available water power if utilised would be equivalent to some 1,800,000,000 tons of coal per annum. The world's output of coal in 1913 was approximately 1,200,000,000 tons, of which about 500,000,000 tons were used for industrial power purposes, so that on this basis 55,000,000 continuous water h.p. would be equivalent to the world's industrial power at that date. While a large proportion of the energy developed from water power is utilised for industrial purposes and for lighting, power, and traction, an increasing proportion is being used for electrochemical and electrometallurgical processes. The electrification, on a large scale, of trunk line railways is also a probability in the not distant future. In the U.S.A. 650 miles of the main line of the Chicago, Milwaukee, and St. Paul Railway, comprising 850 miles of track, has been electrified, the power for operation being obtained from hydro-electric stations. In France much of the track of the Compagnie du Midi has been electrified with the aid of water power; much of the Swiss railway system has been electrified; and the electrification of many other trunk lines on the European continent is at present under consideration. Much energy is now being utilised in the U.S.A. for purely agricultural purposes.

The large amount of attention which has been concentrated on the various aspects of water power development during the past ten years has been responsible for great improvements such as increasing the size, capacity, reliability, and efficiency of individual units; of improving the design of the turbine setting and of the head and tail works; of increasing the rotative speed of low head turbines; of detailed modifications in the reaction type of turbine to enable it to operate under higher heads than have hitherto been considered feasible; and of increasing the transmission voltage. One of the great drawbacks of the low-head turbine in the past has been its relatively low speed of rotation, which necessitated either a low-speed, and consequently costly, generator, or expensive gearing. As a result of experiment it has, however, been possible so to modify the form of the runner as greatly to increase the speed of rotation under a given head without seriously reducing the efficiency. Until comparatively recently the Pelton wheel was looked upon as the only practicable turbine for high heads, and the use of the Francis turbine was restricted to heads below about 400 ft. In the earlier Francis turbines, when operating under heads involving high speeds of water flow, corrosion of the runner was very serious. A newly-constructed hydro-electric plant has often to compete in the market with a steam plant built in pre-war days, whose standing charges are comparatively low, and in order to enable it to do so with success the constructional cost must often be reduced to a minimum compatible with safe and efficient operation. There appears to be ample scope for investigation into the possibility of reducing the first cost by modifying many of the details of design and methods of construction now in common use, e.g., by the elimination of the dam in storage schemes in which natural lochs or reservoirs are utilised, this water level being drawn down in times of drought instead of being raised in times of flood; the substitution, where feasible, of rockfill dams for those of masonry or monolithic concrete; the introduction of outdoor installations with the minimum of power house construction; and the simplification of the power plant. Among the many questions still requiring investigation on the civil and mechanical sides may be mentioned: Investigation of turbine corrosion; bucket design in low-head high-speed turbines; questions affecting the design of canals and tunnels; methods of construction of dams; and run-off data.

While such data may be obtained either from stream gaugings or from rainfall and evaporation records, the former method is by far the more reliable. Useful results would

follow the initiation of a systematic scheme of gauging applied to all streams affording potential power sites. Among other questions which are ripe for investigation may be mentioned: The combined operation of steam and water-power plants; the relative advantages of high voltage d.c. and a.c. generation and transmission for short distances; and the operation of automatic and semi-automatic generating stations.

The question of tidal power has received much attention during the last few years. Many suggestions for utilising the tides by the use of current motors, float-operated air compressors, and the like have been made, but the only practicable means of utilising tidal energy on any large scale would appear to involve the provision of one or more dams, impounding the water in tidal basins, and the use of the impounded water to drive turbines. If some electrochemical or electrophysical process were available, capable of utilising an intermittent energy supply subject to variations, the value of tidal power would be greatly increased. Various schemes have been suggested for obtaining a continuous output by the co-ordinated operation of two or more tidal basins separated from each other and from the sea by dams with appropriate sluice gates. This method, however, can only get over the difficulty of equalling the outputs of spring and neap tides if it be arranged that the maximum rate of output is that governed by the working head at the lowest neap tide, in which case only a small fraction of the available energy is utilised. Among the hydraulic, mechanical, and electrical problems involved may be mentioned: The most advantageous cycle of operations as regards working periods, mean head, and variations of head; the best form of turbine; the best method of operation; constant or variable speed; whether the generators shall be geared or direct driven; and whether generated power shall be direct or alternating current.

A research laboratory is required with facilities for experiments on the flow of water on a fairly large scale; for carrying out turbine tests on models of sufficient capacity to serve as a basis for design; and, if possible, working in conjunction with one or more of the hydro-electric stations already in existence. As a result of representations made by the Water Power Committee of the Board of Health, it is understood that it has now been decided to initiate a Chair of Hydro-Electric Engineering in some university.

Long-distance Transmission of Electrical Energy with Special Reference to Tidal Power.

By T. F. WALL, D.Sc., &c. (Abstract.)

Section G.—Engineering.

INTRODUCTORY.—The utilisation of tidal power for the generation of electricity involves a peculiar and difficult problem arising from the extremely large variation of speed of the turbines under the varying head of water.

According to the reports appearing in the Press, the proposals of the Ministry of Transport for the Severn scheme provide for an average development of 500,000 h.p. over a 10-hour day. The scheme involves the use of special d.c. generators driven by water turbines, these generators being so designed that each machine will develop about 1,300 kW at a constant pressure of 525 V, and at a speed varying from 300 to 500 r.p.m. The d.c. so generated would then be supplied to rotary converters giving a.c. at 320 V, and by means of static transformers this pressure would be raised to 60,000 V, which would be the pressure of transmission to the Midlands. Transmission to London—a distance of 115 miles—is suggested, at a pressure of 120,000 V.

Owing to the varying speed of the turbines, the use of a.c. generators driven by the turbines is, in the ordinary way, not practicable, since the generated e.m.f. would be of varying frequency—viz., for the speed range given above, the maximum value of the frequency would be 1.66 times the minimum value. Moreover, unless elaborate automatic arrangements were made, the generated e.m.f. would also vary

It is clear that the proposal to generate 500,000 h.p. by means of 1,300 kW d.c. sets, and then to convert to a.c. by means of rotary converters, would involve an immense number of machines. The duplication of machines necessary owing to the generation in the first instance as d.c., and then conversion to a.c., is a very serious matter, and the capital outlay for these machines alone would probably be sufficiently large to imperil the feasibility of the scheme.

The purpose of the paper is to give very briefly a preliminary outline of an alternative system obviating the difficulty of the varying speeds of the turbines. The system permits of the use of a.c. generators driven directly from the turbines, and it is expected that an appreciable saving in capital outlay will result. The system also presents other advantageous features.

Briefly stated, the scheme involves the generation of a.c. at such a frequency that the length of the transmission line at one turbine speed (viz., the lowest) will be equal or approximately equal to one-quarter the wave length of the travelling waves of p.d. and current which will be established in the line. As the speed of the turbines increases, so will the frequency of the generated a.c. increase correspondingly, and if the excitation is constant, the generated e.m.f. will also increase correspondingly. As the frequency increases, the wave length decreases, so that, if at the lowest speed the length of the line is one-quarter wave length, then at double

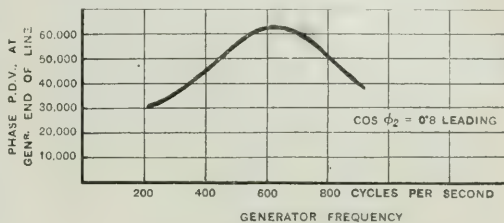


FIG. 2.

this speed the length of the line will be one-half wave length. Assuming constant current at the receiving end of the line, it is shown that, notwithstanding the rise of the generator voltage as the speed rises, the voltage at the receiver's end of the line will remain constant. The arrangements thus result in an a.c. supply, at the receiver's end of the line, of constant voltage and variable frequency.*

So long as the p.d. is constant and the frequency is high, a variable frequency is not objectionable for heating and lighting apparatus. In order to obtain a supply suitable for driving motors, &c., it is proposed to obtain d.c. by means of mercury arc rectifiers, and it is shown that, by such means, a constant a.c. voltage of variable frequency, generated and transmitted in the manner already described, may be transformed to a d.c. supply of constant current and very approximately constant voltage.

GENERATION AND TRANSMISSION.

The author develops a number of equations expressing the relationships between line constants and the voltage and current vectors at the receiving and generating ends of the line respectively, for quarter-, half-, and three-eighth-wave length conditions. An actual example is worked out for the three conditions, and the results are summarised in the curves (figs. 1, 2, and 3), which show the phase p.d. which is necessary at the generator end of the line in order that the phase p.d. at the receiver's end of the line shall remain constant with varying generator frequency. In each case it is assumed that the load at the receiver's end of the line is constant and equal to 15,000 kW.

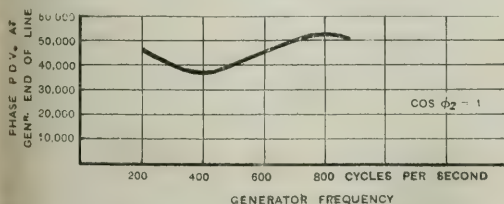


FIG. 1.

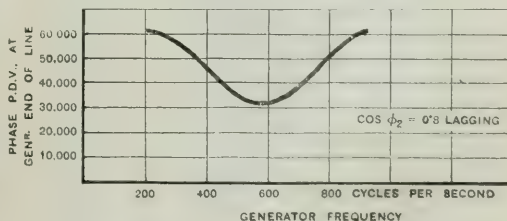


FIG. 3.

in magnitude more or less in proportion with the speed variation.

Such large variations of frequency and e.m.f. would be impracticable for feeding a distribution system, for the obvious reasons that motors, such as induction or synchronous motors, would have similar speed variations independently of the requirements of the consumer, and lighting and heating appliances could not be operated from a system the pressure of which widely varied.

Fig. 1 shows the conditions for unity power factor at the receiver's end of the line, that is, $\cos \phi_2 = 1$; line current = 96 A. Fig. 2 shows the conditions for $\cos \phi_2 = 0.8$ leading; line current = 120 A. Fig. 3 shows the conditions for $\cos \phi_2 = 0.8$ lagging; line current = 120 A.

* The principles of quarter-wave and half-wave transmission were explained in the ELECTRICAL REVIEW of August 15th, 1921, and following issues.

MERCURY ARC RECTIFICATION AT THE RECEIVER'S END OF THE LINE.

Assuming that the rectified load per phase is 5,000 kW, viz., 2,500 A at 2,000 V, and assuming values for the reactance and resistance of the rectifier circuit and load, the following values have been calculated for the p.d. which is necessary at the secondary terminals of the transformer to which the rectifier is connected. The calculations are based on the assumption that the d.c. voltage and current are kept constant at the values given above.

Frequency of supply (cycles per second)	P.D. at secondary terminals of the transformer to which the Rectifier is connected.
800 cycles per second	5,900 volts
400 cycles per second	5,500 volts
100 cycles per second	3,550 volts

It thus appears that for 100 per cent. variation in the frequency, viz., from 400 to 800 cycles per second, it is only necessary that the p.d. should vary by 7 per cent. in order that the rectified current and pressure should remain constant.

As already stated, for lighting and heating purposes it would not be necessary to rectify the variable frequency alternating current. If the voltage drop with increase of frequency were troublesome in the distribution system, this could be compensated for by allowing the voltage at the receiver's end of the line to rise by a definite percentage as the frequency increased instead of maintaining this voltage constant.

It will be observed that the proposals put forward involve the existence of a consumers' load of constant magnitude. If a large industrial area is supplied, such constancy of load is not difficult to obtain and, by the establishment of electro-chemical and metallurgical industries in or near the areas supplied, a practically constant load could be ensured. The extremely good load factor so obtained would ensure practically ideal conditions as regards minimum cost of supply.

THE CENTRIFUGAL PURIFICATION OF OIL.

THE DE LAVAL METHOD OF TREATING LUBRICATING AND TRANSFORMER OILS.

It has long been known that centrifugal force has the same effect as gravity, many times multiplied, and that by its use liquids of different specific gravities are readily separated, and solid impurities can be removed. Besides being very much more speedy than the ordinary methods of gravity settle-

ment for reclaiming oil, and thus reducing expenditure, but it has remained for the De Laval Separator Co., of America and Canada, in conjunction with the Aktiebolaget Separator Co., of Stockholm (whose sole licensee for Great Britain and Ireland is Chadburn's (Ship) Telegraph Co., Ltd.), to apply centrifugal force to the purification of oil. It is claimed that the purifier instantaneously removes dirt, water, and other impurities from used oil, discharging pure oil from one spout, water and the

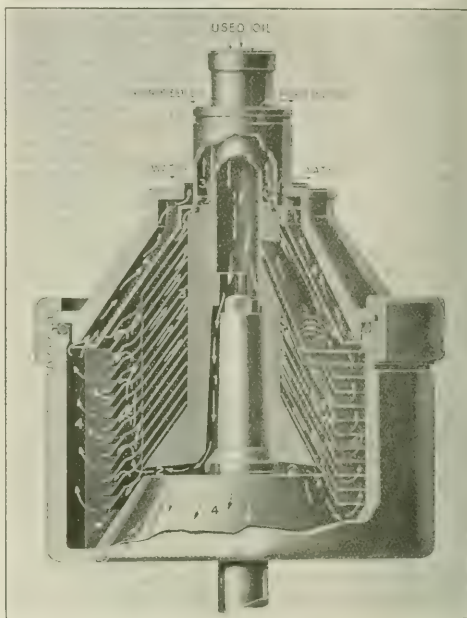


FIG. 2.—PURIFIER BOWL.

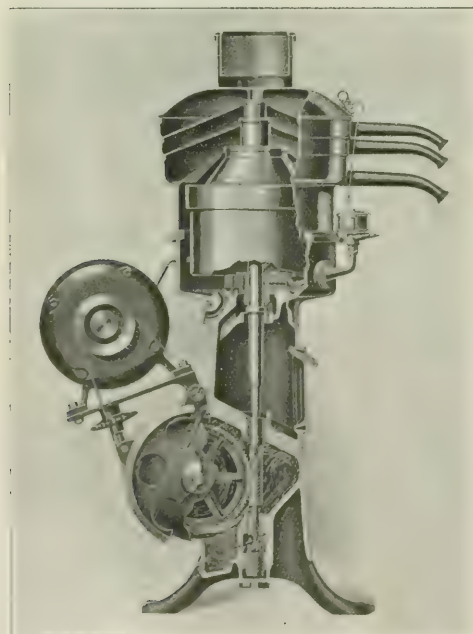


FIG. 1.—A LARGER TYPE OF DE LAVAL OIL PURIFIER.

ment and filtration, the action of centrifugal force is much more positive and results in the line of demarcation between the purified liquid and the waste matter being more clearly defined.

Various methods have from time to time been evolved

lighter solids from another, and retaining the heavier impurities in the sediment pockets in the bowl. It makes it possible to retain with safety the same oil in service for much longer periods than is common at present, breaks up emulsions and prevents them from forming again, and greatly reduces the consumption of oil.

The lubricating oil purifiers are also adaptable in a slightly modified form for use in the dehydration of transformer oil, as will be explained later, and greatly simplify this operation by saving both time and labour. The necessary modification is simple and can be made in a short time so that there is no reason to prevent one machine from being used for more than one purpose. Amongst the numerous applications of the system the following may be particularly mentioned:

Elimination of all impurities (liquid and solid) from lubricating oils and moisture from electrical insulating oils; reclaimation of crankcase oils and gear greases; recovery of cutting oils and soda wash used on machine tools; treatment of edible oils and fats, &c.; the purification of quenching oils used in tempering operations, and of internal-combustion engine fuel oil. It may be added that crude oil suitable only for burning under boilers is being converted by the process into a high-grade fuel for internal-combustion engines, with a consequent saving of over £1 per ton.

The machine, fig. 1, comprises a pedestal casting in which a high-speed vertical shaft carries at its upper end a bowl, fig. 2; the impure oil enters at the top of the machine (through the strainer shown in fig. 1), passes downwards through the central tube (1) and out into the bottom of the bowl. The latter contains a number of truncated conical shells of thin sheet metal so arranged as to practically fill the whole of its interior and divide it into thin conical spaces. The oil flows upwards through the circular holes (2) in the cones into the spaces between them, and the heavier impurities (such as dirt and water) are thrown outwards into the annular space surrounding the cones, while the lighter purified oil travels inwards and upwards towards the central tube (3). Of the heavier impurities, the solid matter is retained on the periphery of the bowl, whence it must be removed at intervals; the water passes upwards (4) and out through the lowest outlet into a pan provided with a spout as shown in fig. 1. The pure oil leaves by the intermediate outlet and spout, while the top outlet only comes into use as an overflow in the event of the bowl becoming clogged with dirt.

Due to its construction, the bowl will adjust itself automatically to varying proportions of oil and water, and its

action is so perfect that if perchance no water enters the bowl with the oil, no discharge takes place through the water outlet; similarly, if water only is passed through the bowl, nothing will come out of the oil outlet.

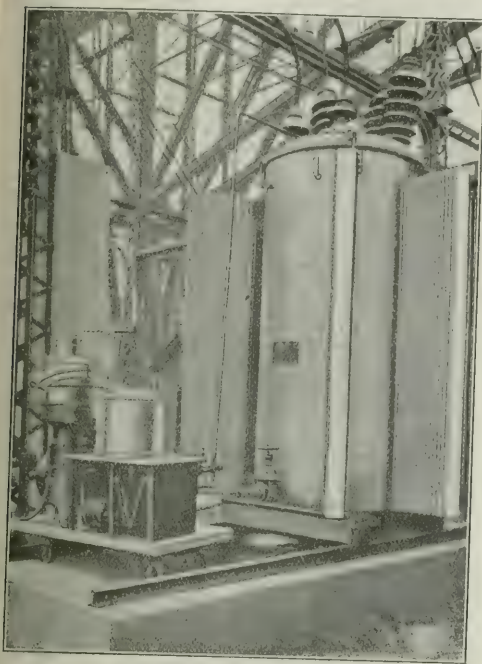


FIG. 3. TRANSFORMER AND PURIFIER.

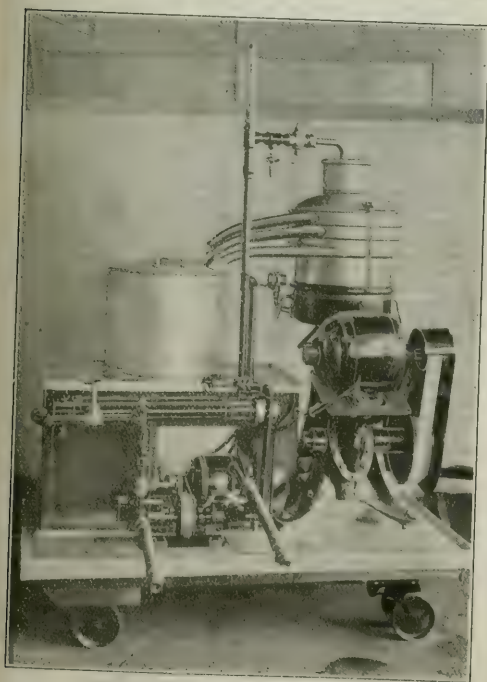


FIG. 4. PORTABLE OIL PURIFIER.

With regard to the treatment of electrical insulating oils, American practice is to test oil to 40 kV, with the old style of test gap, 0.5 in. face and 0.2 in. separation, or 22 kV, with a 1 in. face and 0.1 in. separation. When the dielectric

strength of the oil at the bottom level of the transformer has decreased 25 per cent. from the above value it should be removed and treated. For this purpose a stationary machine (the 1), and a portable set (the 2 and 3), have been developed. The oil is pumped from the bottom of the transformer through a bayonet type electric heater (which is only used when the oil to be treated is too thick), into the purifier; it is discharged into a small collecting tank from whence it is pumped back into the top of the transformer. The machines are supplied complete with electrically driven pumps, electric heater, valves, etc., and a dual purpose bowl is provided, which consists essentially of a purifier bowl with an adjustable discharge diameter, and is provided with an additional top disk which is used when operating the bowl as a clarifier without the water seal. The bowl is used as a purifier only when an abnormal amount of water is present, or the oil is emulsified, in which case a water seal is employed, and the small blank disk is used in its regular place on the top of the seal is, of course, discarded, and the blank top disk is inserted over the bottom disk. In this case one must be extremely careful to ensure that the bowl parts are free from moisture. Another precaution to be taken when heating the oil prior to circulating it through the purifier, is to make sure that it is heated to a temperature of at least 110 deg., but not over 150 deg. F., and on no account must it be heated with live steam. When considerable moisture is present in the oil it is recommended that the higher temperature be used.

In conclusion, it remains to be said that from test data obtained in the U.S.A., the machine appears to do what is claimed for it in an efficient manner. The largest purifier made is capable of dealing with 350 gallons per hour, requires a floor space of only 2 sq. ft., and less than 2 h.p. to drive it. The driving power may be applied either by belt, electric motor, or a steam turbine which forms an integral part of the machine. We are indebted to Mr. A. W. Empey, A.M.I.E.E., F.C.S., &c., for the loan of photographs and his assistance in the preparation of the above article.

THE HOPEFUL OUTLOOK IN RUMANIA.

THE fact that a very large proportion of the trade done under the British Government's export credit scheme has up till now been transacted with Rumania lends special interest to a report which the Department of Overseas Trade has recently issued from the pen of H.M. Commercial Secretary at Bukarest (Mr. Alexander Adams).

Seeing that in an agricultural country the progress of reconstruction is likely to be hastened or retarded by the harvest yield, it is most satisfactory to learn how excellent are the prospects of a grain surplus for export in the autumn.

All interests are striving towards the rapid reconstruction of the economic life of the country. The export merchant is struggling to get goods down to the shipping ports. The manufacturer is doing his best to replace lost and worn-out machinery, and to repair that still standing in his factory, in order that production may continue. The Government is doing its best to procure railway material and locomotives from abroad, and is aiding industrialists to procure machinery and the implements of production. Despite the present state of the railroads, manufacturers who are re-establishing their works have been given certain preferences with regard to the allotment of railway trucks for the transportation of machinery from the seaports.

Britain's Advantages.

With the newly acquired provinces, in which the Rumanian administration is gradually securing a firm foothold, the country becomes no considerable one in the list of Britain's customers abroad. The Danube provides a highway for British goods into the heart of the country. Until the reconstruction of the railroads is accomplished, not only in Rumania but also in Central Europe, waterborne merchandise will be able to compete on more than favourable terms with that coming by rail, subjected as the latter is to high charges and intolerable delays.

Thus the British exporter is not only in a privileged position, but he has a certain period in which to make good his foothold before any considerable element of competition may be expected from late enemy countries.

In Mr. Adams's opinion, Rumania will probably be one of the first war convalescents to attain complete recovery. British enterprise and British capital may regard the country as a fertile field wherein honest endeavour will bring forth a bounteous harvest.

Import Possibilities.

The present partial elimination of Germany and Austria from the circle of suppliers gives the United Kingdom a magnificent opportunity to redeem her past neglect of this market and to take her stand as the primary supplier of manufactured goods. With the advantage of sea transport to the Danube doorstep of Rumania the United Kingdom is able to give quicker deliveries of merchandise to Rumanian importers than are possible to-day from Germany or even the former Austria-Hungary, which two countries formerly held that advantage.

The breakdown of land transport in Central Europe has so far acted as an almost insuperable barrier to the sale of German or Austrian goods in Rumania in any large quantities, and may continue to do so, at any rate, for some years. During this time the British exporter will have every opportunity of making acquaintance with this market and of firmly establishing his goods in the favour of the ultimate consumer, but as the passage of every month brings with it an amelioration in the existing state of transportation, merchants and manufacturers interested in the future wants of this market with eighteen million customers are recommended to take steps as soon as possible to make themselves acquainted with those wants and the best means of supplying them.

In order to give an example of where the Rumanian market for British goods is capable of expansion, H.M. Commercial Secretary quotes particulars of certain United States imports into Rumania in 1913. Amongst them appear the following, in addition to quantities of agricultural machinery:—

	Tons	Lea
Pumps of all kinds for liquids, air or gas, also fans	126	151,942
Steam engines weighing from 500 to 2,500 kg.	79	119,791
Stationary engines and other special apparatus weighing 2,000 to 10,000 kg. per piece	116	116,530
Stationary engines and other special apparatus weighing 500 to 2,000 kg. per piece	80	96,897
Articles in metal	164	147,953
Instruments for boring wells and other bore-holes	252	302,572
Iron tubes and pipes	28,128	18,263,816

Other lines of British goods for which Rumania offers a market include electric dynamos and motors, fans, lamps, &c., and gas and oil engines.

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Bradford Housing Scheme.

With reference to the statement by Messrs. Henley in this week's REVIEW, no doubt my own experience with a similar type of wire would interest your readers. I, myself, with the aid of a boy have on numerous occasions finished completely in 7½ hours, a four-point installation. That is to say, everything is completed, down to shades, including main switch and fuses, and as all furniture and linoleum had to be moved by us, you will, I think, agree with me that it is quite as good a performance as that of Messrs. Jessop & Boydell Ltd. I may state that at present myself and the same boy are installing the Walsall Continuity Grip system in a housing scheme, and our present rate of progress for wiring and tube work only, but including plugging walls and earthing, is eight lights in 7½ hours. Should any of your readers desire any further information, by all means give them my address.

September 11th, 1921.

Progress.

Electricity for All.

Much has been written of the squalid approaches to London, but I was never so impressed, as on one of the beautiful summer evenings last week, with the appearance of the backs of the houses from the train, and with the great need of electricity by the masses. About 80 per cent. of the houses had all their windows closed or nearly closed, and one could look into hundreds of rooms badly lighted by ill-placed gas brackets, whose greenish-yellow glare showed up the ceilings they had blackened, but gave little enough light where required. One could imagine the gas-vitiated atmosphere, the clammy heat, like a foretaste of the crossing of the Styx, and realise something of the horrors of gas lighting in these small overcrowded rooms.

In wondering whether in our time the clean, healthy, and cheerful electric lamp would reach these thousands of homes, an idea occurred to me which I ask your indulgence for space to outline. It seems Utopian at first, but as one turns over the suggestion a way seems possible which would not only benefit the health of the community at large, but bring employment and great prosperity to every section of the electrical industry.

The days when we had to fight the gas interests for our first footing have so far receded that we tend to forget the very solid foundations upon which the electricity supply industry stands. The indisputable advantages, to any but a gasman, of electricity from an hygienic point of view, its cleanliness and saving in decorations, its safety and convenience, make an irresistible appeal to those who can afford its installation. We are now practically face to face with the

problem of how we are to bring its benefits to those who cannot afford the first expense, or who are not willing to lay out their money on premises held on short or expiring leases.

The latter is the real obstacle to the lighting of a vast number of houses, where if the wiring were installed the tenants would not object to purchasing the fittings and portable appliances. In both cases many would be willing to pay a portion of the installation cost if it could be apportioned in relation to their period of tenure.

The question then is whether we can overcome this difficulty or whether we are to wait for the more general use of electricity until all these tens of thousands of houses are rebuilt.

My suggestion lies along the lines of the old National Free Wiring Co.; instead, however, of a company formed purely for the benefit of its shareholders, I propose a corporation being formed to finance hire-purchase wiring schemes, with the idea of only paying sufficient interest to attract investors who are satisfied with a small return, provided their money is safe and repayable at par. This corporation should have the support of the whole industry, and all its important members should not only invest a portion of their reserves, but guarantee it according to their means. It would only require to be a finance company operating through the various supply authorities in the country; let us call it The National Electric Wiring & Banking Corporation, until a better name is offered. Its function would be to offer various schemes of hire-purchase wiring as on a weekly payment basis, quarterly, or taking a broad average by adding so much per unit.

As the supply authorities would reap the benefit of a permanent revenue, they might well be expected to supervise the erecting of installations, the collection of the hire-purchase moneys, and to act as the corporation's agents free or at most for a trifling percentage on the sums collected. The corporation should be everybody's child. The Electrical Development Association could perhaps undertake the publicity. The I.E.E. might be asked to draft from its rules a formula to establish a standard of material and workmanship as low as considerations of safety and durability permit. The committee appointed for this purpose might also take steps to remove any irksome local supply authorities' conditions, where they involve expense not called for by I.E.E. rules, by making suitable representations direct or through the Electricity Commissioners. The Contractors' Association might contribute data on the life of installations for the I.E.E. Committee to consider and prepare for the corporation's actuary. Local wiring contractors would canvass, and those bringing in the agreement would naturally have the order for the installation. The drafting of an agreement as between the corporation and its agents and the landlord and his tenants, to ensure payment for the installation, would not be difficult, seeing that all parties are to benefit.

Some new legislation might be necessary to empower supply authorities to play their part, in which the good offices of the Ministry of Health might be enlisted.

The corporation might extend its usefulness by including a fire policy under its agreement, and so eliminating any severe fire office regulations; this risk could be easily under-written. The great thing would be to establish it upon such a basis that its stock would be a gilt-edged security of the highest order. The ultimate capital would of course be immense, but, to commence, if, say, a hundred only of our principal manufacturers and institutions would contribute as an investment £1,000 each, and guarantee a like amount, a start could be made. There are thousands amongst our ranks who spare no effort to advance our industry, and who might be willing to invest small sums, and with this as a foundation the savings bank branch of the corporation could get going and accept deposits in small or large sums, and on short or long notice. All the men in the industry would give their support, and we know the general public has unlimited faith in the future of electricity.

Could we, after the first few months, tackle 500,000 installations a year? Anyhow, let us put down a few figures on that ambitious assumption, and try to get a rough idea of what might be done:—

500,000 installations at an average of 10 points = 5,000,000 points.

5,000,000 points at an average of 30 watts = 150,000 kW.

Suppose with modified wiring rules and men doing their best, knowing there was plenty more work waiting, we could work at 20s. to 25s. per point (I am not a contractor, and can only guess), we shall eventually want about five million pounds to finance this number of installations. Heating and cooking installations would, of course, be additional.

To get our money back in ten years, it would mean about 7d. or 8d. per week, which is nothing to pay and ample to cover capital, interest, and expenses. Stock could be issued at 95 bearing 6½ per cent. interest, repayable in 10-15 years.

We get some idea of possibilities if we suppose for a start that each of these additional consumers had an electric iron, say another 125,000 kW load, which would mostly come in slack periods, and give an improved diversity factor.

I shall be told that such a scheme could never be worked—I think it could, with the right spirit of co-operation; and that the initial capital could not be found—again, if the big men in the electrical industry took it in hand, I feel sure it could.

I hope, therefore, that this letter may provoke discussion

and produce constructive criticism. The tremendous impetus to the whole industry, bringing full employment to contractors, makers of plant, cables, meters, &c., the increased manufacturing output reducing costs and strengthening us in overseas competition, the increased station output spreading out capital charges and enabling a real cheapening of electricity for all purposes to come about, would react and help other industries; the possibilities are such that I hope leaders may be forthcoming and a united effort may be made to bring the National Electric Wiring Corporation into being.

Fred. M. West.

London.

September 10th, 1921.

Leading-in from Overhead Mains.

I would be grateful to know if any standard method has been adopted for leading-in to consumers' premises from overhead mains; several towns I have visited seem all to have methods of their own. I have never seen any discussion on this matter, but I am sure some of your readers will be in a position to give their experience from actual practice.

Spark.

September 12th, 1921.

Competitive Trials of Electrical Apparatus.

Many papers are read at various Institution meetings, and many letters appear in "Correspondence" columns, with regard to the practical efficiency of electric cooking and heating appliances, current limiters, meters, and various other electrical apparatus.

It would be of great advantage to the electrical industry if practical trials under working conditions were arranged by the I.E.E., or the E.D.A., similar to those conducted by the Royal Agricultural Society in connection with agricultural machinery.

Such trials could be held in connection with electrical exhibitions; the awards would be an excellent advertisement for the successful competitors, and would guide designers in their efforts to achieve perfection.

Arch. J. Howard.

Electricity Dept., Taunton.

September 10th, 1921.

Accumulator Froth.

Mr. A. E. Frost's letter in your issue of September 2nd, is one that cannot pass without notice.

He states that frothing only occurs in accumulators by certain makers, the cause being inferior quality celluloid.

Every manufacturer of small accumulators enclosed in celluloid cases has experienced frothing trouble at one time or another. Everyone who re-charges or repairs accumulators of all makes is aware of this. Is it likely that high-class manufacturers of accumulators would not make every endeavour to obtain, and use, the best quality celluloid obtainable, when the matter is of such importance to them?

It is certainly true that frothing is usually experienced when celluloid is used for the containing cell, but it does not follow that it is entirely due to the celluloid. It may be due to other causes which the celluloid may assist.

Frothing in most cases has its origin in the use of impure water, lime salts being deposited on the plates and interfering with the process of charging.

Camphor (which is extremely volatile) is one of the principal constituents of celluloid, and celluloid even at its best is not a particularly stable compound.

When trouble arises from impure water, the fact that the containing case and probably the separators are celluloid tends to assist and increase this troublesome complaint.

Wm. Peto.

Pritchett & Gold and E.P.S. Co., Ltd.

London.

September 8th, 1921.

Carpets and the Electric Suction Cleaner.

As an actual user of various kinds of cleaners in my home, I find the most satisfactory type for domestic use must certainly have a revolving brush, to flick off pieces of cotton or such-like material that become entangled in the pile or nap of the carpet. Suction alone is useless. The brush should not be driven by the motor, but be capable of being driven at varying speeds—fast or slow—to suit the varying classes of material it is desired to sweep up.

This is easily accomplished by coupling up the brush to one of the rubber-tired wheels on which the cleaner runs; thereby the brush is turned at any suitable speed as the cleaner moves over the carpet.

The brush should be of the toggle type, i.e., a number of soft pencil-shaped brushes fixed staggered fashion to a hollow spindle. A light brush of this kind is much more effective than the continuous mesh brush; a simple rubber belt will drive it, no adjustment is necessary, the brush is instantly detachable—and easy to clean if long threads get wound upon it.

The "Rayvac" cleaner has these improvements, as well as ample suction power, with a big saving in time and cost as compared with the plain suction cleaner.

C. Geo. Nobbs.

London.

September 10th, 1921.

[Several letters on this subject have been received, extolling the virtues of specified models of cleaner. Our aim throughout has been to deal with the matter from the technical point of view, without regard to any particular make, and we feel that no useful purpose will be served by continuing this correspondence on the lines it is now following.—Eds. ELEC. REV.]

Supply without Statutory Powers.

Many thanks for your clear and full explanation in last week's issue of the position of unauthorised schemes under the new Acts. May I just say that in the case in my mind it is taken for granted that the existing small scheme cannot compete in price with the new and official scheme, and that any attempt by the former to obtain an Order would be opposed tooth and nail by the competent local authority, which in fact intends to get an Order itself.

Indeed, in this particular locality prominent members of the Labour party, which has a majority on the R.D.C., have said that they would shut down the existing plant at once, without waiting for an authorised supply, if they were able to do so, and they are in any case refusing further permits for poles where they can. In spite of the fact that there is no gas, and that the advent of an authorised supply must be a matter of years.

As regards the other question—cost of power—I am afraid you do not do me justice. The figures mentioned were not intended to be taken as a full comparison at all, and the items you mention—interest, depreciation, rent, rates, labour, lubrication and repairs—were omitted on both sides. All the same, I freely admit that some of these items would be lower in the case of the electric motor, and obsolescence perhaps not counted at all.

Against your statement that I "tacitly assume that the oil engine set is going to run at full load and maximum efficiency when it runs at all," I put forward figures given in a technical journal last year, relating to the type of engine in question. The engine is of 5 h.p. The consumption at full load was 425 lb. of paraffin per b.h.p.-hour, and at 3 h.p., 46 lb., i.e., well within the half pint mentioned at 60 per cent. of full load. These are test figures, certainly, but my experience is that the fuel consumption of oil engines need not exceed the test figures by any very serious amount, given reasonable treatment.

Further, the comparison was obviously favourable to electricity by reason of the small sets taken as examples, and the efficiency mentioned, 90 per cent., is not, if I remember, attained by electric motors of this size.

Consideration of, say, a 100-h.p. modern steam, suction gas, or crude oil plant, running ordinary factory hours, would be perhaps more useful. Is it certain, even where a final drive by electric motor is convenient and desirable, that a plant such as mentioned, driving a generator, would not be cheaper in very many cases than a supply from a far distant hydro-electric station, delivered to the works at 2½d. or 3d. a unit?

A. O. G.

September 12th, 1921.

[Why the Labour members of the Rural District Council should wish to shut down the plant in question is a mystery that we cannot fathom. With regard to the cost of power, we regret that our correspondent feels that we have not done justice to his figures, in our brief reference to this subject; we merely wished to utter a warning against hasty and incomplete estimates of comparative cost. We do not know the nature of the small plant to which he refers, but he appears to be satisfied "that the existing small scheme cannot compete in price with the new and official scheme"; yet he questions whether an outside supply at 2½d. or 3d. a kWh can compete with a private installation.—Eds. ELEC. REV.]

Organ Blowers.

In changing over from d.c. to a.c. the church organ blower motor offers a peculiarly difficult problem. The ordinary d.c. organ blower motor is controlled easily enough by means of a resistance in the armature circuit. The a.c. motor, on the other hand, runs at a constant speed, and is also liable to make an unpleasant noise, which is intolerable in a church. An account of methods by which the difficulties have been overcome will be welcomed by

Organ Blower.

September 12th, 1921.

The E.P.E.A. Schedule and Economy Stunts.

What good does "Anti-Bunkum" hope to achieve by rattling the sabre, and why should he waste time in lashing himself into such uncontrollable fury over a weak, powerless Association such as the E.P.E.A.?

Being a believer in sweated labour, as "Anti-Bunkum" practically admits himself to be, has it never occurred to him

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THE STRUCTURE OF THE ATOM.

SCIENCE, which comprises what we know, has been likened to a sphere. If the surface of that sphere represent the area of contact with the unknown, the more we add to our knowledge, as measured by the bulk of the sphere, the more we increase the sense of our ignorance, as revealed by the growing area of its surface. There is something consoling about the image, seeing that the ratio borne by the surface to the content of a body diminishes as they expand. Nevertheless there is an element of desperation in the thought that our sense of ignorance must ever increase in spite of all we can do—indeed, by reason of all we succeed in doing—to remedy it.

These reflections are forced upon us by the survey of current developments in scientific research recorded in the proceedings of the British Association just concluded at Edinburgh. The early workers set out to explain the properties of matter—density, impenetrability, elasticity, chemical behaviour, &c.—and to do so they adopted the conception of discrete atoms which they next proceeded to endow with density, impenetrability, perfect elasticity, chemical affinity, &c. Now we find that each of these atoms must consist of a central nucleus called a proton about which are revolving electrons on a model not unlike that of the solar system. These protons and electrons appear to be dense, impenetrable, perfectly elastic, and electrical in behaviour, &c. There are some problems to the solution of which we seem never to come near. The resolution of the atom into a composite system of moving parts, however, explains a vast number of facts. We can mention but a few. The association of atomic weights and chemical affinity is loosened in accordance with the results of recent investigation and the existence of isotopes explained. The atoms can be placed in order according to the number of their parts, and in that order are to be found exactly appropriate places for numerous atoms having the same chemical properties but different atomic weights. A vast new realm thus swings into our ken. For example, the nearness of the figures obtained by all investigators for the atomic weight of chlorine is found to arise from the fact that all samples are derived from the sea, in which the several isotopes we call chlorine may be expected to have been most thoroughly mixed. Again, ordinary lead is also a mixture, but lead derived from the break-up of radium atoms is of one kind only, thus furnishing a clue to the quantity of radium that has undergone disruption in the past. A new light is thus thrown on the age of the earth, and the period which can be imputed to the geological changes that have occurred is vastly increased. Indeed the questions for which the new knowledge gives promise of solution are too numerous to mention or even to surmise. Speaker after speaker at the British Association meeting testified to the immense domain of science that had now been brought within our reach. However, the number of fresh questions that arise to confront us seems larger still.

To say that we find the problems associated with the solar system again presented to us in every atom would

be an inadequate presentation of what is in fact opened up by recent investigations as to the constitution of matter. The central proton does not merely attract like the sun according to the law of inverse squares, its action upon surrounding electrons varies in zones from attraction to repulsion according to a law yet to be determined. The revolving electrons, it is true, are limited to eight for each zone, but the number of possible zones is not yet known. Unlike the single simplicity of the solar systems we are acquainted with, which, being separated by distances representing hundreds of light-years, develop in isolation, the atoms join up, share out their electrons on principles accounted for by the phenomena of valency in chemistry, and carry out their evolutions at such a speed that we cannot suppose the masses of the bodies concerned to remain constant. It is as if our planets were capable of developing velocities approaching 100,000 miles a second, so that we should have to allow for alterations of their mass as provided by the theory of relativity. Of course, these protons and electrons, though small, cannot be conceived as not consisting of parts. Hence we must expect to have something analogous to the tides, giving rise to phenomena like the secular acceleration of the moon. Our day is gradually getting longer and is, in time, to increase to some 1,500 of our present hours. By that time the moon will have receded considerably. Possibly if it could break away altogether we should have something analogous to what happens in the radium atom when its constituents are expelled as rays.

Perhaps the simile with which we began is not so appropriate as we thought. It might be better to liken our knowledge to the surface of the sphere and our ignorance to its volume. The two being then conceived as expanding together might serve to illustrate the change in the ratio between them more closely in accordance with the actual facts.

Factory Lighting. ONE of the aims of manufacturers in these days of high wages is the increase of production, and any increase which may be obtained without stress upon the

operative is doubly welcome. The approach of the winter season and the consequent curtailment of "summer-time" renders it necessary to carry on with an increased proportion of artificial light, which normally has an adverse effect upon production. Much has been written and said by firms interested in pushing the sale of commodities accessory to good lighting, and we have noted pamphlets and reports circulated by unbiased authorities; throughout mention is made of the advantages accruing from the intelligent application of modern lighting units. A pamphlet which has recently been issued by the Home Office* emphasises the increase in quality and quantity of work produced when the attributes of good lighting, natural or artificial, are present; the health, safety, and efficiency of the worker are also dwelt upon. A *précis* is given elsewhere in this issue, but we consider that employers and employés alike should obtain a copy, since it is probably the most concise statement of the case that has ever appeared.

We have always championed the cause of good lighting in the belief that it is to the benefit of all concerned; we have also drawn attention to the superiority of electric lighting over all other forms of illuminant, but we have seldom seen the case presented in so forceful a manner as in the pages in question.

An interesting point in connection with the pamphlet is the recognition of the lighting engineer and the suggestion, made more than once, that he be consulted in order that the best effect may be obtained. We believe that the electrical industry has a long lead over the gas world in this respect, electric lighting being much more

adaptable to circumstances and lending itself to the exactitudes of modern conditions, without undue risk and cost, so that its application has attracted the minds of thinking men.

The fact that this statement from a Government source follows closely upon the second report of the Departmental Committee on the Lighting of Factories and Workshops would indicate that our legislators may be called upon at no distant date to give effect to the recommendations of the Committee. If this surmise be correct, we may anticipate a tremendous step forward in the standard of artificial lighting obtaining in this country, and there can be no doubt that the indirect benefits to British trade generally, which are bound to result, will be immense.

Million-volt Transmission. THE remarkable feat of the American General Electric Co., reported in our last issue, of transforming up from 2,000 volts to 1,000,000 volts at 60 cycles with apparatus designed on normal lines, has gained a good deal of attention in the lay Press on the ground that "according to the claims of the engineers . . . electrical energy can now be transmitted on a commercial scale over a distance approximately of 1,000 miles" (*Daily Telegraph*). "Approximately" is good. It is stated that the spark gap was "gradually widened, until at last a brilliant blue flame was leaping 15 ft. through the air," and it will be readily realised that when one is dealing with young lightning of this sort something quite special will be required for the line construction. The engineers, according to the published reports, used "hollow wires" 4 in. in diameter, and claim that transmission can be accomplished at 1,000,000 volts without losing too much energy by leakage (mainly corona effect, presumably) *en route*.

The highest voltage at present in use, we believe, is 165,000 volts, and the Southern California Edison Co. is about to conduct experiments at 220,000 volts, with a view to transmitting half a million kilowatts from the San Joaquin river to Los Angeles, a distance of 240 miles (*ELECTRICAL REVIEW*, July 1st, 1921, p. 31). Flashovers have occasionally been experienced on the existing line at 150,000 volts. The step in pressure to one million volts is obviously a very considerable stride, and a great deal of investigation and experiment will be necessary before the system can be regarded as technically feasible, let alone "commercial."

Assuming, however, that the technical problems are solved, the question arises whether transmission over such a distance as "approximately" 1,000 miles will ever be called for in our time. The tendency is for industries to migrate to the neighbourhood of hydro-electric power stations, and though they often cannot be conducted in the near vicinity owing to topographical difficulties, it appears to us unlikely that suitable sites will not generally be found within, say, 300 miles of the source of energy. Undoubtedly there are immense hydraulic resources available within that radius of suitable sites, and the tendency will be to utilise these, wherever they are found, before embarking on projects involving transmission over greater distances. Some day the great powers running to waste far in the interior of South Africa and South America may, perhaps, be harnessed; but by that time, possibly wireless transmission of energy will have been achieved. If the energy of the atom is brought under control, of course, all such long-distance projects will cease to have a *raison d'être*.

Admitting that we have not at hand authenticated reports of the actual statements of the G.E. Co.'s engineers, we can only suggest that the use of 4-in. tubular conductors for overhead transmission is fantastic; that in any case the capital cost of a super-pressure transmission line of 1,000 miles is commercially prohibitive so long as coal supplies hold out; and that the risk of obsolescence of the whole scheme due to the progress of science would deter any competent financier from sinking immense sums in long-distance transmission lines.

*Welfare Pamphlet No. 7. Lighting in Factories and Workshops.

ELECTRICITY IN MINES.

By M. I. WILLIAMS-ELLIS.

THESE days of labour unrest, culminating in the great coal strike, a disaster for both labour and capital, which hit our trade more than any war could, and caused suffering to the public at large, not to mention the loss of wages to the trades dependent on the output of our collieries, give many of us engineers food for thought as to the future production and output per man required to enable this country to compete in the open market with other countries. The facts one has to face are short hours of work in many industries, re-

ELECTRIC WINDING.

While the time has passed when it was necessary to advocate electrification to the colliery and mine engineer, the mine manager must always bear in mind that his electrical transmission must be justified by one or two reasons, if not both. One is economy of steam, and the other is convenience or safety.* For underground work, convenience is often of itself an adequate excuse, but for surface work, convenience is not often a sufficient reason for adopting electrical transmission on a

large scale. It is, therefore, necessary that economy should be proved. The large colliery winding engine has stood by itself, and up to the present it may be said that in many cases it has not been practicable to substitute an electric winder for the steam winder. Winders to-day reach 2,000 and 3,000 h.p., which means that only large central power stations can supply the demands, a winder giving the most fluctuating of all loads. In the case of small winders the matter is different, as a power station which would not be equal to supplying 3,000 h.p. at a few seconds' notice might easily supply an extra 200 or 400 h.p. for a few seconds. In the

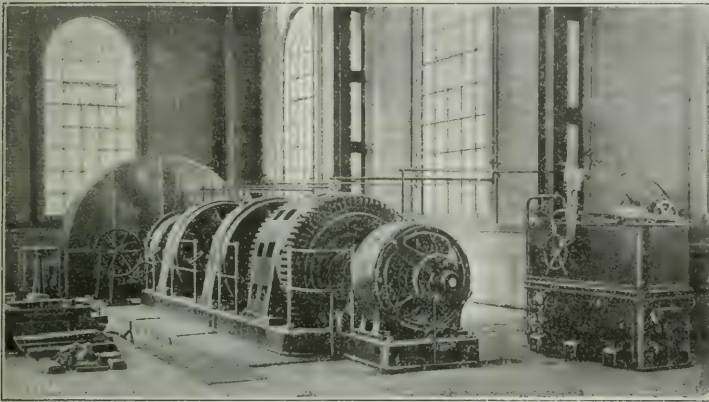


FIG. 1.—BRITISH WESTINGHOUSE WARD LEONARD FLYWHEEL SET.

duced output per man per hour, heavy increases in wages, and high minimum wages, all resulting in increased cost of production and consequent loss of trade. No State help in the form of subsidisation or nationalisation can ever make production; it rests entirely on the individual and the machinery of the concern. As an individual is his own engineer, good, bad, or indifferent, the problem we are left with is the machinery; how to get the best and most efficient results, *i.e.*, increased production of goods, at a marketable value.

Electricity stands foremost as a productive power to-day, and already with what little we know of it, its influence is felt more and more in every industry, with world-wide, far-reaching results yet to come. It will, however, in this article be sufficient to see how far its adaptability may be utilised in conjunction with winding, hauling, coal-cutting, and electric traction, &c., all with the idea of increased output, over that of methods perhaps in too many instances obsolete. One cannot lay down any hard and fast rule, as conditions vary both in industries and in districts, so that one can only write broadly on the subject, leaving the initiative to those in charge.

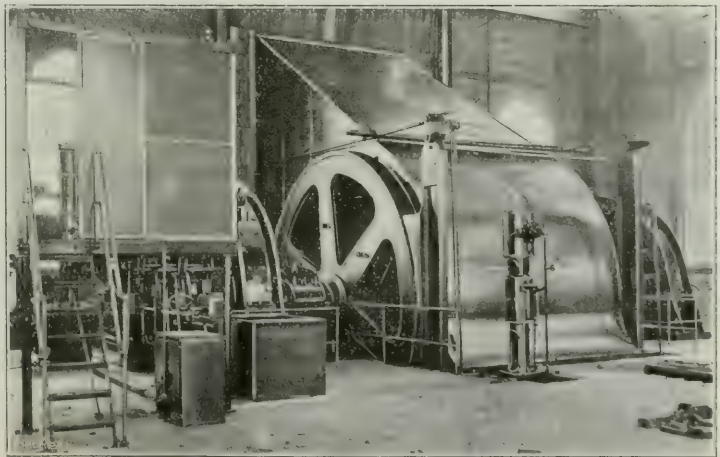


FIG. 2.—BRITISH WESTINGHOUSE 1,800/2,700 h.p. ELECTRIC WINDER.

matter of winding electrically we are sadly behind, although we trust not for long, if the contemplated

* But let it be remembered that the position is this:—If coal costs nothing, steam winding is cheaper; if coal is valuable, there is a particular value of coal at which the two are equally cheap. As the price of coal advances, so does the balance swing in favour of electric winding, and more so than ever to-day with the present short working hours, the shortage of skilled miners, and the curse of a high minimum wage.

super-power schemes materialise. To give some idea of the cost of winding electrically in this country, one may mention the case of a 360-h.p. "Witton" motor driving a winder for the Midland Coal, Coke & Iron Co., raising coal 450 yards at a cost for energy of 4s. 2d. per 100 tons.

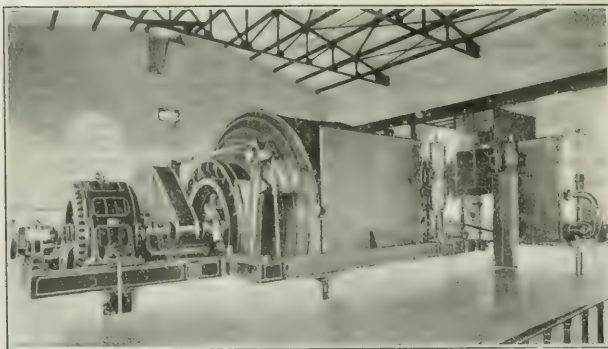


FIG. 3.—BRITISH WESTINGHOUSE A.C. 700/1,500-H.P. ELECTRIC WINDER.

The accompanying illustrations give some idea of modern electrical winding practice.

Fig. 1 shows a Ward Leonard flywheel set, built by the British Westinghouse Company (now known as the Metropolitan-Vickers Electrical Co., Ltd.), supplying power to a winder at the Great Western Colliery Co.'s Cwm pit. In fig. 2 is shown the electric winder above mentioned, fitted with two d.c. motors of 1,800/2,700 h.p., direct coupled, and winding a net unbalanced load of 26,880 lb. at a speed of 1,640 feet per minute, from a shaft length of 2,250 feet, the drum being of the cylindro-conical type with diameters of 12 feet and 18 feet.

Fig. 3 is a view of a British Westinghouse electric winding engine at Hordon's Colliery Co.'s pit, fitted with an a.c. 700/1,500-h.p. geared motor, winding a net load of 7,050 lb. at a speed of 2,650 feet per minute from a shaft length of 1,350 feet, with a drum of the cylindro-conical type, 10 and 20 ft. in diameter.

Fig. 4 illustrates a Sandycroft cascade a.c. two-speed hoist of 700 h.p., working at 485 and 325 r.p.m.

Fig. 5 shows a winder installed at the Burley Pit of the Midland Coal, Coke, and Iron Co., driven by a G.E. Co.'s "Witton" a.c. motor.

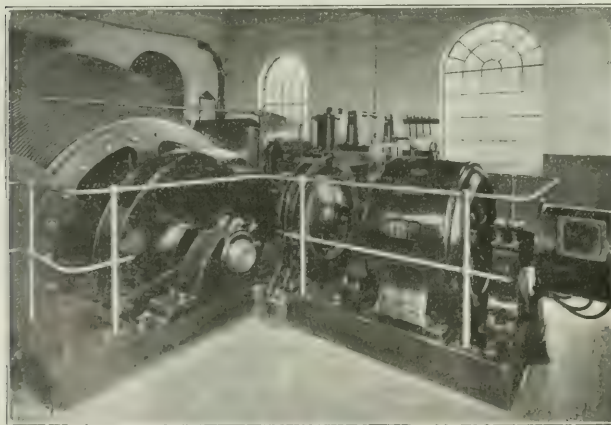


FIG. 5.—GENERAL ELECTRIC CO.'S "WITTON" A.C. WINDER.

As regards electric winding, a great deal may be learnt from our own Colonies, South Africa especially; the whole of the winding on the Rand is carried out electrically, giving highly efficient results, the power

being derived chiefly from the Victoria Falls Power Co.'s steam-driven generating stations. There are many systems of winding plants, differing in the design of the electrical and mechanical gear, and all having their special advantages.

It is now a proved fact that provided capital expenditure can be kept down, and the demand for power is supplied as and when required, there is a large saving in energy consumption, running costs, and wear and tear in connection with electric winding. There are many contemplated winding schemes held up to-day solely on account of the high prices that have to be paid for new plant as a result of high wages and general upset of labour conditions. When once these factors again become normal, one will undoubtedly see mining more economically carried out than ever before. Small electrical winding and hoisting plants are far and away more efficient and applicable than many other means of winding, they can be placed right up against the working point at any reasonable distance from the power supply,

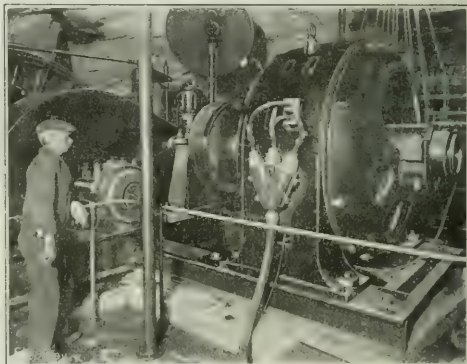
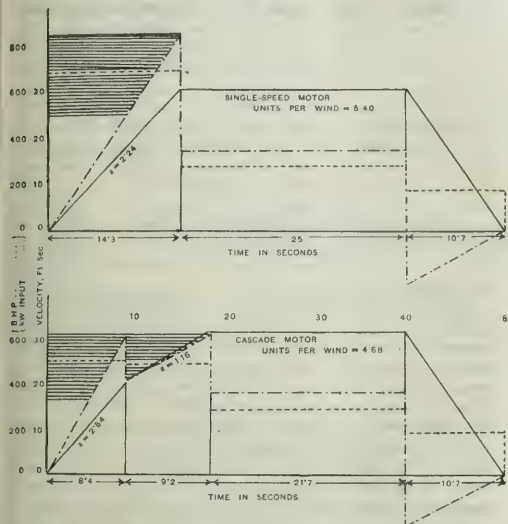


FIG. 4.—SANDYCROFT "CASCADE" A.C. 700-H.P. TWO-SPEED HOIST.

at low cost, and with high efficiency, and moved quickly to any other point, at little expense, when necessary. In the writer's mind, too little consideration is given to the economical speed of hauling or winding, in either mines or quarries, and many examples could be given of small production in consequence of slow winding. In some cases the motor is too small, the shaft or incline in too bad a condition, or power not available. The economic speed in each case, and for each class of mine, can be carefully worked out, and hinges on the following conditions: The directors knowing what can be spent, the manager knowing what he wants, the engineer knowing what he can do, and, last but not least, the miner knowing what he can produce, and doing it.

It may be interesting here to give a comparison between single and two-speed winding, the cascade system being adopted for the latter, which has specific advantages over the former. One of the chief points is a reduced peak load with the two-speed system, as may be

shown from the actual curves, with a reduction of energy consumed per wind, see figs. 6 and 7. For incline haulages, the writer has found the two-speed machine of great use in special instances of variable inclines; on the small angle of incline the motor is



FIGS. 6 & 7.—COMPARISONS OF SINGLE- AND TWO-SPEED WINDERS.

Speed ———; kW input - - - -; b.h.p. — The two-speed "Cascade" motor takes a peak load 27% less than that of the single-speed motor, and the energy per wind is 14% less. The shaded portions show the losses in resistance; single-speed 4,935 kW-seconds, two-speed 2,890 kW-seconds.

used at top speed, and on the high angle of incline, the motor is worked at bottom speed, while where high speeds are possible for rock a lower speed is permitted for men.

(To be continued.)

THE TEST OF SALESMANSHIP.

By H. R. TAUNTON.

ELECTRICAL engineers and women move normally on different planes. It is, perhaps, one of the advantages of being an electrical engineer. But there is, nowadays, one point at which their orbits coincide—the electrical accessories showroom.

The contractor himself generally sheers off in a parabola, and leaves the meeting to an unhappy junior. He would be wiser if he stayed, if only to learn from defeat. If his courage fail him so far, it is at least essential, in view of the increasing importance to him of the sale of accessories, that he depute the care of his showroom not to a junior, but to an expert, capable—or as capable as mere man can hope to be—of facing undismayed "the tempestuous petticoat." For that is the true test of salesmanship.

Any fool can sell anything to a man. The average man only enters a shop from dire necessity. To buy, for instance, his tobacco. Generally he has to be lured in by seeing what he wants actually displayed in the window. But in any case he knows exactly what he wants. If you have it, or something reasonably like it, the transaction is ended in a minute. But even if you haven't, he is usually far too timid to refuse something "just as good." Few men have the moral courage to leave a shop without buying something, by way of apology; and most of them spend far more than they intended.

Now, a woman enters a shop in a spirit of reckless enterprise, heedless of what she wants, or whether she wants anything. On the other hand, she has very clear and decided opinions as to what she doesn't want. She will watch you dismantle the showroom, and gut the stores, in search of the nebulous something she may want, and consider you well repaid if she thanks you before leaving, empty-handed, to favour somebody else with her custom.

It is quite useless to show her anything you think she ought to want; quite useless, even if you succeed in producing the article she really does want, to try and persuade her to spend more on it than she has decided it ought to cost. A woman shopping has no heart; she is the hard-headed business man, with a tight clutch on the purse strings.

It takes an expert salesman to sell a woman something that she wants. To sell her something that she doesn't want is the rare achievement of genius.

Let not the contractor lose heart, however. There is big business to be done in the sale of accessories. The number of women who are discovering the potentialities of amusement in electrical showrooms is increasing daily—and some of them must buy something. You may as well sell it as the other man.

The first rule of success is to avoid technicalities. It is no good saying an electric iron "consumes 500 watts." A man will nod his head sagely, and pretend he knows all about watts. "Oh, yes. What's-his-names! Consume them myself. Prefer them to proteids for breakfast." He buys the iron in a hurry, and gets away before you begin babbling about volts and amperes.

A woman is more candid. She doesn't pretend to know what watts are, and doesn't want to. A futile jargon! If you persist in it she will suspect you of trading on her ignorance. No sale! The sound and simple method is to translate the consumption into pence, or, what will probably appeal more to her, into farthings. (Assuming, that is, that you have sufficient knowledge of the calculus to master the complexities of the local supply company's rates.) Tell her it will cost her three farthings an hour to use (don't call it ".75 pence," by the way); and you are giving her the facts in terms of everyday speech. And you are reassuring her on a vital point.

The use of domestic electrical appliances would be far more general were it not for the common impression that they are expensive luxuries. Supply companies, unfortunately, what with their complicated power rates, and their reluctance to give small power services, do little to remove that impression. When Mrs. Smith, after lightheartedly using an electric fire for a few weeks, gets in a bill for electricity exceeding the original cost of the article, she makes remarks about it to Mrs. Brown—who was going to buy an electric iron, but now decides it will be cheaper to engage another "tweeny." Of course, Mrs. Smith has had to attach her radiator to a lighting plug because the company won't be bothered installing a meter for so small a power supply. Nor will it adapt its lighting rates to encourage the use of accessories; and there you are! The company goes on grumbling about its day load, and the contractor watches his stock of nicely polished kettles and toasters getting tarnished, unsold.

Having persuaded the good lady that an electric iron, or kettle, or toaster is actually within the sphere of practical domestic economy, proceed to expatiate on the usual talking points. Be circumspect! She knows more about irons and kettles than you can ever hope to do. If you exaggerate in a single detail, or handle the truth a little carelessly, she will, with feminine logic, jump to the conclusion that the whole science of electricity is built on a foundation of lies. You will lose her confidence, and the sale.

Your only chance, then, is in the demonstration. Always demonstrate if possible. She expects it as part of the afternoon's amusement; and besides, it carries conviction better than all the eulogy in the dictionary. Seeing is believing.

Remember, again, in your demonstration, that you are performing before an expert critic. Even if you attempt no higher flights than the ironing of a handkerchief, or the boiling of an egg, go warily; or she will pull you up, and electricity will be damned in her eyes for ever. You may think boiling an egg a simple enough matter. You rely on your watch, of course; you check off three and a half minutes. A woman has no use for so scientific a process. She boils an egg by intuition. It serves her well; while your watch may let you down. Eggs have their idiosyncrasies.

There are lots of points, too, about an electric washer where you may be caught out, if you trust too much to the book of words. Times and temperatures and currents cut no ice with a practical woman. Thermometers make her tired. She tests the baby's bath water with her elbow, and gives the baby the thermometer to float the soap on. Degrees Fahrenheit, revolutions per minute, watts, amperes; cut them all out. Talk to her of soap and borax, flannels and silks; give her homely wrinkles in the use of the machine; and, having convinced her that you are familiar with the technicalities of washing day, you will the more readily convince her that you know what you are talking about when you dilate, later, on the electrical and mechanical perfections of your particular type of washer.

Plain, concrete facts such as that the clothes do not want soaking overnight, or that an average batch of soiled linen can be thoroughly cleaned in 15 minutes, will carry a conviction born of understanding; whereas your statement that the wringer has ball bearings, or that the copper in the motor is 100 per cent. Matthiesen's standard, will leave her cold, unless you have already succeeded in interesting her on practical points.

Try to prove to her that the average life of a washer is about 20 years, and that, therefore, it will only cost her per annum a twentieth of its price, and that this ridiculous amount is little more than the modern laundry's charge for mauling a pair of pyjamas. Do that, and you will make a sale—if she had made up her mind to buy before ever she entered your showroom!

In the same way, if you are trying to sell a vacuum cleaner, an ounce of understandable facts is worth a ton of theoretical fancies. A housewife will know the difference between a clean and a dirty carpet, even if her only idea of a vacuum is the emptiness inside the bag. Demonstrate with a strip of carpet and some fluff and grit well rubbed in, so that she can see for herself the carpet lifting to the nozzle, the brushes beating it down again and loosening the dirt, and the clean track of the sweeper. Appeal to the eye rather than to the ear.

An argument often used in selling electrical appliances is the saving in the cost of domestic labour. It is an argument that can easily be overdone. In these hard times, families with one or two servants are the rule. There are many who can afford to buy quite expensive electrical devices who cannot afford the luxury of a servant at all. It would be a very complicated electrical machine that would perform all the duties of a general in a middle-class household, and so really save the cost of her wages and keep. To say that an electric kettle is going to enable the lucky purchaser to dispense with the services of one of her two servants, savours of exaggeration. The sound common-sense of the housewife sees the fallacy, and will have none of it. And in a large household where, for instance, a complete installation of electric heating and cooking *might* save the labour of a housemaid, the argument has little value, for the mistress of such a household can afford to ignore it.

The more plausible statement that it saves part of a servant's labour, carries little weight, for, after all, one cannot dispense with the fractional part of a housemaid, and cut down the rations for what is left of her. And Mrs. Newrich doesn't see why she should "pay me gals their wages, and then buy electrical fads that'll only make 'em idle."

Indeed, the electrical showroom must be prepared to hear and combat the most extraordinary arguments: often stupid and illogical; but as often, shrewd and

practical. And "practical" must be his own watchword. The successful salesman must be the complete housewife, the modern Mrs. Beeton. One might call him a domestic electrical engineer, with all the accent on the "domestic," and little or none on the rest of the phrase. In short, "thoroughly domesticated."

That is a qualification which is rare in men who may have all the others that go to make the successful electrical showroom attendant. But it is so obviously an essential one that the question arises whether a saleswoman would not perhaps be better in his place. She would at least be able to discuss details with possible buyers on their own high level of domestic technicality. A woman herself, she would be able to conduct negotiations in the same terms of feminine logic as her customers, by the light of an intuitive insight into their obscure psychology denied to the obtuser male. On the other hand, the average woman lacks certain characteristics essential to good salesmanship. To mention one only: few women bring the same rest to selling as they do to buying.

Saleswoman or salesman, whichever it be, it is clear that she, or he, must be an exceptional individual to command success in the electrical showroom. The position is becoming one of increasing importance and responsibility. The sale of domestic appliances is developing into a large proportion of an electrical contractor's total turnover. If he would ride to fortune on the coming boom, it behoves him to give to the selection and training of his showroom attendant the care essential to the choosing of one of his most specialised employés; remembering always that the only successful salesman is he who can sell to women, who will form to-morrow, if they do not to-day, the majority of his customers.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR AUGUST, 1921.

The August returns of electrical export and import business which we publish herewith show some falling off all round as compared with the July figures. The exports reached the total value of £1,281,511, as compared with £1,565,545 for July, a decrease of £281,000.

The only satisfactory sections of electrical export returns were insulated wire and electrical machinery unenumerated in which increases of £43,000 and £40,000 were recorded, decreases occurring in all the other items, the largest being £266,000 in the submarine cable section.

The imports total of £140,334, compared with £170,673 for July shows a decrease of about £30,000, a falling off occurring in all items with the exception of meters and telegraph and telephone instruments and apparatus.

The re-exports total of £14,557 was £25,000 less than the preceding month's return.

VALUES OF ELECTRICAL EXPORTS AND IMPORTS FOR AUGUST, 1921.

	Exports.	Imports.	Re-exports.
Electrical goods and apparatus ...	£131,478	£35,113	£3,122
Insulated wire	221,149	11,581	—
Glow lamps	33,381	7,935	287
Arc lamps and parts	2,597,934	887	75
Batteries	46,927	2,959	—
Meters	36,093	9,108	1,303
Carbons	3,101	1,573	2,197
<i>Electrical machinery .—</i>			
Railway and tramway motors ...	21,554	—	—
Other motors and generators ...	217,052	—	—
Switchboards (not telegraph or telephone)	23,190	20	636
Electrical machinery (unenumerated)	169,985	18,362	2,732
<i>Telegraph and telephone cable and material:</i>			
Telegraph and telephone wire and cable (not submarine) ...	118,078	4,377	353
Submarine telegraph and telephone cable	72,491	—	—
Telegraph and telephone instruments and apparatus ...	183,200	15,419	3,552
Totals...	£1,284,511	£140,334	£14,557

THE KINGSWAY WIRING SYSTEM.

We have received from the General Electric Co., Ltd., particulars of the "Kingsway" wiring system, which the company has developed with a view to reducing the number of parts and special accessories to the minimum, whilst complying with all the requirements met with in wiring installations. It is claimed that the new system is simple, easy to install, not unsightly, safe in operation, and moderate in cost. Lead-sheathed wire and cables are employed, of the company's L1 grade, specially manufactured at the Firelli-General Cable Works, Southampton, 600-megohm class, insulated with pure and vulcanised rubber, and having from one to three cores, carrying from 6 to 18 amperes (I.E.E. rating). The wires are fixed to the walls with saddles or wiring clips, the latter being of tinned brass with countersunk holes for the screws or fixing pins, so that injury to the metal sheath of the cable is avoided (fig. 1). The backplate is of tinned brass



FIG. 1.—THE "KINGSWAY" CONTINUITY CLIP, WIRE CLIP, AND EARTHING BAR.

in the form of a wheel with spokes, fig. 2, and is provided with a centre screw, which acts as an earth terminal, and provides for fixing either the junction box cover or a wooden patress. A nut and washers are provided for clamping the continuity clips, and large and small holes in the rim enable the plate to be fixed in any position.

The "Kingsway" junction-box cover, shown in fig. 3, is a stout stamping provided with slits in the wall, so situated that any number of entries up to four, of any size of cable, can be

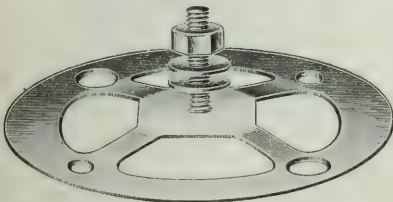


FIG. 2.—THE "KINGSWAY" BACK PLATE.

accommodated by bending the tongues of metal upwards and inwards, without special tools. A milled nut is permanently secured to the cover, to fix it to the back plate.

Fig. 4 shows the back plate with cables and connectors in position and the bonding completed, and fig. 3 shows the cover in place. Bonding is effected with the aid of the continuity clip illustrated in fig. 1, which has two fixing holes, one for side entry and the other for back entry. Only one size of clip is required. Lastly, a special earthing bar, shown

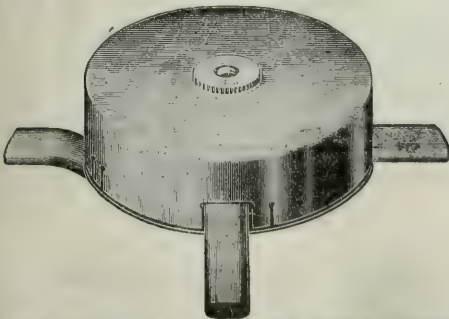


FIG. 3.—BACK PLATE AND JUNCTION-BOX COVER WITH WIRES IN POSITION.

in fig. 1, is provided for use at the back of fuse and switch-boards, and in other positions where it is necessary to bond several cables together; the bar is made of stout tinned brass strip, with an earthing terminal, and the connections are made with the continuity clip, attached with flat-headed countersunk screws.

It will be seen that the parts are few and simple, and no special training is needed for their installation, nor are special

tools required. Ordinary ceiling roses, switches, &c., are used with them, and the appearance of the completed installation is neat. The makers have issued a new section (Section W (2)) of their catalogue giving full details and prices of the

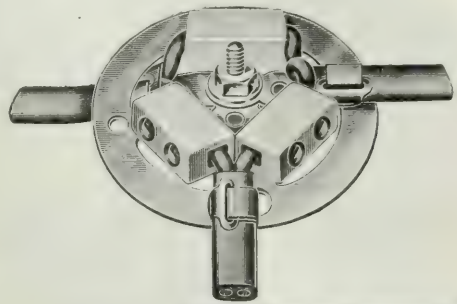


FIG. 4.—BACKPLATE, SHOWING WIRES AND CONNECTORS IN PLACE AND METHOD OF BONDING.

parts of the system, for which patents have been applied for, as well as of standard accessories for use in conjunction with it.

THE IMPORT TRADE OF BRAZIL.

THE following figures showing the value of Brazil's imports of electrical and allied goods have been taken from the official returns. The corresponding figures for 1918 have been given for purposes of comparison, and notes of increases or decreases added :—

	1918. \$	1919. \$	Inc. or dec. \$
<i>Dynamos and electrical generators.—</i>			
Total	222,000	203,000	— 19,000
From United States	140,000	141,000	+ 1,000
" Great Britain	6,000	18,000	+ 12,000
" Switzerland	74,000	39,000	— 35,000
<i>Electric motors.—</i>			
Total	188,000	597,000	+ 409,000
From United States	117,000	519,000	+ 402,000
" Great Britain	8,000	22,000	+ 14,000
" Switzerland	17,000	24,000	+ 7,000
" Uruguay	31,000	17,000	— 14,000
<i>Insulators.—</i>			
Total	127,000	192,000	+ 65,000
From United States	108,000	160,000	+ 52,000
" France	3,000	6,000	+ 3,000
" Great Britain	8,000	9,000	+ 1,000
" Portugal	7,000	14,000	+ 7,000
<i>Electric lamps.—</i>			
Total	726,000	1,046,000	+ 320,000
From United States	618,000	788,000	+ 170,000
" Great Britain	7,000	33,000	+ 26,000
" Netherlands	79,000	209,000	+ 130,000
<i>Transformers.—</i>			
Total	231,000	596,000	+ 365,000
From United States	213,000	578,000	+ 365,000
" Switzerland	10,000	16,000	+ 6,000
<i>Copper wire, electrical.—</i>			
Total	346,000	637,000	+ 291,000
From United States	337,000	602,000	+ 265,000
<i>Copper wire, unclassified.—</i>			
Total	440,000	600,000	+ 220,000
From United States	421,000	628,000	+ 207,000
<i>Copper wire, uninsulated.—</i>			
Total	57,000	17,000	— 40,000
From United States	57,000	17,000	— 40,000
<i>Electric wire or cable, n.o.c.—</i>			
Total	675,000	727,000	+ 52,000
From United States	662,000	682,000	+ 20,000
" Great Britain	4,000	13,000	+ 9,000
" Italy	6,000	27,000	+ 21,000
<i>Telegraph and telephone posts, bridge and fence material.—</i>			
Total	33,000	161,000	+ 128,000
From United States	31,000	87,000	+ 56,000
" Great Britain	2,000	74,000	+ 72,000
<i>Machinery, industrial.—</i>			
Total	1,411,000	2,538,000	+ 1,117,000
From United States	1,024,000	1,740,000	+ 716,000
" Argentina	17,000	57,000	+ 40,000
" Great Britain	141,000	571,000	+ 430,000

	1918.	1919.	Inc. or dec.
Motors, oil.—			
<i>Total</i>	182,000	59,000	- 123,000
From United States	2,000	11,000	+ 2,000
<i>Great Britain</i>	2,000	20,000	+ 18,000
<i>Switzerland</i>	160,000	12,000	- 148,000
Engines, steam.—			
<i>Total</i>	39,000	36,000	- 3,000
From United States	20,000	19,000	- 1,000
<i>Great Britain</i>	...	11,000	+ 11,000
Pumps —			
<i>Total</i>	188,000	313,000	+ 125,000
From United States	128,000	197,000	+ 69,000
<i>Great Britain</i>	29,000	70,000	+ 41,000
Other machinery, not textile —			
<i>Total</i>	2,314,000	5,466,000	+3,152,000
From United States	1,488,000	4,081,000	+2,593,000
<i>Argentina</i>	160,000	84,000	- 76,000
<i>Great Britain</i>	259,000	774,000	+ 515,000
<i>Sweden</i>	145,000	141,000	- 4,000
<i>Switzerland</i>	63,000	103,000	+ 40,000
Machinery, electrical, n.o.e.—			
<i>Total</i>	2,662,000	3,285,000	+ 623,000
From United States	1,722,000	2,762,000	+1,040,000
<i>France</i>	7,000	45,000	+ 38,000
<i>Great Britain</i>	85,000	279,000	+ 194,000
<i>Italy</i>	94,000	55,000	- 39,000
<i>Spain</i>	39,000	42,000	+ 3,000
	\$5	£1 approximately.	

THE INTERNATIONAL DENTAL EXHIBITION.

UNDER the auspices of the Incorporated Dental Society, an International Dental Exhibition was held at the Horticultural Hall, Westminster, from September 12th to 16th. Electricity nowadays plays a large part in dental surgery, but, of course, the various makes of apparatus differ only a little—chiefly in purely mechanical details—and, as a consequence, there was a great amount of duplication of exhibits.

As an example of this we will instance the "Ritter" apparatus for producing X-ray photographs of dental subjects; this appeared on three or four stands. The principal agents for this—an American production—are MESSRS. DE TREY AND Co., LTD.

One of the largest exhibitors were MESSRS. CLAUDIUS ASH, SONS & Co., LTD.—Among the exhibits of this firm was a "Cases" dental X-ray outfit. This consists of a Coolidge radiator tube, with a life of 1,000 hours, fitted with a dust-proof lead-glass shield and a lead-glass focusing tube to give the proper distance for radio-photographs. The tube is supplied with power at 70,000 V by an oil-cooled transformer whose primary can be connected to a 100/250-V supply. A motor converted can be supplied for dealing with d.c. The tube holder is mounted on the top of the transformer cabinet and is easily adjusted. This apparatus is of British manufacture although of American origin. The ionic medication outfit shown by this firm consisted of a dry battery, to the terminals of which electrodes could be connected for the application of ionised solutions such as copper sulphate, and zinc chloride which are used by dentists. Another device shown was a thermoelectric hot air syringe containing a small heating coil in an easily replaced cartridge. Electric-motor lathes for d.c. and a.c. at various voltages and frequencies were exhibited. These were equipped with brushes, small grinding wheels, and various other accessories. A number of small mouth lamps and reflectors also appeared, in addition to "Empire" high-frequency apparatus.

MESSRS. COTTRELL & Co. displayed and demonstrated high-frequency electro-medical sets, including the "Rogers" outfit. This is fitted with three "violet-ray" electrodes, cautery instruments, and an "ozone" attachment for giving a patient internal treatment. The set may be connected to an ordinary lamp socket and the current and pressure are regulated by small dial switches. Electrodes for special dental treatment are made in a variety of shapes. X-ray photographic units were also exhibited by this firm.

THE PALATINE DENTAL MANUFACTURING Co., LTD., in addition to the inevitable X-ray photographic exhibit, showed the "Rayway" special reflector for dental operations. This gives a beam of pure white light about 6 in. in diameter by the agency of a gasfilled lamp. Another device displayed was a "Rayway" hard-soldered steriliser fitted with a triple heating element and a three-heat switch. The danger of melting joints due to overheating has been eliminated from this steriliser.

THE DENTAL MANUFACTURING Co., LTD., exhibited a number of electrical devices. Included among these were examples of "Rathbone" electric lathes and small current converters. The "Pentz" steriliser was also shown. This consists of a necked cylinder into which a cylindrical tray of perforated metal slides. The cylinder is heated by means of an electrical

element. Mounted on the case is a small cup from which water drips through a glass tube into the heated chamber where it is evaporated. The instruments undergoing sterilisation are placed in the above-mentioned tray and reports of medical men testify to the efficiency of the method. This company also exhibited a high-frequency set for "violet ray" treatment, cautery, hot air, &c. Another steriliser shown by this firm, the "Thorne," was electrically heated and provided with an automatic switch, actuated by the melting of a fusible plug, to prevent overheating.

On this stand appeared a dental photographic outfit by X-RAYS, LTD., which is illustrated herewith (fig. 1). The

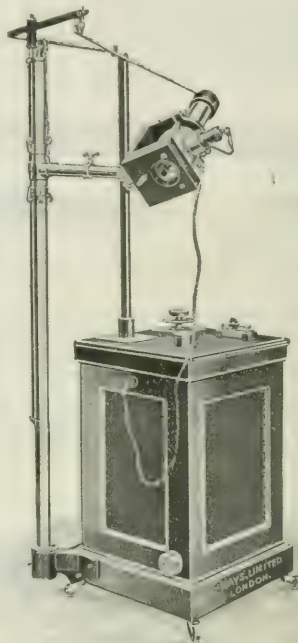


FIG. 1.—X-RAY DENTAL PHOTOGRAPHIC OUTFIT.

cabinet contains a small step-up transformer which gives an output of 45,000 volts, and is designed for use with the special Coolidge dental X-ray tube, as shown in the illustration. There is only one high-pressure wire, and this is kept well out of the way of the patient, being led up through a stout ebonite tube. The other wire which lights the filament is at a low pressure, and no shock is experienced if the patient touches this. On the top of the cabinet a special switch is provided, the first stud of which lights the filament and the second turns on the high-pressure current. A milliamperemeter is fixed, which gives the milliamperage passing through the tube and a small sliding resistance in the lighting circuit allows this to be controlled, the output being from one to ten milliamperes.

Mr. CONRAD H. PINCHES displayed and demonstrated the "Adams" X-ray dental unit, which is provided with a special film holder ensuring correct angles in the taking of photographs.

In conclusion, it remains to be said that each year the number of members of the profession who take the opportunity of inspecting the exhibits grows; the exhibition is of a strictly professional character, the lay public being rigidly excluded.

German Cable Deliveries.—The Java newspapers announce the arrival at Bandoeng of Herr Engler, representative of the Norddeutsche Seekabel Werke, of Nordenham, in connection with the laying of new submarine cables in the Dutch East Indies. It appears that the Government of the Dutch East Indies has purchased about 2,900 kilometres of cable from this German company, which cable reached Priok at the beginning of August on the steamer *Flint*, together with a number of engineers, including Herr Gruno, the company's chief engineer. Dutch State engineers boarded the ship and were conveyed to the Dutch East Indies cable steamer the *Telegraaf*, which took the cable on board for laying between Singkel and Sibolga, on Sumatra, and two new cables were to be laid between Java and Sumatra in the Soenda Strait and then from Makassar via Donggala to Menado and from Makassar to Socorboja.

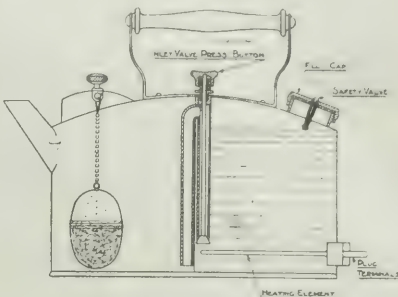
NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Watt-hour Meter Tester.

The Sangamo Electric Co. has recently placed on the market an improved type of portable test meter (fig. 1), intended for checking the accuracy of service-type watt-hour meters. The advantages of using this type of meter for testing are readily understood when it is realised that no indicating instruments or stop watches are necessary, and variations in the load and voltage are automatically eliminated. The meter is designed to combine a number of capacities in one case, the changes in capacity being effected by the rotation of a drum controller of special construction, operated by means of a dial switch mounted on the cover as shown. The range in capacity covers practically all the standard capacities now in general use, namely, 1-5-10-25-50-100 amperes. The larger currents are carried by multiple-leaf brushes bearing with considerable pressure on two sides of a flat disk. For the lower capacities the usual leaf brush is utilised. The entire drum mechanism is extremely simple, and the arrangement of moving parts such that they may be easily inspected. The standard meter is arranged for 110 and 220-volt operation, the changes from one voltage to another being accomplished by means of a rotating switch. When additional voltage ranges are required, "multipliers" are used. The register is of the three-pointer type. The large circle represents a single revolution of the disk, and is divided into hundredths. The two smaller pointers make one revolution for each 10

ance which combines the functions of a kettle with those of a teapot. As will be seen from the illustration (fig. 3), the water is boiled in one compartment by means of an immersion heater. A screwed filling cap is fitted, and this has a safety valve in the centre. When the safety valve acts, the button upon the top of the kettle is pressed, and



HASTIE ELECTRIC TEA KETTLE

FIG. 3.—THE "HASTIE" ELECTRIC TEA KETTLE.

the boiling water is forced by the steam pressure through an inlet valve into the other chamber. In the latter a tea-infuser is suspended. It will be seen that this device ensures that the tea is made with boiling water only, and when once made the tea is kept at a high temperature by the steam generated in the next compartment.

B.T.H. Floodlight Projectors.

Near the entrance to the Shipbuilding and Engineering Exhibition, at Olympia, is a large "Mazda" lamp poster, which is as visible by night as by day. The illumination

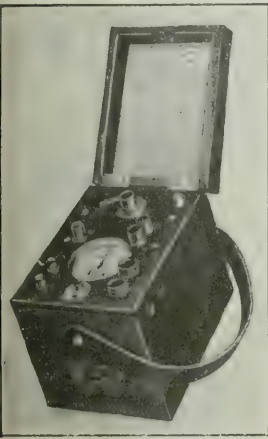


FIG. 1.—A WATT-HOUR METER TESTER.

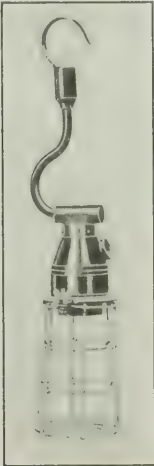


FIG. 2.—THE B.S.T. HAND LAMP.

and 100 revolutions of the disk respectively. A resetting device is provided, consisting of a small button on the top of the case and so arranged that upon applying a slight pressure the hands are immediately returned to zero, eliminating the necessity of taking the differences between successive readings in order to obtain the number of revolutions for a given test. A simple sealing device is provided which will enable testing laboratories to seal the meter against any possible tampering by unauthorised persons. All moving parts, including the vertical shafts of the register, operate in jewel bearings. The main spindle is held in position by a ring jewel where it passes up through the train plate, thus insuring against possible wear.—*Electrical News* (Toronto).

The "B.S.T." Hand Lamp.

We have received a sample of a new type of hand lamp from the B.S.T. ELECTRIC FITTINGS CO., DIXONS GREEN, DUDLEY. This has a movable handle which enables the lamp to be tilted to any angle when it is suspended by the hook seen in the illustration (fig. 2). The lamp-holder is contained in a wooden cone, in which is an ebonite plug for the entry of the wires. The wire guard is fastened by wing nuts to a flange retained by screws fixed in the wood cone. All the "live" parts are well protected, and the lamp complies with H.O. regulations in every respect.

A Combined Kettle and Teapot.

An effective time and trouble saving device has been put on the market recently by the HASTIE ELECTRIC WATER HEATER CO., ASHLEY STREET, NOTTINGHAM. This is an appli-

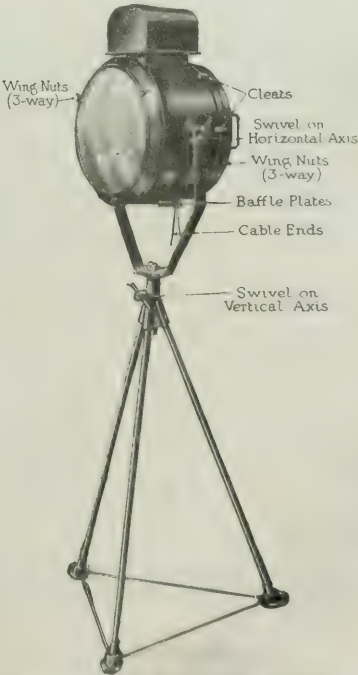


FIG. 4.—B.T.H. FLOODLIGHT PROJECTOR.

is effected by means of five B.T.H. flood-light projectors similar to that described below.

This type of projector consists of a sheet-steel cylinder with a glass front secured by wing nuts on the top of which is a housing containing a lamp-holder. The reflector may be one of three types, a plain mirror, a diffusing mirror, or a vitreous enamelled reflector. The lamp may be of from 300 to 1,000 watts capacity, gasfilled. The whole can be mounted on a tripod as shown in fig. 4, or on a segmental bracket. This illustration is about 1/13th actual size. Other types are manufactured, one of these having a conical, cast aluminium projector, the reflecting surface being the interior of the case. Coloured slides can be supplied for use with these projectors.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

A Novel Sign.

With regard to "E.H.K.P.'s" inquiry as to a novel sign he noticed, also your footnote, when in Paris recently the writer noticed a number of signs of this description, manufactured and installed by Messrs. Paz et Silva, of most attractive design.

The system of working is apparently as you describe. The lettering was done in script form, and a continuous length of tubing was employed, the portions not required being painted a very dark colour.

So far as memory serves, the tubing was backed by half-oval opal or sheet. The effect is certainly artistic, and one may believe that there may be a market for such signs in this country, though they are rather expensive.

Marshall Tate.

London.

September 12th, 1921.

[As noted in our last issue, the neon letter lamps are on view at the Shipping Exhibition. These lamps contain the letters; those to which our correspondent refers, and which we also mentioned, are shaped to form the letters.—EDS. ELEC. REV.]

Books on Lighting and Heating.

I shall feel obliged if you, or one of your readers, will be kind enough to recommend to me a manual on modern domestic and hotel lighting and heating.

Wireman.

[Possibly "The Theory and Practice of Heating and Ventilation," by A. H. Barker (Constable & Co.); "Modern Illuminants and Illuminating Engineering," by L. Gaster and J. S. Dow (Pitman & Sons); "Electric Light Fitting," by S. C. Batstone (Pitman); and "Elements of Illuminating Engineering," by A. P. Trotter (Pitman) would be found useful.—EDS. ELEC. REV.]

Abnormal Meter Readings.

With reference to Mr. Theo. R. Kernick's solution *re* the above, published in your issue of July 29th, I beg to state that the meters in question were checked by four members of our staff, including myself, at once, on receiving complaints from the consumers, and there was no error in the readings. The meters read in some cases to 1/100th of a unit and in others to 1/10th of a unit.

We use nothing but Ferranti meters, and have always found them satisfactory.

R. Forrest Preston.

Electricity Works, Ahmedabad.
August 22nd, 1921.

The Cost of Living in West Africa.

I should be very much obliged if you could obtain for me through your valued journal, the cost and conditions of living in Accra, West Africa, and whether it is at all a possible place for a white woman to live in, for the usual periods of West Africa.

R. N. Torpy.

Borough Electrical Engineer.

Tunbridge Wells.
September 15th, 1921.

[In our issue of January 14th, 1921, p. 42, some particulars of the conditions obtaining on the Gold Coast were given. We should welcome further information from our readers.—EDS. ELEC. REV.]

A Question of Sincerity.

I note with very great satisfaction that you really mean that all should work, and I gladly withdraw my strictures, but I am surprised to find that you have such revolutionary ideas. They are far more revolutionary than mine, and if carried into effect would completely upset the present system which divides the people, broadly, into two groups, parasites

and workers, though there are plenty of parasitic workers or working parasites.

Now for the test, if I may be excused for putting it that way.

What do you suggest should be done to eliminate the parasite? It must be clear to everyone that a start in that direction will have to be made soon, or things will begin to happen. Of course, we don't want any Bolshevism in this country, yet, seeing that before the war there were upwards of two million sheer parasites in this country, and that by now the number must have increased enormously, it would be interesting to me, and I am sure, to all your readers, if you would put forward some suggestions as to how it could be ensured that all should work. Such a state of affairs cannot possibly come about accidentally. Deliberate attempts must be made to change the system, if catastrophic change is to be avoided.

F. W. Shorrocks.

London.

September 14th, 1921.

[Our correspondent asks us how to constitute an ideal State; we do not know—we wish we did. No man capable of working should be idle from choice.—EDS. ELEC. REV.]

The Design of Bakery Machines.

As one of the 20-odd firms which exhibited machinery at the recent Bakers', Confectioners', and Allied Traders' Exhibition and Market, we are very interested in your Editorial comments. At the same time, we must admit that your suggestion to incorporate the motor as a component part of the machine has been thoroughly studied by ourselves, but discarded as unpractical from a production point of view.

No attempt at standardising can be successful, particularly when building machines for home requirements as well as for export, whilst so many freak voltages and periodicities abound. Further, we have to consider districts where no electric supply is available.

For the above reasons our dough mixing and kneading machines are exclusively designed for belt drive. The belt risk is negligible, as the belt is behind the machine and well away from the operator. We can easily place the motor in a position to suit local conditions, that is, on the floor alongside, on wall brackets above the machine, or in the loft overhead. If existing shafting is available we can drive off it, and where neither of the above facilities exists we install an oil or gas engine.

Our experience is that belt-driven machines are the safest, inasmuch as when a seizure occurs through lack of attention or a sack of flour is inadvertently dropped into the machine, nothing more serious than the throwing-off of the belt occurs, whereas with a direct-gear machine the windings may give out. It may be said that the fuses will prevent such happenings, but in the bakehouse we do not find skilled electricians, and consequently the gauge of wire used to replace a blown fuse is of no account. We have found No. 18 copper wire used to protect a 3-b.h.p., 450-V motor!

In conclusion, we reaffirm that no attempt at incorporating the motor as a component part of the machine (always considering the universal distribution of the article) can be successful until electricity supply is standardised. Single-phase supply with peak frequencies and 330-V d.c. supply are pests.

W. Eller-Styles, M.I.E.E.,

Managing Director,
Artoflex Engineering Works, Ltd.

London,

September 19th, 1921.

Accumulator Froth.

The correspondence in your paper concerning the above should not be allowed to drop until the definite cause has been located and the cure discovered.

The makers themselves do not appear to have realised the seriousness of the trouble, or, if they have, they have not taken reasonable care to deal with the situation.

As an illustration, the writer has had three separate 6-volt sets of accumulators by different makers, in celluloid cases, brand new, charged under his own supervision with the best materials obtainable, and has had to abandon them in favour of glass-boxed cells, owing to the destructive effects of the frothing.

When I add that the last set—a type of accumulator manufactured in very large quantities for the Government—frothed to such an extent when charged at less than one-third rate, that before the cells were properly charged the acid covering the upper half of the plates was entirely frothed out of the containers, the seriousness of the trouble may be realised. The only remedy the makers suggested was that these cells should be washed out with distilled water and re-loaded.

This suggestion, in itself, indicates that the situation has not been properly grappled with by the makers, for no kind of washing either with distilled water or the best of accumulator acids obtainable is sufficient to effect a cure.

I would not have troubled you with this correspondence, but for the fact that I am convinced the makers are not taking a reasonably scientific attitude in the matter, for if

it is desired to retain the admitted advantages of celluloid for a containing cell, it does not seem unreasonable to expect the makers to retain these advantages, whilst eliminating the possibility of frosting, by painting the interior faces of the celluloid with some such preparation as paraffin wax.

The writer's experience with three different reputed makes of cells, is such that he is completely in accord with Mr. Frost's letter; and the further correspondence of Mr. Peto, and the general attitude of the makers towards this question, lead him to assume that the makers are in sympathy with the proverbial ostrich whose head is buried in the sand.

Thos. Hesketh,
Managing Engineer.

Electricity Supply,
Folkestone,
September 19th, 1921.

Organ Blowers.

Commenting on "Organ Blower's" letter, which appears in your issue of September 16th, 1921, there are in general two types of blower, i.e., motor-driven fans and motor-driven feeders; the latter, usually three in number, are operated by a three-throw crankshaft on the under-side of the bellows. To the best of my knowledge the latter scheme can only be applied where a d.c. supply is available, as obviously the speed of the motor has to be controlled in accordance with the demand for wind.

"Organ Blower" states that a d.c. motor is easily controlled by means of resistance in the armature circuit, but this method is extremely wasteful of power and should only be resorted to if the only practicable scheme is a three-throw feeder.

I hold an appointment as organist, and am responsible for a three-manual organ, the wind supply for which is furnished by a motor-driven fan. The motor is a 3-h.p., 3-phase squirrel cage machine, and is started up by means of a Y-delta switch. The speed is more or less constant; the control of the wind supply being entirely automatic. This is effected by inserting between the main bellows and the fan a control box, inside of which is a wooden grating. On the blower side of the grating a leather roller blind is fixed, spring biased to the down (air inlet to bellows closed) position. When the bellows are empty, however, a cord fastened to the top of the bellows, and passing over suitable pulleys, pulls up the roller blind, thereby fully opening the inlet to the bellows. When the fan has attained full speed the bellows begin to rise and at the same time the roller blind commences to descend (gradually closing the fan outlet).

The operation of this gear is extremely satisfactory; the wind supply is steady, and there is no elaborate electrical control gear to contend with.

I agree that there is certainly an objectionable hum with a.c. motors, an inherent feature which in this instance we overcame by building a sort of double box with felt packing. This box is large and fits over the whole of the blower equipment. The air is drawn through gratings in the wall at the motor end, and suitable inspection doors are fitted in the box. By so placing the inlet gratings, all the air passes across the motor, thereby ensuring very little increase in temperature rise, due to the boxing-in of the equipment. It should be noted, however, that this sound-proof box is of generous proportions, otherwise trouble might have occurred due to the excessive temperature rise of the machine.

An important fact with regard to fan blowers is that when the outlet is closed the fan is running, comparatively speaking, light, and there is therefore no waste of power.

In conclusion, I would point out that an organ blowing equipment should not be bolted to the floor, as if this is done the motor will be heard all over the building. The bedplate of my equipment rests on felt pads and is not bolted down at all, yet I have not experienced any tendency for it to "walk."

C. H. C.

September 19th, 1921.

With regard to "Organ Blower's" letter in your issue dated September 16th, 1921, the writer is evidently not conversant with the latest practice. We make an a.c. motor practically silent, running at 1,600 r.p.m., which in turn operates a device giving 5 r.p.m., and this device also is practically silent. We shall be pleased to show him the arrangement at work if he cares to write us.

We might point out that the method he mentions of inserting resistance in the armature circuit of a d.c. motor is a very inefficient way to reduce the speed.

H. A. Easter.
For British Electric Co.

London,
September 17th, 1921.

We are interested in the letter appearing in your issue for September 16th, regarding the difficulty of changing-over electric organ-blowing installations from direct-current to alternating-current working. We have carried out many hundreds of electric organ-blowing installations of various types, and our experience is that the rotary blower is the only practicable

plant to install for alternating-current working, the blower running at constant speed and the regulation being carried out by means of a wind control valve attached to the organ reservoir.

With a specially designed blower the wind will merely circulate in the casing when the delivery is closed by the regulating valve, and the current taken by the motor will fall under these conditions.

It is usually possible to find a place for these blowers, either in an adjoining vestry, or in a chamber below the organ, although sometimes it is necessary to sink a pit or build an outhouse outside the church.

The output of a rotary blower is quite independent of the bellows capacity of the organ, and any quantity of wind can be arranged for at a steady pressure.

It is, of course possible to operate a feeder blowing installation with alternating-current motors, regulating the speed of blowing by means of fast and loose pulleys and automatic striking gear controlled from the reservoir, or, alternatively, a repulsion type motor can be used on single-phase circuits with resistance control. All these arrangements are, however, inclined to be noisy, and cannot compare with the direct-current installation for smoothness in working.

For these reasons we ourselves have made it a practice to adopt a rotary blower direct coupled to motors for all alternating-current work, and we shall be very pleased to give your correspondents any further information on the subject if desired.

The Rockingham Engineering Co.

Thornton Heath,
September 19th, 1921.

Carpets and the Electric Suction Cleaner.

Re correspondence in the REVIEW on this subject, I presume this deals with domestic machines and not with plant for commercial work.

I have had 40 years' experience in cleaning carpets, and have yet to see the vacuum or suction cleaner that can do so efficiently. For loose fabrics or surface cleaning, or tidying up, I admit that the vacuum has its use, but I maintain that to remove the dust from the body and not merely from the surface of a Brussels or Axminster carpet the only practical and efficient method is to beat it. Should any of your readers wish for further proof of this I shall be happy to give details.

Alex. Orr.

Edinburgh,
September 19th, 1921.

Supply without Statutory Powers.

The letter regarding the above makes very interesting reading. In my mind, "A.O.G." is getting rather alarmed at the prospect of an outside supply. It seems they have had the field pretty much to themselves. I wonder what is the difference in cost per kWh, between the supply under discussion, and the proposed figure (3d. per kWh)? If the figures are much higher, why? I think it is the dearth of supply (not always justified) that has hindered the progress of village lighting and power. Why all this bitter feeling on the part of the R.D.C.? It must have a reason. I think the sooner "the far-distant electric station" erects its transmission lines, the better for those in need of cheaper electricity.

Northwallan.

September 19th, 1921.

In your footnote to my letter last week you say I "question whether an outside supply at 24d. or 3d. per kWh can compete with a private installation," although I have elsewhere assumed the opposite.

At the risk of appearing to be trying to run a serial in your columns, may I point out that two kinds of private installation, with vital differences, were mentioned?

The approximate figures of the village supply are:—Population 800, annual output 8,000 units all lighting, no power load. This case is best dealt with, keeping in mind the lowest possible total of annual charges on capital and cost of labour, by installing a 14-h.p. engine, running somewhere near full load, four hours per day on an average, in conjunction with a storage battery. The fuel cost per unit, delivered to consumer, with an oil engine of the type mentioned, would be about 2d. But, and here comes the rub, you must have a man in charge, and, however easy his work, he must have a decent rate of pay. His wages in this case at only 42 12s. a week say, come out at 4d. per unit.

If the population does not exist, to require a larger plant, you cannot reduce this item, and that is exactly where these very small schemes differ vitally and inevitably from the larger ones.

There are still the capital charges &c., but as we already have 6d. against the 24d. or 3d. before assumed, we need go no further. It is taken that the outside supply would be by static transformer.

It is unnecessary to labour the point that the case of the other private installation, a works power supply, is not comparable with the above, and that a supply at 3d. which would

undersell the first, might possibly not be cheap enough for the second.

Regarding the attitude of some of the labour men, which you describe as a mystery, the only explanation is hatred of private ownership of public utilities carried to fanatical extremes.

Thanking you for the use of your valuable space.

A. O. G.

September 16th, 1921.

[We are much obliged for this interesting statement, which fully explains the situation.—EDS. ELEC. REV.]

A Conundrum.

Shortly after the appearance of an article in your issue of July 29th entitled "Super-scale Measuring Instruments," we received the following inquiry:—

"Re article in the Review.

"If four super-scale instruments are arranged in a Scott Bow, how many herrings can one purchase for a shilling?"

As you are possibly aware, we rather pride ourselves upon our ability to deal with any and every problem that may arise in connection with electrical measuring instruments, but our pride has had a fall, and we must confess that this one completely baffles us.

It seems clear that the "herring" is introduced as a term of contempt, and symbolises the now almost obsolete 90 deg. scale ammeters and voltmeters which our correspondent evidently values at several to the shilling.

What defeats us, however, is the reference to the "Scott Bow." We have consulted every available dictionary as well as several members of the B.E.S.A. Committee on Nomenclature, but in vain: and yet on referring to the article in question we find on page 139 that the term is used without any comment whatever. It occurs to us, therefore, to ask whether you or any of your readers can help us?

Everett, Edgcombe & Co., Ltd.

London,

September 19th, 1921.

[On reference to the article we were as much perplexed as our correspondents to account for the mysterious allusion. On investigation, however, we find that it resulted from a hieroglyph of the author's which was intended to read "switchboard."—EDS. ELEC. REV.]

The Testing of Meters.

I have read with great interest Mr. R. M. Moberly's article on the testing of meters in your issue of September 9th. I would, however, like to draw your attention to the Sangamo portable test meter, since in Mr. Moberly's article he only mentions a meter supplied by the British Thomson-Houston Co., or the Metropolitan-Vickers Co.

In some respects the Sangamo meter is an improvement on the others mentioned, since the standard current ranges of the Sangamo meter are 1, 5, 10, 25, 50 and 100 in the self-contained meter, which is, I believe, considerably more than is possible on the other meters specified.

E. H. Miller,

For the Edison Swan Electric Co., Ltd.

Ponders End,

September 19th, 1921.

[By a coincidence, this portable meter is described in our "New Devices" to-day.—EDS. ELEC. REV.]

Situations Vacant.

A vast amount of time, trouble, and disappointment would be saved if the employers advertising vacancies in your columns would state for what part of the country they are offered—London, Glasgow, &c., or even Midlands, North of England, &c.

This week most of the notices do contain the information, but there are still five which do not, and it frequently happens that jobs are offered the nature of which must obviously appeal to many without the slightest indication as to what part of Great Britain the post lies.

September 17th, 1921.

Watts.

Enamel for Mercury Meter Disks.

In your issue of September 9th there was an interesting article on "The Testing of Electricity Meters." The author mentioned the necessity of burning off the mercury and re-insulating the disk of Chamberlain and Hookham meters, but did not name an enamel that would be suitable for the job.

I should be very pleased if you or any of your readers could give me information as to a suitable enamel and whence it could be obtained.

F. B. S.

"F. B. S." is advised to consult Messrs. Chamberlain and Hookham, who no doubt will let him know the name of their present varnish or supply him with some. Failing this, a sealing-wax compound has been found satisfactory for several years.

R. M. Moberly.

Wind Power Machinery.

I shall be very glad to receive communications from any firms manufacturing modern types of windmill suitable for pumping or driving electric generators.

J. W. Beauchamp.

Director and Secretary, E.D.A.

84, Kingsway, London, W.C. 2.

September 20th, 1921.

Sound Methods of Providing Employment.

The leading article of March 18th, commenting upon the attitude of supply authorities and new service connections, evades what, in many instances, is the crucial point. You apparently make no allowance for the stringent financial conditions under which many of the smaller electricity undertakings are struggling, and where, owing to inadequate working capital, enterprise has perforce to be strictly curtailed.

It seems to me regrettable that some of the funds now being expended to meet the prevailing problems arising from unemployment, cannot be utilised for useful industrial purposes. The existing method of dealing with the matter represents a real loss to the community. If financial aid could be given to those public utility companies which are not only endeavouring, despite the present difficulties, to carry out their statutory obligations, but also desire to embark upon urgently necessary extension schemes, the capital so advanced would ultimately be wholly repaid and work provided for both technical men and skilled artisans—a class who obviously gain no encouragement from the announcement of road-making projects.

Some such suggestion carried into effect would result in permanent employment for various branches of engineering and add its quota to the industrial development of the country.

H. H. Arthur, M.I.E.E., M.I.Mech.E.

Electricity Works, Staines.

September 15th, 1921.

[Our reference of March 18th was to illegal charges, and methods likely to hinder the progress of electricity supply; on April 29th and May 27th, we drew attention to the hard case of the small supply companies, and we venture to suggest that our correspondent's criticism is somewhat belated. The proposal which he puts forward is one with which we are in full agreement, and we are pleased to note that in principle it has received the support of Sir Alfred Mond's Committee, and other authorities on the industrial situation.—EDS. ELEC. REV.]

[Will "Not a Prude," who has written us a letter for "Correspondence" columns relating to an advertisement appearing in our last issue, kindly send us her name and address, in accordance with our rule?—EDS. ELEC. REV.]

REVIEWS.

The Elements of Direct-current Electrical Engineering. By H. F. TREWMAN, M.A., and G. E. CONDLIFFE, B.Sc. Pp. 219; 146 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d. net.

The authors of this book have set out to bridge the gap existing between the elementary text-books on magnetism and electricity and the more advanced books which deal with the design point of view. The result is a very concise outline of the elements of d.c. electrical engineering, which should prove particularly useful to engineering students who are already familiar with the simple phenomena of electromagnetism, and who are passing through electrical shops and test bays.

The book is divided into twelve chapters, the first of which deals with units and gives a résumé of the fundamental laws of electromagnetism. Then follow two chapters on induced currents and electromagnetism, in the latter of which the subjects of magnetic testing and the magnetic circuit are dealt with very fully. A few examples at the end of each chapter serve to crystallise out the most important points and to ensure that the student can make calculations—a good test of the soundness of his knowledge.

In the chapter on instruments the authors, while dealing only with typical cases for the sake of simplification, have succeeded in covering a very fair amount of the ground, including ammeters, voltmeters, dynamometers, wattmeters, recording instruments, potentiometers, and the various types of supply meters. The only notable omissions are hot-wire instruments and the electrostatic voltmeter. A wire preference for line diagrams over the customary catalogue illustrations characterises this section of the book. It is a pity that a little more space has not been given to the Edison cell in the chapter on storage batteries, but so far as the lead cell is concerned, the treatment is both clear and comprehensive.

In the five chapters dealing with the dynamo, which naturally occupy nearly half of this little volume, the construction and parts of the dynamo are first explained; then the various types of windings are described and the method of calculating the e.m.f. of the machine is given. The methods of excitation

are next described, followed by a number of typical calculations on the magnetic circuit for a d.c. machine. Commutation and armature reaction form the subject of a separate chapter, as do also losses which are analysed very carefully, the treatment forming a useful introduction to the subject of testing to which the last chapter is devoted. The operation characteristics associated with the various types of excitation are covered very fully in a further chapter, the whole treatment of the dynamo being exceptionally thorough and practical.

The Arithmetic of Telegraphy and Telephony. By T. E. HERBERT and R. G. DE WARDT. 1p. viii+187; 38 figs. London: Sir I. Pitman & Sons, Ltd. Price 5s. net.

Ability to make accurate calculations in any branch of applied science demands not only experience and accuracy in using the ordinary operations of arithmetic, but also a definite understanding of the technical principles involved. Many students and qualified technical workers lack one or other of these essentials, and sometimes they come to grief on both counts. The present volume is, therefore, sure to be welcomed by a wide circle of students and workers in the field of telegraphy and telephony, for it provides at once an admirably clear exposition of arithmetical methods and a first-class means of testing and consolidating technical knowledge by the working of numerical examples. Those who go straight from school to college or evening classes cannot realise the *hiatus* created by even a year or two between schooldays and the endeavour to apply the lessons then learnt more or less efficiently.

The first chapter, dealing with all the ordinary rules and operations of arithmetic, is therefore far from unnecessary. Then follow chapters dealing with the calculations appertaining to the arrangement of cells; shunts and current division therein; resistance of conductors; measurement of current, e.m.f., and resistance, and fault localising. In each case the general method of treatment is as follows: The theory of the subject is discussed briefly in so far as it affects quantitative calculations, and worked numerical examples are then given illustrating the solution of problems for all the conditions likely to be encountered in practice. Finally, a number of set problems are presented, answers being given at the end of the volume.

In addition to the chapters mentioned above there are others dealing with the calculations appertaining to condensers, to magnetic circuits and electromagnets; to work, power, and heating; to electrolysis, and to overhead lines. The final chapter on curves gives an excellent introduction to the plotting and interpretation of graphs. Simple arithmetical methods are employed throughout, and the authors deserve the thanks of their readers for the care devoted to selection and presentation of the subject matter. The volume has a distinct value as a technical handbook, quite apart from its arithmetical function. It can be used as well for private study as for class work, and it will be particularly appreciated by post office employees and by candidates for the Grade I examination in telegraphy and telephony. Needless to say, the calculations involved in most of the subjects enumerated above are equally applicable in other branches of electro-technics, so that the book has a much wider field of utility than is covered by its title.

There is a chapter on the d.c. motor which, while it only occupies 20 pages, succeeds in covering all the essentials, and includes a fair account of starters and control gear. The few examples at the end of the chapter have been carefully chosen with a view to emphasising the essential points, and are of a practical character.

The few criticisms we would make concern matters of detail, the general planning and execution of the work being sound and praiseworthy. The statement of the practical units in Chapter I is not ideal; in view of the scope of the book the B.O.T. or International Units would have formed a more suitable basis than the G.C.S. electromagnetic system. The "amount of the inertia" referred to on page 157 should read "moment of inertia." Apart from such minor matters, we think well of this little book, and would recommend it to students as a good common-sense account of direct-current electrical engineering.—P.H.S.K.

Is Trade Unionism Sound? A suggestion for outflanking the power of capital. By J. H. BUNTING. Pp. x+98. London: Benn Brothers, Ltd., 1921. Price 6s. net.

In a note by the publishers, enclosed with the book, we are informed that it was printed and privately circulated during the war by the Garton Foundation. It is well that this fact should be appreciated at the outset, for reasons which will appear later. Further, it is explained in a footnote that the expression "the power of capital" does not mean its beneficent power in the promotion of production, but the tyrannical power that it may become in hands that use it ill.

The author has devoted a considerable amount of thought to the preparation of his arguments, and has shown that there is much to be said in their favour. They are carefully set out and well arranged. They amount, in substance, to a suggestion that collective bargaining is not the best method of advancing the interests of the workers. Their interests, and with them those of the whole community, would be better served by the prompt acceptance by the workers of the terms

offered by employers. To make the greatest possible use of capital, i.e., of labour-saving machinery and the like, they are to take the highest wage they can readily obtain, and as an immense increase in production, reduce the relative amount they pay for the use of capital. In other words, as we have never ceased to point out, the overhead or standing charges are to be spread over an enormous output, and so become smaller not only absolutely, per article produced, but relatively, when compared with the total sum paid to the workers as wages.

Safeguards are suggested, so that the rates of wages obtaining in different parts of the country are known to all the workers, and employers who do not pay well do not get any workers. The demand for workers is so increased by the cheapening of the supply of labour, that competition between employers ensues. The increased production of goods cheapens everything and so increases the effective demand. This brings about a boom, plenty, and prosperity for all.

We should like to see a greater "will to work" on the part of the whole community. The gospel of work needs preaching to-day more than any other. If it could be universally realised that the good of all depends upon the effort of each one of us, and the good of each depends upon the effort of all, the world would be a lot happier than it is to-day. Abolish selfishness and substitute goodwill, and you are well on the way towards peace on earth, with all that that implies.

Yet we are compelled to ask if there is the least possibility that the wisdom of this course will be accepted by the workers. At present we fear the answer must be an emphatic negative. The workers know something of the history of their lot, and they cannot find that it was better before collective bargaining was first instituted. On the contrary, it was infinitely worse. At the stage that had been reached in the early days of trade unionism, united action was an imperative necessity, and we have often shown how the employers' action in cutting piece-rates, and in seeking generally to impose a limit on the possible earnings of their employees, staff and manual workers alike, discouraged these employees from putting forward their best efforts, and directly fostered the worst features of trade unionism. And now that collective bargaining has become the order of the day—and let it not be forgotten that there are employers' associations which exist for the purpose of standardising rates of pay, as well as trading combinations which control market prices—the course which has commended itself to most of those who have devoted time and thought to the problem is that of a proper regulation of collective bargaining. What else are Whitley Councils than controlled, or regulated, bodies which exist for the purpose of discussing and settling rates of pay, working conditions, and all matters relating to the industries in which they are interested?

The reader will now see why we insisted at the beginning of our consideration of Mr. Bunting's book that it was printed during the war. No doubt the Whitley reports had not then been issued, and Mr. Bunting's work was the result of his own meditations on this most important matter. He saw, as we all saw, the days when unemployment did not exist, when demand was so great and insatiable that all available labour was absorbed in satisfying it. Alas! that it was all for destructive purposes. If only we could apply to the arts of peace the concentration of purpose, the initiative, the unity of effort, that we applied to the arts of war, not only the country but the war-weary world would be the better for it.

Dealing with the book itself, we admire the way in which it is set out, the subjects treated being arranged in headed and numbered paragraphs, so that any particular point can be turned up from the contents list—there is no index—with a minimum of trouble. We rather wonder how Mr. Bunting's arguments are helped by the supposition, on p. 34, that we are in Mars, and that the conditions are precisely the same as on our own planet. We also wonder how long it has been true that it costs 25s. to produce the gold in every sovereign (p. 46). "Same" is not a relative pronoun (p. 66). We do not consider the interest analogy on p. 55 a good one. It is very seldom that compound interest accrues on capital in the shape of money, and the compound interest growths in nature are limited by other operations of nature—very fortunately, too, or the sea would be stiff with fish, and flies would cover the earth. "Has" should be "have" on p. 4, and "effected" should be "affected" in the last line of p. 51.

We hope we have shown that we have been much interested in Mr. Bunting's book. We should be further interested to learn whether he still considers that the acceptance by labour of the best terms available would be better than the widespread—in fact, universal—acceptance of what we may call Whitleyism, and how he suggests that his principles should be so brought home to the workers that they may be appreciated and acted upon.

Nitrogen Products from the Air.—Dr. William S. Nicholas, chairman of the Board of the Allied Chemical and Dye Corporation, speaking before the annual meeting of the American Chemical Society at New York, said that chemists of his company had succeeded in solving the German secret of making nitrogen products from nitrogen in the air.—*Birmingham Post*.

BUSINESS NOTES.

Bankruptcy Proceedings.—CHARLES AGUSTUS CARPENTER, electrical engineer, 4 and 5, Mason's Avenue, Basinghall Street, E.C.—This debtor attended at the London Bankruptcy Court on September 13th for public examination under the receiving order made against his estate on June 27th. A statement of affairs showed gross liabilities £1,500, all of which were expected to rank for dividend. The only assets disclosed consisted of shares in C. A. Carpenter, Ltd., of doubtful value. The debtor said that in October, 1913, he, in partnership with another person, commenced the business of electrical engineers at 4, Maidenhead Court, Aldersgate Street, E.C. In December, 1913, the business was sold to a private company, which, in the following year went into voluntary liquidation, and thereafter he continued a similar business on his own account at the same address. Towards the end of 1916 he was joined by a partner who put in £200 capital. In June, 1917, he (debtor) left the business, his partner retaining the assets in consideration of the capital which he had introduced. In July, 1917, he became managing director of a company formed to acquire a patent burglar and fire alarm which he had invented. As vendor he received £500 in cash and £900 in shares, but in June, 1918, he resigned his appointment and sold his shares for £150. In June, 1918, he rented premises at 4 and 5, Mason's Avenue, E.C., and recommenced business on his own account as an electrical engineer. In December, 1918, and March, 1919, he was joined by partners who, however, retired after a few months. Owing to illness and labour troubles his trading had not been successful, and in March, 1921, he registered a private company "C. A. Carpenter, Ltd.," with a capital of £2,000, to which he transferred the whole of his business assets, but the company did not take over his trade debts. As vendor he received 1,998 £1 fully-paid shares, 1,200 of which were allotted to his brother in consideration of advances received in August, 1920, which advances had been made on the understanding that shares would be allotted therefor when the company was formed. He attributed his failure to ill-health during the past two years, to labour troubles, and to lack of capital. Of the unsecured liabilities £1,044 was due for cash advanced; £410 for trade goods supplied, and work done; £56 for rent; £29 for law costs, and £15 for repairs. The examination was concluded.

M. WATKINSON, H. WATKINSON, and A. WATKINSON (WATT & Co.), electrical and mechanical engineers, 22 and 24, Palmer Road, Sheffield.—First meeting September 23rd at Official Receiver's Offices, Sheffield. Public examination October 20th at the County Court Hall, Sheffield.

J. JONES and J. R. JONES (J. JONES & SON), electrical engineers, Penzance.—Last day for proofs for dividend October 3rd. Trustee, Mr. W. C. Pezzack, Public Buildings, Penzance.

Company Liquidations.—MAXIM LAMP WORKS, LTD.—Petition for winding up has been presented to the High Court by Messrs. C. Quitman, glass merchants, &c., of 3, Cloth Lane, E.C., and will be heard in London on October 18th.

CRY ELECTRIC WELDING CO. (NEWCASTLE), LTD.—Winding up voluntarily. Liquidator, Mr. J. C. Graham, Junr., 16a, Granger Street, Newcastle-on-Tyne, to whom claims should be forwarded by October 14th. Meeting of creditors called for October 4th.

FLORUNDUM FLAME CARBONS, LTD.—Meeting will be held October 17th at 4, Pavilion Buildings, Brighton, to hear an account of the winding up from the liquidator, Mr. F. N. Clarke.

OXFORD PORTABLE PROJECTOR, LTD.—Winding up voluntarily. Liquidator, Mr. W. G. Barnard, Fernwood, Ashford, Middlesex.

LITTLE WONDER BATTERY CO., LTD.—Meeting of members will be held at 26, Budge Row, E.C., on October 21st to hear an account of the winding-up from the liquidator, Mr. R. G. Pye.

Dissolutions of Partnerships.—W. C. MARTIN & Co., 10, West Campbell Street, Glasgow.—Mr. Gilbert Austin has voluntarily retired from this partnership, and Mr. James Lowson, the other partner, has acquired the whole assets of the firm, and will discharge liabilities. He will continue to carry on the business under the same firm name.

MCCULLOCK & NEWITT, electrical and general engineers, 44, Park Street, Leeds.—Messrs. H. McCulloch and H. Newitt have dissolved partnership. Mr. H. McCulloch will attend to debts and continue the business.

Trade Announcements.—The business of electrical contractor carried on at Victoria Street, Morecambe, by Mr. GEORGE MORRISON, has been taken over by Mr. H. N. Shorrocks, the manager.

MR. ARCHIBALD CAMPBELL, who represents the Swiss Insulating Works, Ltd., of Bretonbac, is now conducting the agency from 8, Wolsley Road, London, N. 8, instead of, as hitherto, 27, Chancery Lane, W.C. 2. His "phone number is now "Hornsey 2711."

Catalogues and Lists.—MESSRS. MELCHIOR, ARMSTRONG AND DESSAN (LONDON), LTD., 14 and 14a, Ct. Marlborough Street, Oxford Circus, London, W. 1.—An illustrated booklet giving full particulars of construction and operation of the "Mad-strong" electric lighting plant.

STERLING TELEPHONE AND ELECTRIC CO., LTD., 210-212, Tottenham Court Road, W. 1.—A card bearing eighteen samples of telephone cables of various types, lead-covered wire, and flexible wires.

MESSRS. HIGGS BROS., Sand Pits, Birmingham.—Price List No. 6 giving specifications, prices, &c., of a.c. and d.c. motors.

THE BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, E.C. 4.—Price list No. 10,482A, giving illustrations and particulars of B.T.H. floodlight projectors for advertising purposes, &c.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C. 2.—Leaflet O.S. 2,569, advertising "Osglim" neon lamps containing letters and numerals. Illustrated and priced. Illustrated booklet, showing component parts and method of connecting up of the "Kingsway" wiring system.

Illustrated leaflet No. X (3) section, 13th edition, showing standard types of circuit breakers, together with leaflet No. X 2,523, of revised prices of circuit breakers appearing in the former.

THE ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, London, S.W. 8.—Illustrated leaflets, giving prices, &c., of automatic motor starters, starters for squirrel-cage motors, ironclad switchgear, &c.

MESSRS. CARRICK & RITCHIE, LTD., Edinburgh.—Illustrated booklet, giving prices, &c., of "Waverley" and "Girard" turbines, Pelton wheels, and other water motors.

Book Notices.—"Aluminium and its Alloys," by Lt.-Col. C. Grand, translated by C. M. Phillips and H. W. Phillips. Pp. xxiv+184; 83 figs; 17 plates. London: Constable & Co., Ltd. Price 17s. 6d. net.

"Practical Electricity," by W. E. Ayrton. Revised and largely rewritten by Prof. T. Mather. Pp. xxiii+547; 289 figs. Price 15s. net.

"Electricity in the Service of Man," Vol. II, Section III. "The Technology of Electricity," by R. Mullineux Walsley. Pp. ix+738 and index. Price 15s. net. London: Cassell and Co., Ltd.

Proposed Railway Classification of Goods by Merchandise Trains.—Table showing the approximate percentage relationships between the 20 new classes proposed, and also between the existing eight classes. Chart 1. Huddersfield: Hirst and Adamson. Price 1s. 6d.

Journal of the American Institute of Electrical Engineers. Vol. XL, No. 9, September, 1921.—New York: The Institute.

"Electrical Contractors' Year Book," 1921-22.—London: Electrical Contractors' Association. Price 2s. 6d. net.

Safeguarding of Industries Act.—In accordance with Section 7 of the above Act, the president of the Board of Trade has appointed the following gentlemen to be members of the permanent panel from which committees, consisting of five persons, will be selected from time to time to consider and report upon complaints referred to them by the Board under Part II (Prevention of Dumping) of the Act:—

Sir W. M. Acworth.	Sir George R. Lowndes,
J. Arthur Athorn, C.B.E.	K.C.S.I., K.C.
Sir William Ashley.	Prof. D. H. Macgregor.
Arthur Balfour, J.P.	Stanley Machin, J.P.
Sir George S. Barnes,	G. A. Moore.
K.C.B., K.C.S.I.	J. W. Murray, D.L.
Sir John N. Barran, Bart.	Sir Douglas Newton, K.B.E.
J. T. Brownlie.	Owen Parker, C.B.E., J.P.
Sir Cecil L. Budd, K.B.E.	R. G. Perry, C.B.E.
Sir James C. Calder, C.B.E.	Arthur Pugh.
Dr. J. H. Clapham, C.B.E.	Sir R. Henry Rew, K.C.B.
F. P. Dorizzi.	C. A. Russell, K.C.
F. R. Davenport.	Arthur Shaw.
A. K. Davies.	Sir Charles Stewart, K.B.E.
T. P. Cook.	Sir Edwin F. Stockton, J.P.
Rayner Goddard.	H. L. Symonds.
Sir E. C. K. Gonner.	Gilbert C. Vyle.
K.B.E.	Sir Frank Warner, K.B.E.

LISTS OF ARTICLES CHARGEABLE WITH DUTY UNDER THE NEW ACT.

There have been issued under the Safeguarding of Industries Act, 1921, lists of articles chargeable with duty under Part I of the Act. Copies are obtainable from H.M. Stationery Office at 9d. net. Under Section I of the Act, it will be remembered, it is provided that for the purpose of preventing disputes arising as to whether any goods are or are not chargeable with duty, the Board may issue lists defining the articles which are to be taken as falling under any of the general descriptions set out in the Schedule to the Act. The pamphlet contains lists defining numerous articles falling under many descriptions, such as optical glass and instruments, optical instruments, laboratory porcelain, scientific instruments, gauges and measuring instruments, compounds, synthetic organic chemicals, lamp blown ware, wireless valves and similar rectifiers and vacuum tubes; ignition magnetos and permanent magnets; arc lamp carbons; metallic tungsten, &c.

Glasgow Shipbuilding, Engineering and Electrical Exhibition.—Glasgow Corporation has decided not to hold the above exhibition this year.

For Sale.—By direction of the Disposal Board, Messrs. Oliver Appleton & Kitchen will sell by auction on September 27th and following days at Barnbow, near Leeds, machine tools, engines, boilers, electric motors, electrical equipment, &c.

By order of the Receiver, Messrs. L. Farmer & Sons will sell by auction at an early date on the premises of Oylers Ltd., Station Works, Richmond, plant and machinery of a rubber tire manufacturer.

Messrs. B. S. Baldwin & Son will sell by auction on September 30th, at the Strarford Arms Hotel, Wakefield, power plant consisting of a 400-kW Turbo-Alternator Set, coupled to a h.p. turbine, condenser, pump, switchboard, &c.

For full particulars see our advertisement pages to-day.

Inquiry.—Information is desired regarding the "Kaplan" water turbine, mentioned in our issue of April 9th, 1920.

Bulgarian Economic Commission.—The Parliamentary group of the Agriculturists' party has elected an economic commission for the purpose of examining certain questions of great importance to the country. Among the questions to be considered by the Commission are the electrification of the railways and the manufacture of briquettes from Pernik coal. —*Reuter's Trade Service (Sofia).*

Fusion of Swedish Electrical Companies.—"Svenska Dagbladet" learns that an ordinary meeting of Aare Aktiebolag has decided upon fusion with an electric power company now being formed under the style of Västtra Jaemtländs Krafttebolag for the purpose of distributing electric power throughout West Jaemtland. —*Reuter's Trade Service (Stockholm).*

Engineering Amalgamation.—According to the "Financier," a scheme is on foot for the amalgamation of Fairbairn Lawson Combe Barbour, of Leeds, with Urquhart, Lindsay and Co., and Robertson & Orchar, Dundee.

Cardiff Invites Manufacturers.—The Development Committee of the Cardiff City Council has issued a booklet containing information regarding the suitability of the city for the establishment of works, factories, &c. The matter relates to such matters as labour, water supply, power and light facilities, existing industries, land available, &c. A number of appropriate half-tone photographic views appear, and there is a large map showing sites that are offered. Copies of the booklet can be obtained from the Development Agent, City Hall, Cardiff.

Australian Zinc Concentrates.—The Electrolytic Zinc Co. of Australasia has completed a contract with the British Board of Trade for the sale of 750,000 tons of concentrates and slimes. —*Reuter (Melbourne).*

Electrical Supplies in South Africa.—The "South African Mining and Engineering Journal" (Johannesburg), of August 27th, states as follows: "The tone in electrical goods is better and trade seems more buoyant, but business still continues very quiet. As soon as the trouble in the building trade is out of the way there are good grounds for anticipating a big revival of business. Although there are no reductions of importance to report, the tendency is for prices generally to come down, and some alterations may be expected next month. There have recently been some declines on account of forced sales, but generally prices remain much about the same. Consignments from Britain are arriving steadily, with, however, no reductions, although these are expected to occur in the near future. Shipments from Germany are slower, but still dribbling in, at prices a long way below British. Electrical wares are also arriving now from America fairly freely, showing slight reductions in comparison with British quotations."

Receiver Appointed.—H. W. SMITH & CO. (1920), LTD.—Mr. J. H. Stephens, of 6, Clements Lane, E.C., was appointed receiver and manager on August 30th, under powers contained in debentures dated February 11th, 1921.

Unemployment in Germany.—According to the *Economic Review*, the number of persons in receipt of unemployment relief in Germany has steadily declined since April. On the first day of that month the total was 413,421, while on August 1st, it had fallen to 269,424.

Patent Restoration.—An order has been made for the restoration of patent No. 11,116 of 1914, and the patent of addition No. 3,433 of 1915, for "Improvements in or relating to electrical reactance cells" and "Improvements on reactance cells," granted to Philip Torchio.

Braby's Extensions.—Messrs. Fredk. Braby & Co., Ltd., of Petershill Road, Glasgow, in preparation for world trade improvement have just completed several large extensions to their works, facilitating increased production of their specialties. The extensions include an addition to the engineering shop, a new bay to the heavy tank shop, a new steel bin and furniture department, a new roof light &c., department. The engineering shop is equipped with a complete range of modern machine tools. The firm has issued a handbook (160 odd pages), of its manufactures, for the use of architects and engineers, and copies will be sent on application.

Lantern Slides.—Mr. George Ellison, of Perry Barr, Birmingham, is prepared to lend a comprehensive set of lantern slides illustrating his various types of electric control gear, and of the works where these are made, to engineering and technical societies, and technical colleges, if they will intimate their desire to have them on loan.

Linen Mill Electrification.—It is satisfactory to know that many Irish concerns are now taking advantage of the slackness in manufacturing to bring their mills and factories thoroughly up-to-date. Thus, in keeping with their traditional progressive policy, the directors of Wolfhill Spinning Co., Ltd., Belfast, are having their present system of steam-driven machinery superseded by a complete electrification of the mill. The new plant will include a Rateau impulse-type turbine direct-coupled to 3-phase, 50-period, 3,000-r.p.m. alternator, with direct-coupled exciter having radial type commutator. The set is designed to give a normal full load of 1,000 kW, and to pass 6,000 to 10,000 lb. of steam at a pressure of 20 lb. per sq. in. gauge to the heating system. In fact, this means double the power of the present beam steam engine, while only one-twentieth of its space is occupied. —*Textile Recorder.*

Reported Find of Copper, Coal and Iron in Ireland.—It is reported from Mountmary, Mountbellew, that a copper, coal and iron mine has just been discovered, or re-discovered, in the locality known as the "Coal-pits." Local people have taken the matter up with a view to asking the Irish Industrial Research Committee to inquire into it.

New Steel Works in Japan.—The Nitto Steel Works has equipped its Kawasaki Works for the manufacture of electro iron plates, and three German experts have been engaged. —*Reuter's Trade Service (Tokio).*

Applications for British Trade-marks.—Appended is a summary of the recent applications for British trade-marks in respect of goods and productions associated with the electrical trades and industries:—

Suncolite. No. 416,647. Class 8. Electrical fittings and accessories.—Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C. July 4th, 1921.

Titan. No. 406,444. Class 13. Sparking plugs.—Champion Ignition Co., Harriet Street, Flint, Mich., U.S.A. July 26th, 1921.

O.A. (lettering and design). No. 414,252. Class 13. Electric incandescent lamps (ordinary), parts, fittings, &c.—Osram Gesellschaft, 11-14, Ehrenberg Strasse, Berlin, 017. April 12th, 1921.

Dasola. No. 416,786. Class 13. Electric incandescent lamps (ordinary), parts, fittings, reflectors, &c.—Osram Gesellschaft, 11-14 Ehrenberg Strasse, Berlin, 017. July 8th, 1921.

Dasola. No. 416,787. Class 13. Electric incandescent lamps (ordinary), parts, fittings, reflectors, &c.—Osram Gesellschaft, 11-14 Ehrenberg Strasse, Berlin, 017. July 8th, 1921.

Durasola. No. 416,788. Class 13. Electric incandescent lamps (ordinary), parts, fittings, reflectors, &c.—Osram Gesellschaft, 11-14 Ehrenberg Strasse, Berlin, 017. July 8th, 1921.

Durasola. No. 416,789. Class 13. Electric incandescent lamps (ordinary), parts, fittings, reflectors, &c.—Osram Gesellschaft, 11-14 Ehrenberg Strasse, Berlin, 017. July 8th, 1921.

Dursoa. No. 416,790. Class 13. Electric incandescent lamps (ordinary), parts, fittings, reflectors, &c.—Osram Gesellschaft, 11-14 Ehrenberg Strasse, Berlin, 017. July 8th, 1921.

Majestic. No. 416,844. Class 13. Electric irons and electric water heaters.—Majestic Electric Development Co., 656, Howard Street, San Francisco, U.S.A. July 11th, 1921.

Triangle and Circle design. No. 415,075. Class 13. Electrical metal goods.—Delta-Star Electric Co., 2433, Fulton Street, Chicago, U.S.A. May 10th, 1921.

Underground Telephone Cables.—The telephone cable company, which was formed some time ago under the leading of the German Ministry of Posts and Telegraphs for the starting and acceleration of the construction of underground telephone cables on a uniform basis for long-distance transmission and which was limited to the A.E.G., Felten & Guilleaume Co. and the Siemens group, has now been extended so as to include the Hackethal Company, of Hanover.

Sweden's Foreign Trade.—During the seven months ended with July the imports of electrical machinery into Sweden amounted to 6,577 tons, as compared with 8,321 tons in the corresponding period of 1920, and those of machinery and engines, &c., were 29,672 tons and 39,305 tons in the same terms of the two years respectively. On the other hand, the exports of electrical machinery reached 10,779 tons in the first seven months, and contrast with 8,103 tons in the same period in 1920; those of telephone and telegraph apparatus were 9,661 tons and 3,761 tons, and those of internal combustion engines were 7,774 tons and 14,347 tons in the seven months of the two years respectively.

The Burden of Taxation.—At a meeting of the Electrical Wholesalers' Federation on September 17th, the following resolution was passed: "That the Federation of Electrical Wholesalers consider that taxation exceeds the limits that commerce can bear, and that much more drastic economy than hitherto practised is essential for the welfare of the country."

Lead.—Messrs. James Forster & Co., reporting under date September 17th, state:—"The position of the metal, apart from speculation, is that arrivals continue quite equal to consumption, which is poor and without much prospect of improvement. Indeed, rather the contrary is true, as the electrical trade, which has for so long been busy and fully occupied, has fallen off greatly, and for the first time in the last two years important works are on short time."

The Ideal Homes Exhibition, Glasgow.—As was to be expected, the Ideal Homes Exhibition, held under the auspices of the Glasgow Corporation, has afforded manufacturers and agents of electrical appliances a splendid opportunity for displaying their goods. That they have made the very best use of it is a matter to which we had no need to freely admit.

Electrical goods of all descriptions occupy prominent places on the stalls, and the bright displays to be seen banish gloomy thoughts of dull trade and hard times. The exhibition, which was formally opened by Lady Blythswood on Monday, will continue till the October 5th.

As is only fitting, the two stands displaying the goods of the Glasgow Corporation Electricity Department are prominent. Demonstrations are given showing the varied uses of electricity, and the very latest heating, cooking and ironing appliances are exhibited. In fact, almost everything electrical on the market, designed to reduce household drudgery, can be inspected. A feature is made of coloured screen lighting for show windows; this is the first occasion so far as this country is concerned on which coloured screen lighting has been seen. Importance is attached to an American Universal cooking range, which, we understand, the Corporation intends to put out for hire shortly. There is a very striking notice displayed on the Corporation stand reminding builders that they can save money by installing electricity for heating and cooking in new houses, no chimneys, &c., being required.

CARRON COMPANY, of Stirlingshire, has an attractive show of its well-known electric cooking appliances. Particular attention is attracted by a combination cooker, the oven of which is loaded to a maximum of 1,250 watts and the hot plate to 1,600 watts, arranged for heat regulation.

MESSRS. DAVID ALEXANDER & Co., representatives for Scotland, show the Austin automatic lighting sets suitable for private installations in country houses, farms, &c. The Austin 0.75-kW Autopilot attracted attention on the stand.

MESSRS. BEATTY BROS., LTD., have a display of electric washing machines that is sure to attract the housewife, while the ELECTRIC SUCTION CLEANER Co., of Croydon, also makes a strong appeal with its stand. The small electric power motors shown by the latter company, suitable for driving small domestic machines, proved particularly interesting to visitors.

MAGIC APPLIANCES, LTD., London, show their suction cleaner, as well as an electric blower. Other companies displaying useful electric appliances are the "GEM" LABOUR-SAVING DEVICE Co., Manchester; DORIC IMPORT Co., Glasgow; the "BELL" WASHER Co., Blackburn; the HOOVER SUCTION SWEEPER Co., LTD., London; COGGANS & Co., Glasgow (electrical fixtures); POLLOCK & Co., Glasgow; JAMES MEIGHAN & SON, Glasgow (electrical fittings); the ELECTRIC APPLIANCES Co., Glasgow; the FALKIRK IRON Co., LTD. (electric cookers and heaters); WESTERN ELECTRIC Co., LTD., London; VICKERS, LTD.; C. F. HOWNEN, heating and ventilating engineer and electrical engineer, Glasgow (a fine display of electrical labour-saving appliances); ROGERS ELECTRIC SALES Co., London, &c. The NORTH BRITISH RUBBER Co., LTD., appeals to a wide circle by its display, and BELA'S UNITED ASBESTOS Co., LTD., Glasgow, has also a fine stand.

B.T.H. Advertising.—The British Thomson-Houston Co., LTD., has secured the services of well-known artists in the execution of two new show-cards. Mr. Heath-Robinson deals in a humorously fantastic vein with lamp tests, and Mr. Septimus Scott, in a symbolical picture called "light," has produced a work of high artistic merit.

Tok Switches now Available.—We are pleased to learn from MESSRS. TOK SWITCHES, LTD., of Granville House, Arundel Street, London, W.C.2, that they are now in a position to supply a full range of their rotary snap switches—single and double-pole, series-parallel, two and three-circuit, and two and four-way. The company does not hesitate to admit that in its earlier days its products were not all that they might have been, and that some of its clients had reasonable ground for complaint; but it has learnt the lessons taught in the costly but efficient school of experience, has eliminated the faults met with in its first designs, and now claims that its switches are at least as good as the American-made switches; moreover, they are wholly British-made, and are sold at competitive prices, on their own merits.

The design of the switches has been improved in detail, and several samples that we have inspected appear to be all that could be desired in point of external finish (black oxidised metal with a moulded key, or nickel plated with a porcelain key), sweetness in working, and excellence of workmanship. A disclaimer, however, has been made in the dial, which is depressed sufficiently to ensure that the figures shall not be mistaken as "The makers ask for a fair field and no favour," to enable them to prove that their products meet the needs of present day practice—particularly in connection with heating and cooking apparatus, for which tumbler

Celluloid in Factories.—In view of the new regulations drafted by the Home Secretary, dealing with places in which celluloid or any article partly made of celluloid is manufactured, manipulated or stored, the British Cellulose & Chemical Mfg. Co., LTD., reminds us that "Celastod," the new safety celluloid made by it, is non-flam. and safe to use, takes the place of explosive celluloid satisfactorily, and is made by British labour.

LIGHTING AND POWER NOTES.

Accrington.—EXTENSIONS NOT APPROVED. The Electricity Commissioners have refused to sanction the application of Accrington Corporation for borrowing powers for £126,850 for electricity extensions. A deputation from the Corporation travelled to London to place further arguments before the authorities, and to prevail upon them to reverse this decision. They were given a favourable hearing, but the decision was postponed. The Commissioners suggest that Accrington's needs might be met by entering into arrangements with Blackburn. To that course the Accrington Electricity Committee will not agree. Blackburn Corporation established its station when costs were high, and it is estimated to have cost £800,000, an annual charge of £80,000, which can only be met if the station is fully engaged. The bulk of the Accrington station was laid down when costs were lower.

Ayr.—THE LOCH DOON SCHEME.—At a recent public meeting, Councillor Paterson explained the present position of the Loch Doon electricity scheme. He said that the production of 40,000,000 units by Kilmarnock would cost about £32,000, while a similar quantity from the Loch Doon undertaking would cost only about £24,000. In any case the present generating station would have to be closed down, but if the water-power scheme were proceeded with, the station would be used for distribution purposes. The speaker thought a long time would elapse before it would be possible to obtain power from Loch Doon, as there were long negotiations to be got through.

Aberdeen.—YEAR'S WORKING.—The annual report of the city electrical engineer (Mr. J. A. Bell) for the year ended July 31st last shows that the revenue of the electricity undertaking was £168,820, an increase on the preceding year of £26,267. Working expenses were £122,186, as against £95,681, leaving a gross profit of £51,634. After the payment of capital the previous year there was a net profit of £13,789. The decrease in profit is due chiefly to the capital charges being increased by £11,972.

Australia.—MELBOURNE.—During the first five months of the present year, the City Electricity Department incurred a loss of £338; the result for the equivalent period of last year was a profit of £13,885. This adverse result is attributed partly to the rise in labour costs and partly to the effects of the restrictions imposed during the shipping strike of January and February.

Barnsley.—LOAN SANCTIONED.—The Town Council has received sanction to loans of £18,573 for mains and services, £1,533 for sub-stations and equipment, and £1,449 for meters and current limiters.

Bishop's Lydeard (Somerset).—ELECTRICITY SUPPLY.—At a parish meeting, Mr. A. Howard, electrical engineer, of Taunton, stated that the cost of supplying electricity throughout the parish would be approximately £1,500.

Blackburn.—ELECTRICITY SUPPLY.—The Mill Hill district is being provided with a supply of electricity from Blackburn's new station.

Canada.—POWER DEVELOPMENT.—Plant is being erected by the Winnipeg Railway Co., at Great Falls, on the Winnipeg river, at a cost of 10,000,000 dollars, which will have a capacity of 18,000 h.p.—*Reuter's Trade Service.*

Carlisle.—NEW PLANT.—At a meeting of the City Council on the 13th inst. the Electricity Committee reported upon the proposal to erect a new generating station at a cost of £200,000, and recommended that this scheme should be deferred, but that a 3,000-kW turbo-alternator should be installed temporarily at the existing works, at a cost of £40,000, to tide over the requirements of the coming winter, for which the present plant was inadequate. The Council approved the proposal.

THE GRETTA STATION.—The Electricity Committee reported having had under consideration a letter from the Secretary of the Greta Committee of the Disposals Commission inquiring if the Council would be willing to purchase the electric power station at Greta, and supply power to any firm or firms which might purchase the factory or construct works in the area. The Electricity Committee had decided to communicate with the Electricity Commissioners and ask their views on the proposals. The Council confirmed the action of the Committee. It was explained that if the Greta power station were acquired it would not remove the need for the new generator; for the acquisition of Greta, if decided upon, would take considerable time.

Cardiff.—REDUCED CHARGES. In view of the reduced price of coal, together with the increased revenue on account of the output for the last financial year being up about one and three-quarter million units, the Electrical Committee has approved a recommendation of the city electrical engineer (Mr. C. G. Morley New) to reduce the additional charge of 90 per cent. now in force, to 75 per cent. over pre-war basic rates, commencing from October 1st. It is also hoped that further concessions will be made in the near future. Subject to confirmation by the Council, the new maximum rates will be as follows: Lighting, 6½d.; heating, 1½d.; power, 2½d. per

unit. In addition to these rates there are special power rates for large supplies, subject to a coal and wages clause, which will automatically receive the benefit of the reduced operating costs.

Crief (Porthshire).—PROPOSED ELECTRICITY SCHEME.—Mr. J. E. Macewan, electrical engineer, Glasgow, and electrical adviser to the Town Council, owing to pressure of work, is unable meantime to continue to act in that capacity. It has been agreed to submit Mr. Macewan's report on the proposed electricity scheme for the town to the Electricity Commissioners.

Continental.—**BELGIUM.**—Following the decision of the Provincial Council of Limbourg to supply electricity to the whole province from the powerful generating stations at the collieries, the setting up of the first post of the first network undertaken was carried out with great ceremony at Winter-slag-sous-Genck on August 16th. This section, which is 45 km. in length, is comprised in the circle Genck-Hasselt-Saint Trond-Cortesse-Diepenbeck-Genck, and the contract has been secured by the Société Electrique de la Campine, which expects to complete it by the end of the year.

Doncaster.—**CONDENSING WATER.**—Following on a report by the electrical engineer on the need for further water supplies for condensing at the electricity works, the Electricity Committee has recommended the acceptance of an offer by the South Yorkshire Navigation Co. to supply from the canal for £127 per annum. The committee also agreed to the purchase from Colchester of a circulating water screen for the new condensing plant, and to the purchase from Oxford of l.p. switch-gear for the Carr House Road sub-station.

Dover.—**LOANS.**—The Electricity Commissioners have sanctioned the borrowing by the Council of £3,000 for mains and services, and £250 for transformers. Permission is being sought to borrow a further £8,000, including £4,000 for the St. Margaret's extension.

Eastbourne.—**POWER STATION FIRE.**—A destructive fire occurred at the Corporation electricity works on September 10th. The outbreak started in the boiler house, and was due to an overflow from an oil tank becoming ignited. The flames were fanned by a strong westerly gale, but the brigade got the fire under in about an hour. The damage is estimated at about £1,000.—*Star*.

Edinburgh.—**PRICE REVISION.**—The Corporation Electricity Committee has agreed to rescind the resolution to increase the charge for lighting by 3d. per unit, and for power and heating by 3d. per unit, and to increase lighting by 4d., no change being made in respect of power and heating.

Federated Malay States.—**ELECTRIC POWER SCHEME.**—With reference to the decision arrived at earlier in the year to provide a public electricity supply to the Federated Malay States, an electrical staff has been appointed at a cost of \$150,000 for salaries and expenses. The preliminary survey by the Government Electrical Advisor calls for an expenditure of approximately \$40,000,000. As the scheme matures the great facilities it will afford industrial development are being appreciated. This is particularly the case as regards tin mining. So far as this particular industry is concerned, however, the question of generating on a large scale has been discussed many times, when it has been held by experts that the prospects of a power company would not be very promising.—*Eastern Engineering*.

Greenock.—**STAFF'S WAGES.**—During the recent discussions upon the salaries of the technical staff employed at the Dellingburn Station, the Provost is reported to have said that the increases due to the application of the E.P.E.A. schedule amounted to £32,000. Mr. J. W. Thomas, assistant secretary of the E.P.E.A., has written to the *Greenock Telegraph*, protesting against this statement. He says the actual increase has only been £2,700. Mr. Thomas further states that if the Corporation considers the salaries under the award too high, the correct procedure is to submit the case to the District Joint Board for Scotland, on which it has a representative. It is also pointed out that owing to a recent fall in the cost of living, the amount paid has already been reduced by £550 per annum.

Hallifax.—**PRICE REVISION.**—Some discontent has been expressed lately with regard to the local charges for electricity for power. It has been alleged that the increases on last quarter's accounts involved a 300 per cent. advance in some cases. The increases were based on calculations to cover coal costs during the strike period. A sub-committee has, therefore, decided upon certain rectifications under which power users, instead of paying the increases which have caused criticism, will pay a penny per kWh more than on their previous accounts.

Hay.—**STREET LIGHTING.**—The Urban District Council has accepted the tender of the Electric Light Co. for public lighting from October 1st to April 1st, at £2 per lamp, plus £78 for new standards and installation.

Hawarden.—**ELECTRICITY SUPPLY.**—Permission is being sought of the Electricity Commissioners for the supply of electricity throughout the district.

Harrogate.—**ELECTRIC LIGHTING ORDER.**—The Council has asked the Electricity Commissioners to fix a date to enable the Harrogate Electric Lighting (Extension) Order, 1915, to operate immediately.

Ilkley.—**LOAN SANCTIONED.**—The Council has received permission to borrow £11,000 for electrical plant and materials.

India.—**GERSOPPA FALLS DEVELOPMENT.**—Plans have now been prepared by the Mysore Government for the construction of a dam on the Gersoppa Falls, about 120 ft. high, which will create a reservoir with a capacity of some 42,000 million cu. ft. It is proposed to build a power-house about 153 ft. below the bottom of the Falls, so that a total fall of nearly 1,000 ft. will be secured for the volume of water. It is estimated that by this means hydro-electric power to the extent of 100,000 h.p. can be produced. This will be utilised for the development of the north-western districts of Mysore. The cost of the scheme is put at nearly £3,000,000.—*Indian Textile Journal*.

POWER SCHEMES SANCTIONED.—In connection with the encouragement of hydro-electric schemes, the Department of Industries, Punjab, has already secured on behalf of the Punjab Hydro-Electric and Industry Department Association, Delhi, sanction to establish four power-houses on the Jhelum and Upper Chenab Canals, namely, Rasul (15,000 b.h.p.) Upper Bhimber Weir (10,000 b.h.p.), Gujranwala (3,000 b.h.p.) and Joyanwala (3,000 b.h.p.).—*Indian Textile Journal*.

THE NILGIRI SCHEME.—Messrs. Tata, Sons & Co. have secured a licence for the Nilgiri hydro-electric scheme.—*Reuter's Trade Service* (Bombay).

Knaresborough.—**TIME EXTENSION REQUIRED.**—The Electricity Commissioners have reminded the Council that its Electric Lighting Order lapsed on August 31st, the official termination of the War. They asked if a time extension was required, and the Council has decided to reply in the affirmative.

Lytham.—**PROSPECT OF EARLY SUPPLY.**—The proposal of the St. Annes Council to extend its electricity mains into Lytham has reached a definite stage. The Council has resolved that an application be made to the Electricity Commissioners for a loan of £9,740. The estimated cost of the cables and laying them for a distance of about four miles is £6,460; disconnecting pillars and section boxes £390; services including cable, boxes, and accessories, £1,250; meters (100), £320; making good the footpaths broken up, £1,320.—*Blackpool Gazette & Herald*.

Lamherthurst (Sussex).—**ELECTRICITY SUPPLY FROM MILL.**—Col. F. G. Delamain has been instrumental in obtaining a supply of electricity for the village, by means of a disused mill, 400 years old. A 40-h.p. vertical shaft turbine has been installed, and this is coupled to a 15-kW generator, which supplies about twenty houses with energy for lighting. A charge of 1s. per unit is made.

Leicester.—**HOUSING SCHEME SUPPLY.**—The Housing Commissioner has notified the Town Council that the Government is not prepared to contribute towards the cost of laying electricity mains to the site of the Council's new houses. The Council intends to press the matter again.

Matlock.—**REPORT ON DERWENT SCHEME.**—In a recently published report by the consultants engaged by the Council to report upon the possibilities of obtaining power from the Derwent the maximum load is estimated at about 150 kW, or 200 h.p., though this might take some years to develop. Selling up to 140,000 units per annum, the average load during the year would only be about 11 per cent. of the maximum. If this was sold at 6d. per unit the revenue would be about £3,500 a year. The cost of the proposed power station would be £13,000, and besides this there would be £10,000, the cost of ten miles of distribution cables. The cost of running would be £2,000 a year, and added to this there would be 7 per cent. and 5 per cent. on the sinking fund on a capital expenditure of £23,000, the total running cost thus being £4,700 a year. This showed a loss of £1,200 a year on the estimated revenue, or otherwise it demanded that the price per unit should be 8d.

An alternative scheme to the river power was an extension of the recently installed gas suction plant which runs the town's cable tramway. This would cost £18,500, and the running would cost £4,350, making a loss of £850, unless the price per unit was raised to 7½d.—*Manchester Guardian*.

Milnrow.—**BULK SUPPLY.**—A sub-committee has been appointed to inquire into the Rochdale Corporation's offer of a bulk supply of electricity, and to take steps to obtain a Provisional Order for the supply of electricity.

Newport (Isle of Wight).—**INCREASED CHARGE OPPOSED.**—The Town Council has decided to oppose the application of the Isle of Wight Electric Light Co. for power to increase the maximum charge for electric lighting from 10d. to 1s. per unit.

Newcastle-on-Tyne.—**IMPROVED LIGHTING.**—It is stated that the 60 per cent. lighting from August 16th to September 30th, and 100 per cent. lighting from October 1st to December 31st inclusive, which have been agreed to, will cost £11,708; this being an excess of £6,646 over the estimates approved by the Council. It is anticipated, however, that savings on salaries, wages, and electricity will amount to £1,798, and it is proposed to apply that sum in reduction of the proposed excess expenditure, reducing the latter to £4,848.—*Newcastle Chronicle*.

New Zealand.—HYDRO-ELECTRIC DEVELOPMENTS.—A survey of the progress made in the development of hydro-electric power has been published in Wellington. Following are the principal works actually in operation: Waipori Falls, Dunedin City Council, 8,000 h.p., to be extended in early future to 16,000 h.p., and possibly to 25,000 h.p.; Lake Coleridge Public Works Department, 8,000 h.p., to be extended to 16,000 h.p., with an ultimate development of 40,000 h.p.; Horahora Rapids, installed by Waihi Goldmining Co., and purchased by the Public Works Department, 8,000 h.p., to be extended to 10,000 h.p.; Wairura Falls, Dominion Portland Cement Co., 3,000 h.p.; New Plymouth Borough Council, 1,000 h.p., to be extended to 6,000 h.p.; Tauranga Borough Council, Omanawa, 1,000 h.p., possibly more; Hawera Electric Supply Co., 600 h.p. There are about 20 smaller schemes, accounting for about 3,000 h.p. Definite commitments have been made for other schemes as follows:—Southland Electric Power Board, 8,000 h.p., with possible extension to 20,000 h.p.; Mangahao, Public Works Department, 24,000 h.p.; Waikaremoana, Public Works Department, 40,000 h.p., with an ultimate capacity of 136,000 h.p.; Waikato, 96,000 h.p. —*Auckland Weekly News*.

Auckland.—The estimates of the city electricity department's requirements for extension purposes, for the next two years, by the electrical engineer, are as follows:—Services, £10,000; meters, £15,000; distributors, £30,000; sub-station and feeder extensions and switchgear, £26,000; and wages to workmen, &c., engaged on extension work, £10,000.

Peterborough.—ELECTRICITY SUPPLY.—The Rural District Council has consented to the supply by the City Council of electricity to 50 houses in course of erection in St. Paul's Road and Paston Lane.

Sheffield.—YEAR'S WORKING.—The number of units sold during the year ended March 31st last was 9,182,951 more than the previous year, an increase of nearly 7 per cent., and but for the coal strike and trade depression this increase would have been very much greater. The average prices obtained were 3.8sd. for light and heat, and 1.41d. for power, giving a total average for 1921 of 1.65d. The accounts show that the capital expenditure on the undertaking to March 25th, 1920, was £3,021,086. During the year, £419,345 was expended on capital account, making the total to March 31st last £3,440,431. The revenue account shows that the income from electric supply was £982,456, and from installation and motors £99,479, making a total of £1,082,025; and the expenditure £705,407, leaving a balance of £376,618. Interest, sinking fund, and income tax take up £260,288, leaving £116,329. To this is added £15,493 balance to March 25th, 1920, and £61,144 balance after settlement of income tax account to March, 1919, and these bring the total balance up to £192,968. The sum of £1,000 has been transferred to the motors and cookers fund; £100,000 to the renewals and special expenditure fund, £73,357 to the reserve fund, and £18,611 for depreciation of stocks. These total £192,968, and balance the account. The amount paid to sinking fund, with accumulations, for reduction of debts, to March 31st, 1921, is £1,048,072. —*Sheffield Daily Telegraph*.

Skegness.—TIME EXTENSION REFUSED.—The Electricity Commissioners have notified the Council that they cannot see their way to recommend any further extension of time for the execution of the works necessary to provide an electricity supply for the town. They are willing, however, to listen to any further representations the Council cares to make. The Council has asked a local electrical engineer for his views and suggestions on the matter.

Swinton.—LOAN.—The Urban District Council has applied for a loan of £15,930 for electricity purposes.

Strichen (Aberdeen).—STREET LIGHTING.—The Town Council has accepted the tender of Messrs. T. C. Smith to carry out the electric lighting of the town.

United States.—HYDRO-ELECTRIC DEVELOPMENT IN CALIFORNIA.—Among the Californian projects completed within the last twelve months are the Kerckoff plant of the San Joaquin Light and Power Corporation, which added 45,000 h.p. to the service of the San Joaquin farms, and also the natural gas-burning plant of the same company near McKittredge, with a capacity of 20,000 h.p. An equivalent installation has been added to the Bakersfield plant, doubling its capacity. The Southern California Edison Co. has added three new important units, all of them completed during 1921. The first to come into service was the 40,000-h.p. installation on the Kern River, supplying energy over the Greenhorn Mountains to the Vestal sub-station, where it connects with the Big Creek line. Soon after this a third unit, with 22,000 h.p. capacity, was added to Big Creek plant No. 1. Big Creek No. 8 has just been completed with an initial capacity of 30,000 h.p.

The Great Western Power Co. completed its Caribou plant early this year. This increased the capacity of the system by 59,000 h.p.; power is transmitted at 165,000 V.; at the beginning of 1920, the total available power in Californian power plants amounted to just about one million h.p. This capacity has now been increased by 25 per cent., and there is sufficient construction work actually under way by Californian power companies to bring this figure to one and a half million h.p. within another year. —*Reuter's Trade Service* (San Francisco).

Walsall.—EXTENSION OF SUPPLY.—The Walsall authorities propose to ask the Electricity Commissioners for sanction to supply electricity to Shelfield and Daw End Lane, Rushall.

West Cornforth.—ELECTRICITY SUPPLY.—The Thirlington Colliery Co. has offered to supply electricity for lighting West and Old Cornforth (Co. Durham) at a charge of 4d. per unit. The Council has decided to seek power to raise a loan and to prepare estimates for carrying the proposed scheme into effect.

TRAMWAY AND RAILWAY NOTES.

Australia.—RAILWAY ELECTRIFICATION.—The latest line to be electrified in the Melbourne and suburban area is that from Clifton Hill to Heidelberg, on which a trial run was made on July 23rd. A three-unit, or six carriage, train was taken over the route, and run to a fixed schedule, so that the exact amount of electrical energy consumed might be noted, and the maximum coasting power ascertained. The trial trains were not available for passengers, but carried electrification officials. The run was successful. A regular service was started on July 24th. For some days the trains ran to the steam train schedule, and then took up the faster electric running. —*Industrial Australian and Mining Standard*.

China (Peking).—A report dated July, from China, stated that consequent on the suspension of payment of the Banque Industrielle de Chine, which held the French shares, the board of directors of the Peking Tramway Co. had petitioned the Government to cancel the Sino-French agreement in connection with the formation of the organisation, so that it might be converted into a purely Chinese enterprise. The Ministry of Finance had appropriated \$500,000 for Government shares so as to enable the work to continue without interruption. The Ministry of Foreign Affairs was negotiating with the French authorities to secure the cancellation of the agreement.

Continental.—SWEDEN.—The completion has taken place of the work of converting to electric traction the railway which connects the blast furnaces and rolling mills at Hagfors, Sweden, with the iron ore mines belonging to the Uddeholm Co. at Finnshtyttan. The 15 locomotives which were ordered from Germany in 1919 have been delivered. Each weighs 41 tons and is able to haul a load of 350 tons in normal service. Alternating current at 15,000 volts is used, as in the case of the Kiruna railway to the Norwegian frontier.

GERMANY.—Constructional work in connection with the electrification of the Berlin metropolitan railways has been started on the northern lines. The first line, running from the Stettiner terminus to Bernau, is expected to be completed by the spring of 1923. Power for these lines will be taken from the Berlin electric power supply stations, and for the inner circuit from the lignite-fired long-distance power plant at Golpa, near Halle (Central Germany, 150 miles distant from Berlin). It is hoped to complete the entire scheme within ten years. —*Times Trade Supplement*.

HOLLAND.—A translation of the report of the Special Commission appointed by the Government to study the question of electrifying the Dutch railways recently appeared in *The Electric Railway and Tramway Journal*. After a comprehensive tour and exhaustive studies of the systems in use on the Continent, in America, and in this country, the Commission has arrived at the following general conclusions (*inter alia*):—Even if no national electricity supply is formed, the electrification of the Dutch railway system must take place on the direct-current system and with a working pressure of 1,500 V. Now that the Dutch railways have to make a start with the electrification, before there is any certainty as to the formation of a national electricity supply, it is desirable that in generating power at high pressure a frequency of 50 cycles should be adopted. The method of collection is not dealt with in the report, but this will probably be left for decision by Dutch engineers.

FINLAND.—The State Railway Administration has under consideration the question of the electrification of the Riihimäki-Viborg railway, and a scheme for this purpose is to be completed this year. Then proposals will be made for the conversion of the other railways in South Finland. It is in contemplation to utilise the falls of the Kymmene river and of the Vuokse.

Dartford.—LOAN SANCTIONED.—The Urban District Council has received sanction to a loan of £12,000 for the repair and reconstruction of the tramway track.

Doncaster.—PROPOSED EXTENSIONS.—The Town Council is to apply for sanction to the construction of a light railway connecting the tramways in Frenchgate and St. Sepulchregate to form a circular route. The project is estimated to cost about £10,800.

Halifax.—SUNDAY SERVICE.—The Tramways Sub-Committee recommends the restoration of Sunday tramway services to pre-war level, which advances the hour of commencement

from 2 p.m. to 1 p.m. It has also been decided to give a trial to workmen's fares on the Wainstalls railless route and on the motor buses to Sidal, with an increased service to Wainstalls between 5 and 7 p.m.

London.—**TUBE EXTENSIONS.**—Reports that the extension of London's tube railways is to be undertaken at an early date are devoid of foundation. It is stated at Electric Railway House that the position is practically the same as in February, when Lord Ashfield informed the shareholders of the company that it was hoped to proceed with the scheme when conditions permitted and the required sum of £1,750,000 could be raised on reasonable terms. The matter is still one of finance, and no information could be given as to when the work was likely to be undertaken.—*Financial Times*.

Salford.—**STRIKE ENDED.**—The tramway strike in Salford, which began on September 12th, ended on Saturday. The suspension cost Salford £1,000 a day.—*The Times*.

Stockport.—**TRACK RECONSTRUCTION.**—The Town Council has decided to have the tramway track in Warren Street reconstructed at an estimated cost of £1,200.

Tynemouth.—**ACCIDENT.**—The report of Major G. L. Hall to the Ministry of Transport on the tramcar accident which took place on July 31st, when five persons were killed and nine seriously injured, indicates that the driver lost control of the car by too sudden an application of the hand brake, and that the track brake was never sufficiently applied. This was the second accident within two years on the Borough Bank. The driver is held responsible, but the conductor is not acquitted of blame. Disciplinary action is recommended to ensure obedience to the authorised speed limits and the compulsory stops; more thorough training of the staff; and an improved supper block. It is pointed out that the short-circuit emergency brake fitted on some of the cars is not now accepted as an adequate electric brake, and that a rheostatic brake should be provided.

York.—**RAILLESS TRACTION.**—At York, railless cars are now running between Market Square and Heworth, a distance of about a mile and a quarter. Here the route within the city runs through narrow and tortuous streets on which tramways would be impracticable, and though both petrol omnibuses and electrical vehicles deriving their current from storage batteries have been tried on it, the results are said to have been unsatisfactory, the former proving costly and troublesome and the latter too slow. The railless vehicles employed are only 6½ ft. wide over all, and are designed on the "one-man" principle. The entrance door is in front, under the control of the driver, and the passengers drop their fares into a "pay-as-you-enter" device. Power is supplied from two overhead wires through two trolleys, which are long enough to enable the cars to deviate 17 ft. from the centre of the road. Their running costs (power, solid rubber tires, and wages) are 1½d. per car mile, or 1s. 7d. including capital charges. The consumption of electricity is 1.42 units per car mile; this is supplied from the municipal power station at 2d. per unit. The cars are of the single-deck type, seating 24 passengers.—*Nottingham Guardian*.

Walsall.—**LINKING-UP TRAMWAYS.**—The tramway manager has been authorised to negotiate with the Wolverhampton Corporation and the Wolverhampton District Electric Tramways, Ltd., for a through service between Walsall and Wolverhampton.

TELEGRAPH AND TELEPHONE NOTES.

Germany.—**WIRELESS TELEPHONY ON TRAINS.**—Wireless telephones will be installed on a number of important German express trains, and receiving instruments will be placed in hotels and Embassies at Berlin, according to an announcement from that city. The tests were made under the observation of engineers, military attachés and diplomatic representatives of the United States and Sweden, says the *Railway Review*.

Italy.—**NEW CABLE.**—The Rome newspapers congratulate the Government on having concluded an agreement for the provision of a direct telegraph cable to South America. The *Morning Post* announces that the cable will be 13,000 km. long, will cost 30 million gold francs, and is to be completed in three years' time. On this subject the *Tribuna* says: "To have established direct communication with the South American States, which are bound to Italy by constant commercial intercourse, constitutes a solution of the problem of political liberty and economic and commercial independence. Although Italy has nearly eight millions of her subjects scattered throughout the States of South America, she had formerly no means of communicating with them except by the British, French, and German cables, which meant that other States were able to exercise control in both public and private transactions between the Italians of Europe and those of South America. The new cable will start from Fiumicino (Rome) and will touch Spain, Brazil, Uruguay, and Argentina, and eventually the Canaries and Cape Verde Islands.—*Reuter's Trade Service* (Rome).

Jan Mayen Island.—A wireless weather intelligence station has been established at Jan Mayen Island by the Norske Radio Co., and is now in communication with stations at Rost, Norway, Iceland, and Spitzbergen.

London.—**NEW TOLL EXCHANGE.**—On Saturday last the Postmaster-General opened the new toll exchange in Norwich Street, in the presence of a number of officials and visitors. He stated that the number of trunk calls to and from London was about 12,000,000 per annum, and about 35 per cent. of this traffic was included within the range of the new exchange—a radius of about 25 miles. The nature of the new service was explained in our last issue, p. 371. Mr. Kellaway said it was hoped ultimately to extend the radius of the toll service to 50 miles. The relief afforded to the trunk service by the inauguration of the toll exchange would accelerate the former. During the first eight months of this year 78,000 new stations had been connected up; the number of subscribers who gave up the telephone on account of the increased charges was 28,900, about 5 per cent. of the total. Thousands of people wanted telephones, but could not be supplied with them on account of the shortage of equipment. This year 75,000 miles of double wire had been laid with a view to improving the trunk service and reducing delays. Since the new tariff was introduced there had been a falling-off in the number of trunk calls by the end of August of 12½ per cent. compared with last year, but the revenue increased by 50 per cent.

Sweden.—**MINES ANCHORED TO SUBMARINE CABLES.**—The cable steamer *H. C. Orsted*, belonging to the Great Northern Telegraph Co., has just started to effect repairs on the cables connecting Sweden and Finland, after a stay of five months in the North Sea. During this period the cable staff were occupied in repairing the cables between Denmark, France, and England. These were found to be in a very defective condition because, besides seizing cables, the Germans, in laying mines, anchored them to the cables. It was necessary to repair six cables, which work was carried out under great difficulties, this accounting for the long stay in the North Sea. It is submitted that the Germans ought to be made to defray the heavy cost of effecting the repairs, as the anchoring attachments remaining on the cables are said to prove that they were the cause of the damage done.

Spain.—A large number of towns in Spain are about to be provided with telephonic exchanges, all of which are to be linked up to the system of the *Compania Peninsula de Telefonos*.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Argentina.—October 21st. State Railways. Twelve months' supply of electrical stores.*

November. State Railways. One year's supply of railway signal material, including telephone and telegraph materials, &c.*

Australia.—MELBOURNE.—Victorian Government Railways. October 26th. D.C. arc welding plant (Cont. No. 34,377). Armature banding machine with electric motor and starting gear (Cont. 34,378).

November 2nd. Electric storage battery complete for automatic telephone exchange (Cont. 34,229).*

January 4th. Victorian Government Railways. 150 electric train stops operated by a single-phase induction motor. One set of electric pyrometer equipment for measuring temperatures of 350 to 2,000 degrees Fahrenheit.—*Reuter's Trade Service* (Melbourne).

ADELAIDE.—October 12th. Postmaster-General's Department. 2,750 yds. telephone cords, 120 hand sets, 160 jacks.*

Belgium.—Belgian Ministry of National Defence is carrying through a large scheme for establishing electric lighting installations in the various military establishments and barracks throughout the country. The latest contracts for which tenders have just been invited are for an installation at the Fort at Edeghem-lez-Anvers and for one in the military depot at Contich.

Bulgaria.—SOFIA.—October 7th. Department of Posts and Telegraphs, 100,000 porcelain insulators.*

Edinburgh.—Midlothian and Peebles District Asylum, Roslynlee. Stores, including electric fittings. Clerk and treasurer, 19, Heriot Row, Edinburgh.

October 10th. Corporation. Electric lighting installation at the city collector's offices, Waterloo Place. Engineer's office, Dewar Place.

Liverpool.—September 24th. West Derby Board of Guardians. Electrical supplies. Mr. H. B. Cleaver, clerk, Brougham Terrace.

Loughborough.—October 31st. Electricity Department. Steam-raising plant, h.p. and l.p. mains networks. (See this issue.)

London.—H.M. Office of Works. September 30th. Electric wire and cable. (See this issue.)

New Zealand.—Wellington. November 29th. Public Works Department. Manahao power scheme. Water wheels, generators, exciter, transformers, 110,000 V insulators, lightning arresters, switchboard, switches, and accessories. (See this issue.)

Post and Telegraph Department. 750 red and 750 white switchboard cords, 3 conductor (spec. No. 87).*

Nottingham.—October 21st. Electricity Department. Three 10,000-kW turbo-alternators with exciters, condensers, auxiliary plant, &c. One 1,000-kW combined turbo-generator alternator with condenser, auxiliary plant, &c. Six water-tube boilers with mechanical stokers, superheaters, forced draught fans. (September 10th.)

October 15th. Corporation. Two water-tube boilers with feed-water heaters, superheaters, stokers, &c.; one 5,000-kW turbo-alternator with condensing plant. (September 2nd.)

South Africa.—JOHANNESBURG. November 7th. Rand Water Board. Two 350-kW steam-driven electrical generating sets, complete with switchboards and all accessories.*

Warrington.—September 27th. Board of Guardians. Electrical goods for three months. Mr. A. Bottomley, Bewsey Chambers.

Workop.—Urban District Council Electricity Department. Supply and erection of an overhead transmission line, complete with underground connecting cables, distance approx. 2,200 yds., pressure 6,600 V. (September 16th.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Aylesbury.—Town Council:—

Electrical pumping plant, sewage works, £2,275.—E. T. Micklethill & Sons.

Belgium.—The Société Nationale Radio-Électrique, of Brussels, last week submitted the lowest tender to the Belgian Ministry of National Defence for the establishment of two wireless stations capable of transmitting telephone messages up to a distance of 150 kilometres and telegrams up to 500 miles. Three concerns competed for the contract for equipping 20 stations capable of dealing with telephone messages up to 30 kilometres and telegrams up to 100 kilometres, the lowest offer being that of the Société Électricité et Mécanique, of Brussels.

Doncaster.—Town Council:—

Circulating water screen for condensing plant, £394.—Bradlett & Co.

Erith.—Urban District Council:—

Power station switchgear, £251, cubic, £180.—English Electric Co., Ltd. Substation equipment, £293.—Metropolitan Electric & Local Co., Ltd. Transformers, £2,747.—British Electric Transformer Co., Ltd. Three-core cable, lead sheathed and steel armoured, approx. £2,500.—Callender's Cable, &c., Co., Ltd.

Hay.—Urban District Council:—

Institution of seven pumps, 18 houses, £189.—Hay Electric Light Co.

London.—STROKE NEWINGTON.—Electricity Committee. Recommended:—

Alterations and additions to main power wiring, £126.—K. Stephenson.

Macclesfield.—Infirmary Governors:—

Electric light installation, infirmary, £275.—Mr. W. R. Brown.

Maidstone:—

Electric light installation, West Kent Hospital extension, £211.—Mr. W. F. Corder. Accepted.

Sunderland.—Electricity Committee. Accepted:—

Gampere meters.—Ferranti, Ltd., Reoson Manufacturing Co., Ltd.

Gear for testing a.c. meters.—Elliott Brothers.

Loading resistance for a.c. meter testing.—Cressall Manufacturing Co., Ltd.

Stoneware ducts.—Albion Clay Co., Ltd.

Tramways Committee. Accepted:—

Cable, copper, 1 in. x 8 ft.—

Time clocks.—Gledhill-Brook Time Recorders, Ltd.

The Corporation has turned down the Tramways Committee's recommendation to accept the tender of the Equipment & Engineering Co., Ltd., for rails, fish plates, &c. The only English tender received was from a Middlesbrough firm, the price was in excess of that of the Equipment & Engineering Co., Ltd. The English tender was £1,744, against the foreign tender of £1,450.

FORTHCOMING EVENTS.

Faraday Society.—Wednesday, September 28th. At the Institution of Electrical Engineers, 21, Bedford Square, W.C. At 4.30 p.m. Discussion on "Radiation Theory of Chemical Action," to be opened by Prof. J. E. B. Fraser.

Municipal Tramways Association (Incorp.).—September 28th, 29th, and 30th. At the Technical Institute, Salford. Annual conference.

NOTES.

Smoking Concert.—The L.E.E.O.C.A. (London Electrical Engineers' Old Comrades' Association) will hold a smoking concert at the Bridge House Hotel, London Bridge, on Thursday, October 6th, at 7 p.m. Admission by membership card. Mr. F. Franking, of 108, Heathwood Gardens, Charlton, S.E.7, is the hon. secretary.

International Tramways Association.—In view of the recent conference of the new International Tramways Association at Vienna (ELECTRICAL REVIEW, September 2nd) *The Electric Railway and Tramway Journal* has undertaken to ascertain the position of the original Association. It was found that the General Secretary had communicated with members, and had received 250 assents to the dissolution of the original body and the formation of a new one. There having been some dissension to this course from neutral sources, a new circular will probably be issued shortly. It is expected that a General Assembly and Congress will be held next year, and it is hoped that British undertakings will participate; to this end it has been proposed that English shall be one of the "official" languages for the meeting.

Appointments Vacant.—Electrician (83s. 7d.), for the Croydon Mental Hospital, Warrington; instructor in oxy-acetylene and electric welding (£300), for the Loughborough College; assistant electrical engineer, for the Holmfrith Urban District Council Electricity Department; electrical fitter (£300), for the Government of the Gold Coast Public Works Department. (See our advertisement pages to-day.)

Faraday House Old Students' Dinner.—It has been decided by the committee to hold the annual dinner at the Holborn Restaurant, Crown Room, on Friday, October 21st, at 6.30 (for 7). Mr. C. C. Paterson, O.B.E., &c., the president, will be in the chair. It may be remembered that this event was to have taken place on April 15th last, but had to be postponed owing to the threatened transport strike.

Fire Extinction.—Writing to *The Electrical World* of August 20th, Mr. C. T. Sinclair discusses the methods available for extinguishing fires in transformers and oil switches. As the result of investigation by the Pennsylvania Water and Power Co., it was concluded that for transformer fires the "soda" extinguisher was very satisfactory, short pipes being run to the opposite ends of each transformer, in the ends of which the nozzles of the extinguishers were inserted. The transformer should be electrically dead before the soda is applied. In the case of oil switches, if the fire is in the tops of the pots only, carbon tetrachloride can be used. If this fails, the switch must be made dead; sand serves to extinguish any blaze in the bottom of the compartment, and then carbon tetrachloride will usually be effective in the tops of the pots. If this does not answer, soda may be used, but first all apparatus within reach of the jet must be made dead—while they may mean half the plant. The personnel should be specially trained to fire extinction.

In the course of the tests, four substances were tested, namely: Carbon tetrachloride; bicarbonate of soda and sulphuric acid (referred to above as "soda"), a carbon dioxide and water extinguisher; water; and "Foamite," a form of carbon dioxide extinguisher. All these were quickly effective. Actual switches and transformers were set on fire for the purposes of the tests. For external fires, sand and damp sawdust were equally effective.

It was found by test with pressures up to 80,000 V that a "soda" jet was non-conducting beyond about 44 inches from the nozzle; at a less distance it became a fairly good conductor, rendering the operator liable to shock. Hence in using "soda" or Foamite the apparatus should first be made dead, not only to ensure the safety of the operator, but also to prevent flash-overs. The same applies to the use of sand and sawdust, and great care should be taken that neither of these be permitted to fall into the blazing oil pots, as the operator may be severely burned and the intensity of the fire increased.

It is especially important to note that carbon tetrachloride, used in poorly ventilated positions, is dangerous to life; under certain conditions deadly gases such as phosgene, chlorine, &c., are generated, and a number of deaths have occurred for this reason. The liquid is valuable for extinguishing small fires, but care should be taken in its use.

An Australian Test House.—A Scientific Test House, the first of its kind in Australia, has been established in Sydney, by Mr. H. H. Scotland, B.Sc. (London), A.M.I.C.E., a New Zealander by birth, having had experience in America as well as England. The programme laid down by the founder of this new establishment embraces general scientific investigation, such as ascertainment of the calorific values of fuels, testing of steam and internal combustion engines, calibration of electrical instruments, and the heat treatment of steel. Furnaces are being put in for the treatment of high-speed steel, for case-hardening and the hardening and tempering of steels generally for traders. Later on it is intended to provide for special equipment for the mechanical testing of steel and other metals, also the testing of electrical machinery. —*Indian Tertiary Journal.*

Correction.—In the advertisement of Messrs. Simplex Conduits, Ltd., appearing on p. 47 (Supplement) of our last issue in the second paragraph, line two, by a printer's error the word "Simplex" was given in place of "simple."

A Floating Exhibition.—With further reference to the floating exhibition ship *British Industry*, which it is proposed to send on a tour of the chief ports of the world in two years' time, as has been explained in our columns recently, the accompanying illustration is intended to give some indication of what the vessel will be like. The venture is likely to be of great benefit to the export trade of the British Empire, and should make a strong appeal to merchants and manufacturers in this country. The idea, of course, is not new, as it has been tried recently by the U.S.A., Italy and Japan with a considerable amount of success. The innovation and essence of the present enterprise is that the ship will be especially built for the purpose of displaying an exhibition of manufactured goods to the best advantage, and at the same time afford ample accommodation for a large number of trade representatives on board. Arrangements will be made for forwarding fresh samples to meet the vessel at any particular spot so as

act as chairman, and Messrs. G. J. Bish, Vickers House, Loveday Street, Birmingham, and W. Y. Anderson, 14, Dale End, Birmingham, as joint hon. secretaries. Tickets are one guinea each, and may be obtained from any of the gentlemen named above. Joyce's London Band will be in attendance, personally conducted by Mr. Archibald Joyce.

Hydro-electric Works in Austria.—As was recently mentioned, a company has been formed in Vienna for the purpose of constructing hydro-electric works for supplementing the supply of electricity in the Austrian capital. Despite many efforts it has been found impossible to induce foreign capitalists to finance proposed works on account of the depreciation of the krone, the change in the international coal situation, and the absolute impossibility of obtaining any return on invested capital in the event of the krone appreciating. Under these circumstances the Vienna banks, under the leadership of the Escompte Gesellschaft, recently reached the conclusion

that a risk of installing one horse-power at a cost of 100,000 kr., which in former peace times cost 1,000 kr., could only be borne by those who were able to determine the price of energy as a monopoly, which is the case with the municipal authorities of Vienna. The steam generating stations of the latter already produce 20,000,000 kWh per annum, and are unable to meet the demands of the area of the city. Under these circumstances eleven banks in Vienna have co-operated with the Vienna municipal authorities in the formation of the Wasserkraft Werke A.G. (W.A.G.), with a share capital of 500,000,000 kr., of which half has been taken over by the banks and the other half by the City of Vienna. The first instalment of the works,

which is to be begun in November, comprises the utilisation of the water power of the Ybbs and of the Lunz-Kienberg-Gammig "water main," and is to be completed in July, 1926. It is intended to raise the capital cost of construction amounting to 3,600,000,000 kr. by the issue of bonds having a mortgage right on the new works, and the interest and redemption charges are to be guaranteed by the City of Vienna. On the completion of the works the City Council will operate them, and they will become the property of the city free of charge at the end of 30 years. The financial relations between the city authorities and the W.A.G. make provision for the payment of the interest on and redemption of the latter's share capital.

INSTITUTION NOTES.

Institute of Transport.—The postponed second dinner of the Institute is to be held at the Hotel Cecil on October 10th. The hon. secretary is Mr. H. E. Blain, C.B.E., 2 and 3, The Sanctuary, Westminster, S.W.1.

Municipal Tramways Association (Inc.).—On Wednesday next the annual conference will be opened at the Technical Institute, Salford, under the presidency of Mr. G. W. Holford, general manager of the Salford Tramways. The Mayor of Salford and the Tramways Committee will receive the Association at 10.30 a.m., and the president will deliver his address at 11 o'clock, after which Mr. J. M. McElroy will read a paper on "Some Phases of Tramway Development in the Past, and the Outlook." Luncheon in the Town Hall, Pendleton, at the invitation of the Tramways Committee, will follow at 1 p.m., and in the afternoon a paper will be read by Mr. J. B. Hamilton, C.B.E., on "The Operation of Tramway and Bus Undertakings under Statutory Powers." In the evening the Mayor will hold a conversation at the Salford Town Hall. On Thursday there will be a meeting of the Managers' section, and a paper by Mr. W. Chamberlain on "Permanent Way—Public Road—Maintenance." Luncheon will be provided at the Manchester Town Hall by the Manchester City Tramways Committee, and in the afternoon the annual general meeting will take place. The annual dinner will be held at the Grand Hotel, Manchester, on Thursday evening; Mr. Arthur Neal, M.P., will be the guest of the Association. On Friday there will be an excursion to Chester, with entertainment on the river at the invitation of the Mayor, the Sheriff, and the Chairman of the Tramways Committee. Special arrangements will be made for the entertainment of the ladies during the conference.



THE BRITISH TRADE SHIP: ILLUSTRATIVE SECTIONS.

to keep the exhibition both up to date and appropriate to the countries visited. The main advantages of the project are so obvious that it would be superfluous to reiterate them; the commercial traveller carrying his samples from town to town covers relatively little ground in a long period of time and at a maximum cost and inconvenience; the principle can be extended by co-operation, and that is the object of the *British Industry*. All the plans have been drawn up and arrangements completed; it only remains for British manufacturers to give the promoters of the scheme their hearty support. The object is a worthy one, and we commend it to all. "Trade follows the Flag."

Engineering Wages.—THE WAR BONUS QUESTION.—The *Daily Telegraph* states that the question of the abolition of the Ministry of Munitions war bonus in the engineering trades was considered at a preliminary conference of the unions involved, at the Central Hall, Westminster, on Tuesday.

The official termination of the war, the employers contend, automatically brought to an end the bonuses of 12½ per cent. for time-workers and 7½ per cent. for piece-workers. It was, however, agreed, when the cut of 6s. per week in wages was arranged two months ago, that the withdrawal of the war bonuses should be discussed between the employers and the unions this month, having regard to the present position and prospects of the industry. Tuesday's meeting of the unions was for the purpose of formulating a policy to place before the employers. The unions represented were the Federation of Engineering and Shipbuilding Trades, the Amalgamated Engineering Union, the Foundry Workers, and the National Federation of General Workers, over a million skilled and unskilled workers being concerned throughout the country. The negotiating committee which acted on the occasion of the recent wage reductions was reappointed, and this committee was to meet a committee of the employers on Wednesday.

Service Notes.—Lieut. A. A. Davis, Lieut. D. E. Ross, and Lieut. W. A. Cladwin, Tyne Electrical Engineers, have been transferred to the regimental list of the Territorial Reserve of Officers. Lieut. H. Hutchinson and Lieut. W. Dixon, of the same electrical corps, resign their commissions and retain their rank.

Survivors of the Battle of Jutland, who would be willing to "speak to" the film when it is exhibited, are invited to communicate with Ideal Films, Ltd., 76, Wardour Street, W.1, giving their rank and the names of their ships.

The Midland Electrical Engineers' Ball.—The committee has decided to hold the Midland Electrical Engineers' Ball this season at the Grosvenor Suite, Grand Hotel, Birmingham, on Friday, November 25th. Mr. R. A. Chattock will again

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

SIR PHILIP DAWSON, who at last week's by-election at Lewisham was elected M.P., is well known to electrical engineers by reason of his lengthy connection with the electrical industry, especially on its traction and power sides in consultative capacities, also through his valuable work as the author of books on the subject of electric traction in which he has long been a recognised authority. In the early days of equipment of electric tramways in this country on the overhead trolley system he played a leading part at Bristol and in many other places. In more recent years he has been responsible for the electrification of the suburban lines of the London, Brighton & South Coast Railway. He is a member of the Electrification of Railways Advisory Committee (of the Ministry of Transport) and of the Water Power Resources Committee (of the Board of Trade), and is vice-president of the Belgian Commission for Electrification of Railways. The services rendered by Sir Philip in connection with the war and as a member of the Disposals Board of the Ministry of Munitions were described in the ELECTRICAL REVIEW for June 18th, 1920, p. 788. It would take a good deal of our space merely to name the host of local clubs, associations, and other organisations with which he holds office either as president, chairman, or in some other capacity; only a man of such boundless energy as Sir Philip possesses could



(Photo 'Ex.)

SIR PHILIP DAWSON, M.P.

[Everitt.]

hope to carry out all his engagements of this kind in addition to his engineering work as a partner in the firm of Kincoed, Waller, Manville & Dawson, of Westminster, and still survive. Now to all of these he has added the heavier claims devolving upon a Member of Parliament, but we have every confidence that his wide experience of public affairs, his intimate acquaintance with the professional and industrial interests of engineering, and his striking and vivacious personality will enable him worthily to contribute to the well-being of the Empire in these critical days.

Last week Mr. JOSEPH SAVAGE, power station superintendent at Paisley, was presented by the staff and employés of the Corporation electricity department with a barometer and Mrs. Savage with a consistet watch. The presentation was made by Mr. W. Blair Smith, the chief engineer and manager. Mr. Savage is taking up a more important position with the St. Helens Corporation electricity department.

Mr. J. W. RODGER, A.M.I.E.E., of Messrs. Ferranti, Ltd., Hollinwood (transformer department), was married on 14th inst. to Miss Kitty Rhoda, of Preston. At the reception the firm was represented by Mr. V. de Ferranti and Mr. Gardner.

Mr. J. W. HAME, city electrical engineer and tramways manager at York, who has been on sick leave in Devonshire for some months past and unable to attend fully to his duty, tendered his resignation last week, and under the circumstances the Electricity and Tramways Committee felt they had no alternative but to accept it. Mr. Hame served his apprenticeship with Messrs. Ronald Scott & Co., London, and joined the St. James' & Pall Mall Electric Light Co. in 1894, becoming assistant engineer at the works of the Leyton District Council three years later. He left Leyton for service with the Cork Electric Tramways Co. and subsequently became chief assistant engineer to the Wigan Corporation Electric Light and Tramways Department. In May, 1902, he became chief assistant at York, and in 1906 he was appointed chief electrical engineer. He has been closely associated with the construction of the new power station at Linton Locks in recent months.

Messrs. Johnson & Phillips, Ltd., Charlton, have appointed Capt. H. J. GROVES-WEBB, A.M.I.E.E., to be the engineer and branch manager of their London branch at 12, Union Court, E.C. 2, in succession to the late Mr. A. R. Connal. Capt. Groves-Webb was appointed chief assistant engineer at the London branch in August, 1919, on his return from France, and enters upon his new duties immediately.

The marriage took place at Whitehaven Wesleyan Church on September 14th, of Mr. T. D. SPARK, electrical engineer to the Whitehaven Colliery Co., Ltd., and Miss M. F. Bell.

The Times states that Mr. ALFRED SHEPHERD has been appointed chairman and Mr. GEORGE BALFOUR, M.P., vice-chairman of the Lancashire Electric Light & Power Co., Ltd.

Obituary.—Mr. L. B. SCHLESINGER.—We regret to record the sudden death which occurred on September 2nd in Scotland of Mr. Leonard Bernhard Schlesinger. The deceased gentleman, who was 64 years of age, was chairman of the National Electric Construction Co., Ltd., and of the Torquay, Musselburgh, and other electric tramway companies.

Mr. A. A. DAY.—We regret to learn of the death of Mr. Arthur A. Day, M.I.E.E., formerly electrical engineer at Bolton, he being elected to that position in August, 1900. In 1904 he took over the management of the tramways. In September, 1912, Mr. Day's health broke down, and he resigned both positions in the following June. The deceased gentleman was 57 years of age.

NEW COMPANIES REGISTERED.

B. Barnett (Electrical Engineers), Ltd. (176,774).—Private company. Registered September 14th. Capital, £1,000 in £1 shares. To acquire the business of an electrical and general engineer carried on by B. Barnett, at 104, Whitechapel Road, E. The subscribers (each with one share) are: B. Barnett, 100, Bedmore Road, Stamford Hill, N.16, electrical engineer; B. Agambar, 1, Rose Cottages, Wells Road, Sydenham, S.E., electrical engineer; T. H. Hammond, 33, Upper Park Road, Haverstock Hill, N.W.3, solicitor's clerk. B. Barnett signs as director. Registered office: 104, Whitechapel Road, E.

Visco Engineering Co., Ltd. (176,772).—Private company. Registered September 13th. Capital, £1,000 in £1 shares (100 preference and 900 ordinary). To carry on the business of foundries, electrical and mechanical engineers, electricians, metal workers, &c. The first directors are: Frances Truscott, 131, Tyneham Road, Battersea, S.W.11, clerk; G. Delrieux, 37, Walbrook, E.C., agent and merchant. Registered office: 21, Bedford Road, W.C.1.

Resisto Electric Wire & Tape Co., Ltd. (176,804).—Private company. Registered September 15th. Capital, £500 in £1 shares. To carry on the business of manufacturers of and dealers in alloy wires and tapes, electrical engineers, wire drawers, engineers, annealers and heat treatment specialists, &c. The subscribers (each with one share) are: H. Kemp, Crofton Avenue, Sheffield, secretary; and G. Mason, 40, Sandford Grove Road, Sheffield, manager. The first directors are to be appointed by the company in general meeting. Qualification £1. Solicitor: W. Irwin Mitchell, 33, Queen Street, Sheffield. Registered office: Burton Road, Sheffield.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Arnott & Harrison, Ltd.—Satisfaction to the extent of £750 (being amount issued) on September 2nd, 1915, of debentures dated October 23rd, 1912, and January 31st, 1913, forming part of an authorised issue of £1,000.

Electrolite, Ltd.—Charge on company's property, present and future, including uncalled capital, dated August 23rd, 1921, to secure advances made and to be made and other moneys which the chargee may call upon to pay under various guarantees (subject to existing debentures for £2,000). Holder: F. Durrant, 21, Russell Hill, Furrey, Surrey.

Advance Engineering Co., Ltd.—Debentures dated August 17th, 1921, to secure £25,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd.

Wilson-Wolf Engineering Co., Ltd.—Satisfaction in full on August 26th, 1921, of mortgage dated December 30th, 1920, securing all moneys due or to become due from company to bankers.

Ramsden Green, Ltd.—Particulars of £500 debentures authorised August 27th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

General Electric Co., Ltd. (67,307).—Return dated August 4th, 1921. Capital, £6,000,000 in 1,800,000 "A" preference, 1,800,000 "B" preference, and 2,400,000 ordinary shares, all of £1 each 1,705,790 "A" preference, 1,622,891 "B" preference, and 2,111,975 ordinary shares taken in £24,418,820 paid in cash on 1,461,790 "A" preference, 1,600,000 "B" preference, and 1,337,500 ordinary. £1,021,826 credited as paid on £24,460 "A" preference, 23,891 "B" preference, and 774,475 ordinary. Mortgages and charges outstanding, £3,500,000.

CITY NOTES.

Mr. E. H. Tootal presided at the annual meeting, held in London, on September Electric Co., Ltd. 15th. The directors' report then presented stated that during the year 1920 the company acquired further interests in Empresa de Melhoramentos Urbanos (Piracicaba) and Companhia Mogiana de Luz e Força. The revenue from these undertakings is proceeding on a satisfactory scale. For the purpose of repaying loans outstanding and for acquiring the additional interests in Brazil the directors had issued the remaining £80,000 of debentures and had further issued 8 per cent. 10-year notes for £174,500. The profit and loss account showed a debit balance to be carried forward of £37,850. The adverse result was due to the heavy losses incurred through the fall in Brazilian exchange and to increased charges for interest on loans, &c. The chairman, after referring to the heavy loss on working and the depreciation of currency in Brazil which had caused the sterling value of the company's revenue to suffer in consequence, said that there had been an increase in the currency earnings, which was very satisfactory considering the adverse conditions of trade in Brazil. The several undertakings with which they were concerned were all carrying on their services to the satisfaction of the local consumers, both public and private, new connections were being made in the coffee-growing districts, and the fresh interests acquired held out good prospects of increasing revenue. Cables to hand from Brazil indicated that the worst of the crisis was now over, and that conditions tended to improve. Health conditions had continued good, and the members of their own staff and the staffs of the subsidiary companies had all carried out their work in the most efficient manner. The speaker welcomed at the meeting the company's Sao Paulo colleague, Mr. Byington, who so ably directed and supervised their Brazilian business.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Committee under Rule 148a:—

Newcastle-upon-Tyne Electric Supply Co.—£633,109 4½ per cent. first mortgage debenture stock, redeemable 1939, scrip certificates; and £100,000 5 per cent. second mortgage debenture stock, redeemable 1949, scrip certificates.

The following have been ordered to be officially quoted:—Victoria Falls & Transvaal Power Co.—£1,932,170 5 per cent. first mortgage debentures (within Nos. A1 to A12,375, B1 to B13,600, and C1 to C20,000).

Prospectus.—Lancashire Electric Light & Power Co., Ltd.—An issue of £400,000 7½ per cent. prior lien debenture stock at 95 per cent. (repayable at 105 per cent.) has been offered for subscription this week. The proceeds are required for the discharge of the balance of commitments incurred in the extension of the power company's generating station, distributing mains, and substation equipment, the cost of which is approximately £850,000. The estimated net earnings available for interest, reserves, and dividends for 1921, based on the actual profits to September and estimated to the end of the year are £92,000, against £47,356 for 1920. The profit for the latter year was seriously affected by the delay in obtaining and installing the new plant ordered early in 1919. The list was to close yesterday, but as a matter of fact, so ready was the response, that it actually closed on the day the prospectus was advertised.

Direct West India Cable Co.—Dividend of 3 per cent., free of tax, for the half-year, making 6 per cent. for the year. There has been expended on repairs £6,385, and £96,051 is carried forward, subject to E.P.D. and corporation profits tax.

Halifax & Bermudas Cable Co.—Dividend of 3 per cent., free of tax, for the half-year, making 6 per cent. for the year. There has been expended on repairs £2,504, and £81,567 is carried forward subject to E.P.D. and corporation profits tax.

General Electric Co. (U.S.A.).—A dividend of \$2 per share on the capital stock is announced.

British Insulated & Helsby Cables, Ltd.—An interim dividend of 9d. per share, less tax, on the ordinary shares is announced.

Dumbarton Burgh & County Tramways Co.—A dividend of 3 per cent. actual on the preference shares is announced. There is no dividend on the ordinary shares.

British Electric Transformer Co., Ltd.—The profit for the half-year ended June was £51,983, against £35,344 for the same period in 1920.

Midland Electric Corporation for Power Distribution.—A dividend of 4 per cent. for the half-year ended June is announced.

South London Electric Supply Corporation, Ltd.—An interim dividend on the ordinary shares of 5 per cent. per annum, less tax, is announced for the half-year.

Manila Electric Railroad & Lighting Corporation.—A dividend of 1½ per cent. on the common stock for the September quarter is announced.

Shawinigan Water & Power Co.—A dividend of \$1½ per share on the common stock is announced.

STOCKS AND SHARES.

TUESDAY EVENING.

TOWARDS the end of last week an impression became current that the Bank Rate was on the point of being lowered, and by reason of this expectation, prices of war stocks, together with those of other investment securities, were promptly advanced. The Bank, however, retained its rate at 5½ per cent., and money inclined to stiffen in the early part of this week. Other circumstances conspire against active business, either amongst investment or speculative issues. Foreign exchanges have again fallen into a condition of chaos, and at the moment of writing, the Irish situation still looks unpromising. People are chary of entering upon Stock Exchange engagements; they confine their attention to investment stocks pure and simple.

Amongst these, the electric lighting list is being studied as a useful field for securities likely to improve in price. County of London ordinary changed hands as high as 9 1/16 x d. Kensington are ½ up; so are Westminster and Metropolitan. Where prices have not moved, it has been, as a rule, because there was no stock to supply buyers who declined to pay more than the current quotations. If a man offers the higher of the two prices quoted in the Stock Exchange Official List, and fails to obtain the offer even at that figure, he can insist upon the price being put up. The disadvantage of doing this is obvious enough. Nobody wants to pay more than he is obliged to do, and there is always the hope that somebody may require to sell, either as an executor or for other reasons, so that quotations are not advanced, in such investment shares as those of the electric light section, until it becomes really necessary. This is the reason why there are not more rises in the lists week by week.

The movements in electric railway stocks are irregular. Central London ordinary assented has gone up to 48½. Underground Income Bonds to 76½, showing rises of 1 in each case. The latter company's ordinary and the "A" shares are both lower, and Metropolitan went back to 24. The Great Northern Railway has given notice to the local authorities, through which its lines run, of an appeal against their assessments. If this should prove successful, and any substantial reduction should be made in rates, the result would rejoice the heart of every railway stockholder in the land, and the progress of the Great Northern's appeal will be watched with lively attention. The company seems to have undertaken an expansive and lengthy job, and it remains to be seen whether the results will justify the courageous effort.

The Lancashire Electric Light & Power Co. has this week offered £400,000 7½ per cent. prior-lien debenture stock at 95. The security was shown in the prospectus to be well-covered, and the subscription lists, which opened at nine o'clock on Monday, were closed 2½ hours later, striking testimony to the willingness of money to take up sound security offered on tempting terms. Amongst the new issue prices, the feature is the way in which Shropshire 7½ per cent. debenture has moved up to 1½ premium on its issue price of 97. North Metropolitan and Metropolitan Electric new debentures have both been up to 9 premium, a price which evidently tempted a little stock to market, because the quotations receded to 8½ premium, still leaving them with a small improvement on the week. General Electric new debenture is quoted 96½. Several new issues are said to be coming in the near future, and with the conclusion of the holiday season, promoters are beginning to get busy again.

The Midland Electric Corporation for Power Distribution is to pay an interim dividend of 4 per cent. on its ordinary shares, the same rate as that paid 12 months ago, but the capital has been largely increased in the meantime, and the money required to pay the dividend is almost double that distributed in September, 1920. The ordinary shares are quoted at 20s., the 7 per cent. preference at 16s. 9d., and the 5 per cent. 1st mortgage debenture stock at 78½, business being done in the last-named at this price on Monday. Another dividend which is maintained, is the 6 per cent. of the British Electric Transformer, the company announcing its profit as £52,000, an increase of £17,000 as compared with this time last year. The 7 per cent. cumulative preference shares stand at 17s. and the ordinary changed hands this week at £1. British Aluminium dropped 1s. 9d. to 15s. 9d. on a reduction to 2½ per cent.—against the usual 4 per cent.—in the interim dividend. In the circumstances, it is difficult to say the yield on the shares.

Anglo-American Telegraph preferred has advanced to 87. Chili Telephones are better at 51, and the rest of the cable group is marking time. Great Northern's at 24½ parted with some of their recent improvement. Marconis have gone back to 1 13/16, but Radio Corporation shares of both sorts, common and preferred, have risen a shilling or so to 10s. 3d. The

dividend announcement in respect of Radio preferred, which was expected as long ago as last May, is still wanting. The other Marconi descriptions are inclined to follow the heaviness shown by the shares of the parent company.

century of the 19th century have been managing hands on the basis of twenty to the shilling, and this is regarded as an incentive to German trade. The German manufacturer, who sells his goods over here for sterling, converts the latter into marks and pays wages in his own country in the debased currency. This is all very well, of course, as long as he does not go outside his own country to buy anything. When he does that, the position is reversed, but so long as he can sell his own country's goods, the low exchange is all in his favour. Nevertheless, electrical manufacturing shares are firm, on the assumption that the safeguarding of Industries 131 will prevent, to some extent, the possibility of a very large export being made the dumping ground for the surplus of German products. General Electric's retail price is at 20s. Siemens keep very steady at 25s. 4d., and Metropolitan-Vickers hold their rise at 36s. 3d. The iron and steel market, however, is on the dull side. Babcock & Wilcox eased off to 23, to rally later to 217/16. Vickers and Armstrongs are languid. Vickers tax-free preference dropped to 13s. 9d. Rubber shares are better on the August Board of Trade Returns reflecting an increased demand for rubber from America and Central Europe.

Brazil Traction's slipped back to 29, and British Columbia Railway stocks are heavy. Canadian General Electric preferred weakened to 102½. Rangoon Electric Tramways 6 per cent. preference at 3½ are 5s. down. Mexican Utility bonds and shares are being neglected. Foreign sales of Puerto Tramsway Light and Power common shares, led to the price giving way to 5½. Other foreign issues remain uninteresting.

SHARE LIST OF ELECTRICAL COMPANIES.

HOMER ELECTRICITY COMPANIES.				
	Dividend		Price	Yield
	1919.	1920.	Sept. 20, 1921.	per cent.
Brompton Ordinary	12	12	63	29 8 4
Charing Cross Ordinary	7	8	42	9 8 2
do. do. do. 4½ Pref. . . .	4½	4½	89	7 4 4
Chelsea	4	6	81 ½	9 4 8
City of London	12	14	82	10 3 0
do. do. 6 per cent. Pref. . . .	8	8	77 ½	6 17 2
County of London	8	8	98 ½	8 17 10
do. do. 6 per cent. Pref. . . .	7	8	84	7 7 4
Kensington Ordinary	7	8	42	10 11 10
do. do. 6 per cent. Pref. . . .	3½	4½	71	8 10 0
London Electric	8	8	22	10 9 0
do. do. 6 per cent. Pref. . . .	6	6	44	8 9 8
Metropolitan	4½	4½	21	7 13 2
do. 4½ per cent. Pref. . . .	12	13	98	9 4 8
St. James' and Pall Mall . . .	6	7	98 ½	10 13 2
South London	6	7	15 9	8 17 10
West Metropolitan Pref. . . .	10	10	65	8 10 0
Westminster Ordinary				

TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Prof.	..	8	8	57	+ 1	6 18 0
do. Def.	..	1½	1½	17½		5 11 7
Chile Telephone	..	8	8	52	+ ½	8 14 2
Cuba Sub. Ord.	..	7	7	77		9 8 8
Eastern Extension	..	10	10	16½	—	8 1 0
Eastern Tel. Ord.	..	10	10	16½		8 2 ½
Globe Tel. and T. Ord.	..	10	10	16	—	1 0 0
Anglo-Am. Tel. Prof.	..	8	8	64		6 6 4
Great Northern Tel.	..	32	34	24	— ½	9 14 0
Indo-European	..	10	10	80	—	8 6 8
Marconi	..	35	35	25	— ½	8 6 8
Oriental Telephone Ord.	..	13	13	2½		*5 16 8
United R. Plate Tel.	..	8	8	6		*6 13 4
West India & Panama	..	8	8	8		*6 8 8
Western Telegraph	..	10	10	16½		*6 1 0

HOME RAILS.						
Central London Ord. Assented ..	4	4	48½	+ 1	8 5 0	
Metropolitan ..	1½	1½	24	- 1	6 5 0	
do. District ..	NII	NII	17	-	NII	
Underground Electric Ordinary ..	NII	NII	2	- ½	NII	
do. do. "A" ..	NII	NII	6½	ad.	NII	
do. do. Income ..	4	2	76½	+ 1	'3 18 5	

FOREIGN TRAMWAYS, &c.						
Anglo-Arg. Trams, First Pref.	..	54	124	93	—	10 0 0
do. do. 2nd Pref.	..	Nil	64	29	—	10 0 0
do. do. 6% Deb.	..	Nil	64	29	—	7 17 1/2
Brazil Tractions	..	Nil	Nil	29	1 1/2	Nil
British Columbia Elec. Ry. Pref.	..	5	5	60	—	8 6 8
do. do. Preferred	..	6	50	60	—	8 12 2
do. do. Deferred	..	8	124 1/2	65	—	11 1/2 5
do. do. Deb.	..	5	11	64 1/2	d	7 5 4
Mexico Trams 5 per cent. Bonds.	..	Nil	Nil	—	—	Nil
do. 6 per cent. Bonds.	..	Nil	Nil	—	—	Nil
Mexican Lights Common	..	Nil	Nil	9	—	Nil
do. Pref.	..	Nil	Nil	16 1/2	—	Nil
do. 1st Bonds	..	Nil	5	48 1/2	—	10 6 0

MANUFACTURING COMPANIES.						
Pathecock & Wilcox	16	14	2	—	6	11 2
British Aluminium Ord. ..	10	10	15/9	—	1/9	—
British Insulated Ord.	15	15	1	—	9	12 0
Callenders	65	15	1 1/2	—	10	8 8
do. 4 1/2 Pref.	15	15	1/9	—	6	18 8
Crompton Ord.	10	10	14/6	—	13	15 10
Edison-Swan	10	10	7/6	—	—	—
do. do. 5 per cent. Deb. ..	6	6	6	—	7	7 1
Electric Corporation	10	10	16/9	—	11	15 10
English Electric	8	8	10/6	od.	15	4 8
do. Pref.	6	6	14/-	—	8	11 6
Gen. Elec. Pref.	64	64	170/-	—	7	6 6
do. Ord.	10	10	190/-	—	10	9 0
Hendley	16	16	1	—	10	5 0
do. 4 1/2 Pref.	44	44	84	—	6	18 6
India-Rubber	10	10	—	—	—	—
Men. Vickers Pref.	8	8	—	—	8	10 0
Met. and Ord.	10	10	1	—	8	13 2
Telegraph Con.	20	20	214	—	5	11 1

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 21st.

	CHEMICALS, &c.	Latest Price.	Fortnightly Inc. or Dec.
a	Acid, Oxalic	per lb. 7 1/2d.	3d. dec.
a	Ammoniac Sal	per ton 465	
a	Ammonia, Muriate (large crystal)	268	
a	Bisulphide of Carbon	" "	
a	Borax	231	
a	Copper Sulphate	231	
a	Potash, Chlorate	per lb. 6d.	
a	" Perchlorate	6d.	
a	Shellac	per cwt. £11.10s.	20/- inc.
a	Sulphur, Sublimed Flowers	416	
a	" Lump	215	
a	Soda, Chlorate	per lb. 3 1/2d.	
a	" Crystals	per ton 27	
a	Sodium Bichromate, cakes	per lb. 7 1/2d.	1d. inc.
METALS, &c.			
p	Babbitt's Metal Ingots	per ton £90 to £275	
c	Brass rolled metal 2" to 12" basis)	10 1/2d.	
c	" Tubes (solid drawn)	1/10 to 1/10 1/2	
c	" Wire, basis	1 1/2d.	
c	Copper Tubes (solid drawn)	1 1/2d.	
c	" Bars (best selected)	2 1/10	
c	" Sheet	2 1/10	
c	" Rod	2 1/10	
c	" (Electrolytic) Bars	2 1/4	10/- inc.
d	" " Sheets	£145 10s.	
d	" " Wire Rods	£90	10/- inc.
d	" " E.C. Wire	11 1/2d.	1/- inc.
d	Ebonite Rod	8/6	
f	" Sheet	2/9	
n	German Silver Wire	3/9	
f	Gutta-percha, fine	15 1/2	1 1/2d. dec.
f	India-rubber, Para fine	1 1/2	4 1/2d. dec.
f	Iron Pig (Cleveland Warrants)	Nom.	
i	" Wire, galv. No. 8, P.O. qual.	230	
i	Lead, English	23 1/2	5/- dec.
i	Mercury	per bot. 39 1/2s. to £10	5/- dec.
c	Mica (in original cases) small	3d. to 3/-	
c	" " medium	4/- to 8/-	
c	" " large	10/- to 20/- & up	
p	Phosphor Bronze, plain castings	1/4 to 1 1/2	
p	" " rolled bars and rods	2 1/2 to 2 1/2	
p	" " rolled strip & sheet	2 1/2 to 3/6	
d	Silicium Bronze Wire	per lb. 15s.	
d	Steel, Magnet, in bars	1/8	
n	Tin, Block (English)	£155	45 dec.
n	" Wire, Nos. 1 to 16	per lb. 3/6	
p	White Anti-friction Metals	per ton £55 to £275	

Quotations supplied by—

a	G. Boor & Co.	g	James & Shakespeare.
c	Thos. Bolton & Sons, Ltd.	h	Edward Till & Co.
d	Frederick Smith & Co.	i	Bolling & Lowe.
e	F. Wiggins & Sons.	j	Richard Johnson & Nephew, Ltd.
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	k	P. Ormiston & Sons.

W. F. Dennis & Co.

A.C. Periodicity in Mills.—In a paper before the recent meeting of the American Iron and Steel Electrical Engineers, and American Institute of Electrical Engineers, Pittsburgh, Mr. B. G. Lamme (chief engineer of the Westinghouse Electric & Manufacturing Co.) discussed the growing tendency to adopt 60-cycle in preference to 25-cycle power in connection with the electrical operation of steel mills. He pointed out that much of the heavier steel-mill service was at relatively low speeds with direct-connected motors, on the basis that large, high-speed, high-power gears would not be satisfactory. However, speeds, frequencies, and the economical combination of poles were intimately related. High speed resulted in lower first cost of a machine, but low speed was most in demand in steel-mill work. In the development of induction motors the tendency was towards higher speeds, and 60 cycles presented material advantages. One condition which now lent itself to the use of 60 cycles in steel mills had been the use of the induced current generator, thus allowing higher-speed motors. For many kinds of service, gearing was now used where direct connection, a few years ago, was considered to be the only method. In consequence, the speeds of the motors used in steel-mill work would in future average much higher than in earlier practice. *Iron and Coal Trades Review.*

Gas v. Electricity.—ATTITUDE OF GLASGOW ASSESSORS.—A remark by the City Assessor at a Glasgow Valuation Court, last week, that he is prepared to assess houses lit by gas at 5 per cent. less than those lit by electricity is being much discussed. A householder, writing in the *Glasgow Herald*, says it would be interesting to have the assessor's reason for this attitude, and goes on to say: "The Corporation advocate the use of electricity on health grounds. They say there are no fumes, dust, dirt, or vitiation of atmosphere. Now the assessor's proposal is a distinct discouragement to those intending to substitute electricity for gas. The writer had intended doing so, but the assessor's pronouncement counsels caution. I have no doubt many others are of like mind, and, as a consequence, men who would be employed installing electricity are idle."

THE BRITISH ASSOCIATION.—III.

On Saturday and Sunday, September 10th and 11th, excursions and church services were arranged. The coach proprietors put on extra services, but the cold and wet weather deterred many, and most of the special excursions were poorly patronised.

In spite of great sectional activity on Monday morning, there was not a great deal of matter of direct electrical interest, although there were several allied subjects which may be mentioned.

Section A (Mathematical and Physical Science) had a short paper by Prof. C. G. Barkla, F.R.S., on "The Energy of X-radiation." This was necessarily largely of a mathematical and diagrammatic nature. The quantitative study of the energy transformations occurring when X-radiation passes through matter is of first importance in any consideration of rival theories of radiation, and it is of the greatest interest to summarise our knowledge of these measurements and study their significance. This Prof. Barkla endeavoured to do. He pointed out that processes of radiation and absorption may be, and are, continuous and without limiting condition. They are governed by chemical laws. But radiation also takes place from atoms under certain critical conditions, possibly from atoms in an abnormal or, at any rate, exceptional, state. Definite changes then occur, and a definite amount of energy is thereby liberated—a quantum. The corresponding absorption is not then a direct effect on electrons in a field, but is an atomic phenomenon. We shall, however, said Prof. Barkla, have to learn much more of the atom before we can picture the process.

In Section C (Geology) a lively and practical discussion took place concerning the search for oil in Scotland, a subject not without some interest to power producers. It seems, however, that the hopes of a home oil industry have to all intents and purposes vanished. Section C also discussed with Section G the proposal to build a mid-Scotland canal, but here also the "noes" were prominent. Section F (Economics) continued its discussion of economic and industrial questions. Particular attention may be called to a paper by Dr. Mary T. Rankin. It contained a review of the legislation regarding so-called compulsory arbitration, which most of those engaged in business know all about, and put forward one or two more or less Utopian ideas which were severely, not to say rudely, handled in the discussion.

Tuesday, September 13th, was the day of electrical interest in Section G, four papers being presented, which will be given in abstract later. Unfortunately, Mr. Sydney B. Donkin was prevented by illness from reading his paper on the new electricity supply station of the Edinburgh Corporation for supply in bulk to the city and to the Lothians, and it was taken as read in his absence. Dr. S. P. Smith's paper, compiled from notes supplied by no fewer than 21 firms, followed, after which came Mr. John Scott-Taggart's paper describing two new negative resistance devices for use in wireless telegraphy. On neither of these three papers was there any discussion, and we got to Dr. T. F. Wall's paper on "The Long-distance Transmission of Electrical Energy Generated by Means of Tidal Power," which dealt with another aspect of the much discussed and now, temporarily, at any rate, abandoned Severn scheme of the Ministry of Transport. The Report of the Committee on Complex Stresses was submitted, and in the afternoon there was a visit to Rosyth. During the reading of Mr. Scott-Taggart's paper messages were received from the Eiffel Tower and the Admiralty station at Aberdeen, but there was a good deal of interference by local stations.

There is not much calling for reference in the other Sections. A great gathering assembled for a joint discussion by Sections A, C, D, and K, on the age of the earth.

In Section B (Chemistry), Dr. J. S. Owens gave a further account of the experiments he is carrying out for the Advisory Committee on Atmospheric Pollution, all of which tend to show the need for restricting in some way the use of raw coal in factories and for domestic purposes. Dr. Owens measured the dust in the air of Edinburgh during the meeting, and found it more unclean than in London, a fact which was given due prominence in the local papers.

The Fuel Economy Committee of the B.A. is attached to Section B, but this year no report was actually submitted. As a matter of fact, a short one is in existence which relates that no work has been done during the past year owing to the disturbed industrial conditions and the unfortunate illness of the chairman (Prof. W. A. Bone). The Committee asks for reappointment to complete the programme laid down in its third report, and indicates its intention to bring oil within the ambit of its future deliberations.

In Section F (Economics) a paper on Trusts was read by Prof. D. H. Macgregor, to which we may have occasion to refer later. It reviewed the development of the Trust in relation to large and small businesses, and discussed the criterion of fair competition.

Section I (Physiology) had a discussion on the Physiology of Heavy Muscular Work, which kept rather too much to the purely physiological side, although it brought out many interesting points.

The only Section of interest to our readers that met on Wednesday was G (Engineering), when papers on air lift pumps were read by Dr. J. S. Owens; "Modern High-speed Centrifugal Pumps," by Dr. S. F. Barclay (of Mather & Platt); and "Iron Bacteria in Relation to the Incrustations of Pipes," by Dr. David Ellis.

During the discussion on Dr. Barclay's paper on centrifugal pumps, Prof. F. C. Lea expressed his anxiety to ascertain whether electrically-driven centrifugal pumps were ultimately more economical than steam-driven reciprocating pumps. The author had stated that a set of reciprocating pumps would cost about five times as much to install as an electrically-driven centrifugal set, with which he agreed, but he was not so sure that a centrifugal set would prove to be cheaper in the long run, say, for a year's working, having regard to the present cost of electrical energy for power purposes. The author, however, in his reply, pointed to the additional advantages of the centrifugal set, viz., the smaller space required, and the fact that there was no expenditure on boilers. Again, if a user could be convinced of a saving of something like £10,000 in capital expenditure, it would influence him to a very great extent; the advantages attaching to automatic starting were also of great value. The morning's proceedings were rather rushed, there being, in addition to the papers on the programme, two others contributed by Prof. Timoshenko, of Zagreb, Jugo-Slavia, on dynamic and static stresses in steel rails, and the vibration set up on a bridge by the force of insufficiently balanced wheels passing over it, which were briefly explained by Major Southwell; and another by Mr. J. D. Watson, of Birmingham, on the use of sewage gas for power purposes. Consequently, not very much time was available for discussions, which were reduced almost to mere questions and answers.

On the motion of Prof. Howe, the Recorder of the Section, a vote of thanks was accorded Prof. Gibson for his services in the chair throughout the whole meeting.

The meeting in 1922 will be in Hull, in 1923 in Liverpool, and in response to a request from the General Committees, the Sectional Committees have been considering an invitation from Toronto for 1924, and passing resolutions in favour of accepting it.

The Utilisation of Tidal Power with Special Reference to the Severn Estuary.

By PROF. F. C. LEA, D.Sc., M.Inst.C.E., M.Inst.M.E.

(Abstract.)

Section G.—Engineering.

THE range of tides of the River Severn is very much higher than in any other estuary round the coast of Great Britain, and it would appear therefore, with the other conditions being at all equal, that it would be particularly suitable as a source of power production. In the neighbourhood of the junction of the Wye and the Severn, the rise of the spring tides is at times about 50 ft. If such a rise could be depended upon day by day throughout the year, the amount of power available would be very large indeed, and there is every probability that it could be used economically. The neap tides, however, may be as low as 16 ft. The problem is furthermore complicated by the fact that during any month there are two minimum values of the neap tides and two maximum values of the spring tides. However, the times of high and low tides are continuously changing from day to day. If a number of industries could be established in the immediate neighbourhood, the hours of working of which could be adapted to the tides, the problem again would be very much simplified, but that is an ideal condition. The storing of power hydraulically means a large expenditure on civil engineering works and also on hydraulic plant. Turbines would be required in the barrage to generate power at times controlled by the tides. This would have to be used, partly to supply the demand and partly to drive electrically-driven pumps for raising the water to a suitable storage reservoir. It might be quite possible to make centrifugal pumps to raise the water to the impounding reservoir reversible so that they could be utilised as turbines when necessary. To convert the energy of water in the reservoir to electrical energy we may assume for pipe line and turbine an efficiency of 75 per cent., and for the dynamo an efficiency of 95 per cent.; and it is probable that this would again have to be transformed to a higher potential for distribution, so that the efficiency from turbine horse-power at the barrage to distributing station would probably be much less than 45 per cent. and might well be as low as 40 per cent. Assuming a mean efficiency for the turbines at the barrage of 80 per cent., which is probably high, the available horse-power at the distributing station, if all power had to pass through the reservoir, would probably be of the order of from 32 per cent. to 38 per cent. of the available tidal power.

The final answer to the question whether it is worth while installing reversible turbines will have to be made when it is shown that such a turbine can be economical as a turbine and as a pump, and when the capacity of the station has been fixed. How far it will pay to incur expense in connection with high-level reservoirs for storage, and what their capacity should be, can clearly only be determined on reference to the probable cost of all other works. For example, suppose the cost of the barrage is £10,000,000, the total cost of the machinery to give an output of 300,000 h.p. is £18,000,000, and the cost of the reservoir £5,000,000, then if by doubling or even trebling the cost of the reservoir the power can be increased by, say, 50 per cent., the cost of the energy per unit will have been considerably reduced.

Instead of making a high-level reservoir it might be possible to enclose part of the basin by suitable dams, and thus to have a number of basins in which the water could be maintained at levels which could be arranged to give a more continuous constant supply than one basin can give on any day, but it is very doubtful indeed if such a scheme could utilise anything like the same proportion of the available energy as the high-level reservoir scheme, and it is possible that the capital cost per annual unit of power would be much greater. It is possible to utilise both the falling and rising tide to produce power, but it is very doubtful indeed if anything would be gained by this at the Severn. Turbines could be arranged in the barrage whereby both the falling and the rising tide could be utilised without reversing the turbines, or used, if desired, for the falling tide only.

Assuming the turbines to be producing power only when the tide is falling, to arrive at an estimate of the energy available in kilowatt hours (or horse-power hours) per day, it is necessary to know the range of tide for each day and the quantity of water to be taken from the up-stream basin, and it is in addition necessary to fix the mean head under which the turbines work.

It is clear that if there is to be anything like a constant output from the scheme, or if power is to be obtained when the tide is not running, a storage system of some kind is very necessary. Suppose a mean of 250,000 h.p. is obtained from the barrage at neap tide for nine hours per day, say, from 3.30 a.m. to 8, and from 3.45 p.m. to 9.15 at night. If the ordinary demand hours are supposed to be between 8 a.m. and 6 p.m., then on this day about 90 per cent. of the energy will have to be obtained from the high-level reservoir. This can, of course, be easily stored on those days when the barrage turbines are giving more than 200,000 h.p., and, pro-

vided sufficient pumping plant is installed, the turbines in the barrage that will give about 342,000 h.p. at neap tides, will give the necessary power to drive the pumps.

If suitable storage could be provided, there should be available, assuming for the whole system an average of 50 per cent. efficiency, a mean output of not less than 500,000 h.p. for a 10-hour working day. This capacity will have to be much greater than that which ensures a daily supply corresponding to the neap tide supply. In connection with this it should be clearly recognised that when power has to reach the distributing station by means of the service reservoir, the efficiency is less than 45 per cent., and the more the mean load exceeds the neap tide output the less the overall efficiency. Again, it should not be overlooked that the barrage turbines can only produce power at the will of the tides, and thus at those times of the day when the load is heaviest the barrage turbines may not be at work.

The number of turbines required, if working on a half-tide system, would be from 600 to 900, depending upon the horse-power of turbine, e.g., turbines of 10 ft. and 15 ft. diameter, respectively, have horse-powers, at 17.5 ft. head, of 2,400 and 3,600 respectively. If, however, we work on the system of a range from 6.5 ft. head to 6.5 ft. head and a fall of half a tide, the number of turbines will be only from 400 to 600, depending upon the size of the turbine determined upon.

At neap tides, the total power available is 372,000 h.p. for nine hours per day. The mean head is 9.3 ft., or at neap tides, 481,600 h.p. could be produced for six hours per day on the half-tide system.

If for a mean head of 9.3 ft., each turbine had a horse-power of say, 1,000, then the number of turbines required would be 372,000/1,000=372.

In the half-tide system the number of turbines to give 481,600 h.p. at 8 ft. head would be much greater. So that from this point of view it will be better to work on the variable head system.

The type of turbine to be used at the barrage must almost essentially be the modified Francis turbine, known as the mixed-flow turbine. The guide blades for these can be made fixed or movable. If the guide blades are fixed and the speed varied, the efficiency can probably be kept more constant.

The use of reaction turbines working under a head of 500 ft. or 600 ft. has not been yet developed, but it should be possible. For starting up the pumps, it may be desirable to be able to run the motors beyond the steady speed, and for this reason direct-current motors may have a distinct advantage.

Finally, it would appear from these preliminary calculations, that it should be easily possible to depend upon a minimum mean output per day at the barrage of 2.5×10^6 h.p. hours, without any high-level reservoir, but the horse-power would vary with the variation of the tide. If this could be used at its time of generation, there would be no necessity for an auxiliary reservoir, but it might be necessary to have expensive electrical plant in order to keep a constant potential on the distributing line. The only hope of using the power economically as produced would be at special chemical and metallurgical works where the shifts might perhaps be adapted to the vagaries of the tide. This does not appear to be a very likely possibility.

The Long-distance Transmission of Electrical Energy Generated by Means of Tidal Power.

Section G.—Engineering.

ON September 13th, Dr. Wall's paper, abstracted in our last issue, was read, and in the course of the discussion Prof. G. W. O. HOWE (Recorder of the Section) said that a great deal of attention had been devoted to the quarter-wave system of working during the last year or two, especially in France. Our knowledge of the transmission of electro-magnetic waves along cables was largely due to the work of Prof. A. E. KENNELLY, of Harvard University, whom he asked to take part in the discussion.

Prof. A. E. KENNELLY, after complimenting Dr. Wall on his paper, said they should be careful to avoid giving voice to criticisms of a plan of the kind dealt with on account of its great novelty, because objections and difficulties were sure to arise in their minds, in view of the experience with the ordinary low-frequency transmissions which they were accustomed to. It was by means of novelties that they were making progress, and it seemed to him that if one did no more than study what might occur on such a system, one was bound to go on learning. This was the first serious proposal that he remembered having seen of power transmission on a considerable scale over fairly long lines at a telephonic frequency, a frequency which would be ordinarily looked upon as a higher harmonic of the working frequency. Proposals had been made to operate at half-wave frequency, but not to adjust to a quarter-wave frequency, so far as he knew; that had been looked upon as a bugbear, something to be dreaded rather than welcomed and entertained. It seemed to him that the

method could be studied effectively in the laboratory, before attempting any serious expenditure, by means of artificial electric lines. This would be relatively inexpensive. He hoped the matter would be carried further, with a view to determining the possibilities of such a method as that indicated in the paper.

Prof. F. C. LEA referred to the author's remark that it was recognised that for total power production the machines must of necessity run at rather low speeds in such a scheme as might be carried out on the Severn. There were considerable limits to the power of the machines, and, therefore, in contemplating the production of a very large number of units of power, and considering that these machines had to run at low speeds, he asked the author whether he still thought there would be an inherent difficulty in that.

Prof. F. G. BAILY said that one could not help feeling that this might not be the right application for Dr. Wall's very ingenious idea, but it was very desirable that everybody should put forward ideas for hydro-electric stations with variable frequency and variable supply, so that out of the mass of the proposals it might be possible for engineers to agree to some acceptable proposal.

Dr. WALL, replying to Prof. Lea, agreed that there would still be a large number of machines, but his proposal was to do away with half of the machines proposed by the Ministry of Transport. A system of generating and distributing d.c. entirely had been suggested as an alternative, but there again the expense would be a drawback, and it was not considered advisable.

Notes on the New Electricity Supply Station of the Edinburgh Corporation.

By S. B. DONKIN. (Abstract.)

Section G.—Engineering.

IMMEDIATELY prior to the war it was found that the limits of distribution direct from the existing generating stations of the Edinburgh Corporation had been practically reached. It was, therefore, economically desirable for any new plant, or new generating station, to produce h.p., 3-phase a.c. which could be distributed by means of less costly feeders to various sub-stations in the supply area. The Corporation decided that a new site should be acquired, and a station erected at Portobello. The Westbank site secured was only 2½ ft. above the sea level, and there was sufficient space for a station having an ultimate capacity of 100,000 kW.

On June 30th, 1919, the Board of Trade allowed the work of the Portobello station to be proceeded with. Three 10,000-kW turbo-alternator sets were to be installed with requisite boiler plant, &c. Roughly speaking, the area to be supplied by the station is bounded by Linninggow and Bathgate on the west; by North Berwick or Dunbar on the east; and by Penicuik and Gorebridge on the south.

A site was acquired large enough to accommodate sidings sufficient to satisfy the requirements of the railway company, and to enable the Corporation to have room to erect gas producing and by-product recovery plant should the raising of steam from coal by such a process prove at any time in the future to be economically sound. It was further acquired so as to enable parts of the clay pit on the site to be filled up by ash refuse from the power house when it was in operation.

The author exhibited lantern slides showing the general arrangement of the power station, together with the sidings, and with the sea work for condensing water, also the cooling scheme, and ash duct. Coal will be brought on to the sidings provided on the clay pit site, and the trucks will be emptied by means of a rotary tippler into a hopper below ground level. This hopper will feed a belt conveyor running in a tunnel from the clay pit site to the power-house site. On the power-house site this conveyor will discharge the coal on to another belt conveyor, which in turn will discharge it into hoppers feeding gravity bucket conveyors, which will carry the coal into the bunkers over each boiler house. The belt conveyor from the clay pit site will be able also to tip the coal into a store on the site, from which a travelling jib crane will grab it and distribute and store it over the power-house site. This jib crane will also collect the coal from the site and discharge it into the hoppers feeding the gravity bucket conveyors. The cooling plant is being provided by the Mitchell Conveyor & Transporter Co. and by Messrs. Fraser and Chalmers. The boilers are of the Stirling Boiler Co.'s tridrum type with superposed steel tube economisers. Three types of stokers will be adopted: the Babcock & Wilcox chain grate, the Erith Riley grate, and the Underfeed Stoker Co.'s self-contained travelling grate, all fitted with forced and induced draught fans driven by motors. The steam pressure will be 300 lb. per sq. in., and the total temperature will be 700 deg. F. Six boilers are being provided at present, two being able to provide sufficient steam for one 10,000-kW turbo-alternator. One short steel chimney is provided for every two boilers, and each chimney is designed with a dust catching device at its base. This has been found necessary with induced draught when the poorer classes of coal are used. The turbo-alternators are of Messrs. Brown, Boveri & Co.'s manufacture, and the condensing plant is made by Messrs. W. H. Allen, Sons and Co. As already mentioned, there will be three sets, each of 10,000 kW normal output, but each having a maximum con-

tinuous rating of 14,700 kVA. A 70-ton travelling crane will be provided in the turbine house, made by Messrs. Marshall, Fleming & Co., and the h.p. switchgear is being provided by the British Thomson-Houston Co. The whole of the steel-work for the buildings has been carried out by Messrs. Redpath, Brown & Co., of Edinburgh, and the building superstructure by Messrs. J. Angus & Co. The plant for the station, which is at present on order, is such that at normal full load the overall thermal efficiency of the station should be 21.0 per cent., the coal consumption being equal to an expenditure of 16,300 B.t.h.u. per kWh. The system of boiler house control is based initially on the scheme devised by Mr. Myers, of Sheffield. The proposals are somewhat novel, and are, therefore, referred to in detail. The instruments necessary for the general control of a boiler house have been divided into two main groups—the recording instruments and the indicating instruments. The former are placed in a specially-built cabin (one cabin for every two boilers), and the latter collected wherever possible on one board, and placed in a convenient position in front of each pair of boilers. The set of recording instruments for each boiler will be situated on one wall of the cabin nearest the boiler to which they belong. The following instruments are proposed for each boiler: Indicators.—Steam flow meter indicator; feed-water meter indicator; coal meter; CO₂ indicator; draught gauge indicator for forced and induced draught; steam pressure gauge; steam temperature indicator; differential draught gauge connection above and below each grate. Recorders.—These include recorders for the indicators and recording thermometers in economiser inlet, economiser outlet on water side, and on flue gas side.

Generally for each group of boilers in one boiler house there will be: A blow-down recorder with chart; a densimeter for the blow down; and a feed-water recording thermometer. For every group of two boilers feeding one turbine there will also be on the indicator board beside the two boilers a kW meter to indicate the load on the turbine fed by these two boilers. The coal consumption indicator and recorders are proposed to be of the type introduced by the Lea Recorder Co., and will measure the rate of flow of coal passing on to any grate in a given time with means of adjusting the ratio of weight to volume to suit any type of coal in use. It is proposed to degas the condensate, plus the make-up, to take out all oxygen from the water so as to render internal corrosion of boilers or economisers improbable. The use of by-product recovery plant can be undertaken without much alteration to the boiler plant, and will be advised whenever it is profitable to under take the additional expenditure.

The author described the system starting from the sea to the pump house and the pipe system through the condensers and back to the sea. Two tunnels will be normally used for suction and one as discharge; one of the two suction can be stopped and changed over to act as a discharge, and the pipe previously discharging can then be used as a second suction. There will be grids for the prevention of entry of fish or seaweed; these will be washed clean by reversal of flow, and the material carried back to the sea. A duplicate system of tunnels and pipes across the site will split up the system as much as possible to prevent a shut down.

Experience in the past on the banks of the Thames proved that the cost of the tunnelling scheme was less than the cost of laying pipes down the foreshore into the water, because so much of the system had to be carried out below low-water level, and this could only be done by means of a dam to keep the water back while the work of construction and laying of the pipes was being carried out. The actual cost of the tunnelling work now under construction works out at £28 per yard run of the tunnel, excluding the cost of the shafts. The sea work shafts and tunnels are being carried out by Messrs. C. Brand & Son, of Glasgow, and Mr. H. H. Dalrymple Hay has been joint engineer with Sir Alexander Kennedy and the author, in connection with the design and construction of the work.

The Element of Compulsory Arbitration in Recent Industrial Legislation.

By DR. MARY T. RANKIN. (Abstract.)

Section F.—Economics.

THE legislation dealt with is the Trade Boards Act, 1918, and the Industrial Courts Act, 1919. These Acts were passed for the purpose of giving effect to certain proposals for the reorganisation of industry contained in the Whitley Reports, and must therefore be considered from this point of view. The Whitley Reports, while professedly aiming at the self-government of industry, advocate the principle that State "assistance" should vary inversely with the degree of organisation in each industry (cf. second Whitley Report). The Trade Boards Act, 1918, was the method adopted for providing this "assistance." The Act may be applied to any trade or part of a trade merely at the discretion of the Minister of Labour. State regulation may thus supersede and must conflict with the principle of self-government. Similarly, the Industrial Courts Act, like the Whitley Report, contemplates and encourages a vast increase in appeals to Government arbitration in trade disputes. No Act of such a nature can retain a purely voluntary character.

THE SHIPPING, ENGINEERING, AND MACHINERY EXHIBITION.

(Continued from p. 371.)

THE RECORD ENGINEERING CO., LTD., shows four models, all built in accordance with its standard design. Fig. 7 shows a 16-kW ship's emergency lighting set, consisting of a "Silent Record" paraffin engine coupled to a 16-kW Sunderland Forge Co.'s dynamo. The engine is of the 2-crank type running at a speed of 650 r.p.m. All working parts are fitted with forced lubrication, and the cylinder heads are removable, this being the standard practice for all sizes of engines. A 2½-kW electric lighting set is shown running on town gas. These sets are made for petrol, paraffin, town, or suction gas, and in sizes from 1½ to 250 b.h.p. An interesting engine fitment is also exhibited by this company, viz., the S.A. impulse starter (fig. 8), which is a standard fitment to any magneto. It is easily fitted, and does not occupy more space than the ordinary standard magneto coupling. The construction is

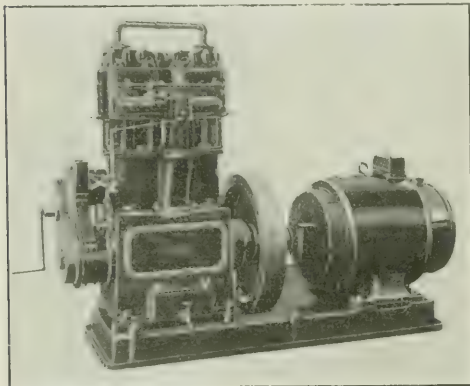


FIG. 7.—A 16-KW SILENT RECORD EMERGENCY SHIP'S LIGHTING SET.

simple, and once the engine is started the action is that of an ordinary magneto coupling. Accumulators are not required. The principle upon which the mechanism of the starter operates is as follows: The magneto armature is temporarily arrested by the action of pulling the pawl into engagement with the armature-plate which is attached to the armature spindle. The action causes the spiral spring inside the starter to be wound up and as a result energy is stored in the spring until such time as the cam on the cam casing disengages the pawl from the armature plate. As soon as disengagement takes place the energy stored in the spring imparts a rapid

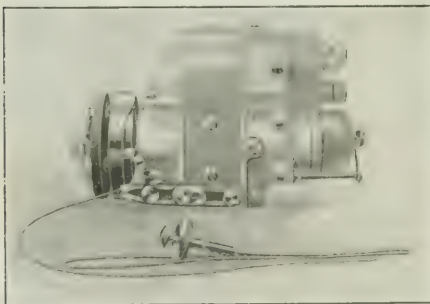


FIG. 8.—THE S.A. IMPULSE ENGINE STARTER.

impulse to the magneto armature, equivalent to revolving the armature at 500 r.p.m.; this produces an intense spark in the cylinder which is on the firing stroke. The spiral spring is so arranged that after the impulse has taken place the armature plate and cam casing are spring locked, thus forming a rigid lock, so that the ordinary timing of the engine and magneto is maintained and the starting device then functions purely in the manner of an ordinary coupling. The pawl-operating mechanism is so arranged that immediately the engine revolves under its own power, the pawl is thrown out of operation, and its design is such that the starter cannot come into operation after the engine is running due to the pawl being arranged in such a manner that it comes under the magnetic influence of the magnets of the magneto, which

keeps it in position until such time as it is operated by the pull-button.

THE BRITISH THOMSON-HOUSTON CO., LTD.—Certain items of special interest to the shipping and kindred engineering trades have been selected for this exhibit, of which the following may be detailed: The portable master controller for cranes enables all operations of the crane to be controlled from the deck or dockside where full view of the load is obtained during all stages of loading or discharging cargo. One man only is required, carrying the controller by means of straps over his shoulders and moving to the most suitable position from which he can control the load. The controller is connected only by a light trailing cable to contactors mounted on a panel which is placed in a convenient position in the crane cabin. The B.T.H. electric rivet heater has been designed to overcome the waste which is generally recognised in existing methods of heating rivets. The rivet heater consists primarily of a portable iron framework which supports a compact air-cooled transformer, the primary of which is connected through a six-tap drum controller to the a.c. supply. The secondary of the transformer is connected to two movable copper electrodes which can be raised or lowered by means of foot pedals so that rivets may be held between these electrodes and a fixed copper block extending below the two electrodes. The rivets are heated by placing them in a vertical position between the electrodes and the copper block, the whole of the current passing through the rivets in parallel. Six heats, from "low" to "high," can be allowed by means of the drum controller on the primary of the transformer, to allow for various sizes of rivets or the rate of output required. There is no danger of "shock" because the maximum potential across the electrodes does not exceed 5 volts. Heated rivets can be produced at the rate of about 5-lb. per kWh. Electric motors for a.c. and d.c. circuits are represented by an exhibit of one of each type, both specially designed for marine use. Special marine type bearings are fitted, each with two oil rings, and allowing a movement of 15 deg. in either direction from the vertical positions. The double master controller for use with cranes and similar machinery controls two motors at the same time, allowing both travel and traverse motions to be controlled by a single lever. The controller consists of two small barrels combined in one frame, both being operated by the same lever through universal gear. Another interesting exhibit in control gear is the watertight controller rated at 10 h.p., 200/550 volts, and has five points forward and reverse. A pedal switch for electrically-operated capstans, winches, &c., allows the operator to have both hands free. The pedal plunger passes through a watertight gland, and when the switch is assembled on the capstan pit cover it is impervious to rain and sea water. When out of service, the plunger can be disengaged from the operating mechanism and dropped flush with the surface of the switch. When in this position the pedal can be locked by inserting a key in the top of the plunger, thus protecting the apparatus from misuse. Flow meters for steam, gas, air, water, or oil, demonstrate the waste-checking value of these simple instruments. A portable wireless receiver shown is a complete unit, weighing only 20 lb., in a case measuring 13 by 14 by 5 in., and it does not require an external aerial or other wires. All that is necessary with this instrument is to stand the box on a pivot on the detachable cover, connect the telephones, and by simple adjustment "tune" the apparatus to the vibrations of the passing wave. The signals are sufficiently loud to enable messages to be taken from stations in France and Germany, and the direction of origin of the signals is indicated by the instrument.

MESSRS. POOLEY & AUSTIN.—In addition to a range of standard a.c. and d.c. motors, the firm shows several interesting novelties. One of these takes the form of a semi-portable chain-driven blower suitable for removing dust, &c., from the inside of motors, dynamos, switchgear, and other similar apparatus, or for use with a portable forge or brazing hearth. The motor is mounted directly above the compressor, the floor space occupied being no more than that taken by the compressor alone, and the set can be easily carried about by one man. In a Wilson-Wolf fractional horse-power motor is incorporated a reduction gear with a ratio of 28-1, the second motion shaft being in line with the armature shaft and revolving in the same direction, the reduction gear being mounted in the pulley end bracket of the motor; other motor combinations are shown, and the motor-generator set converting single-phase a.c. to d.c. for supplying all the d.c. required on the stand is of the "Creedy" compensated commutator type. The electric wiring installation of the stand for the whole of the lights and motor circuits is carried out in C.T.S. cable manufactured by the Greengate & Irwell Rubber Co., Ltd. Amongst the switchgear included in this exhibit is a variety of Park Royal Engineering Works, Ltd., specialties, including a motor car switchboard of special design. The d.c. motors shown are Messrs. Mawdsley's, Ltd., and embody the Mawdsley method of field magnet construction, which is claimed to represent an advance on the ordinary interpole type.

A comprehensive display of electrical apparatus of all kinds is to be seen on the stand of the N.V. HENGELSCHKE ELECTRIC EN MECHANISCHE APPARATEN-FABRIEK, of Holland (Agents: Messrs. Williams, Pell & Baring). The centre of the stand is occupied by a switch desk (fig. 9) for the control of the generator units of a high-pressure three-phase power station. The Heemaf desk is of the unit type, lending itself

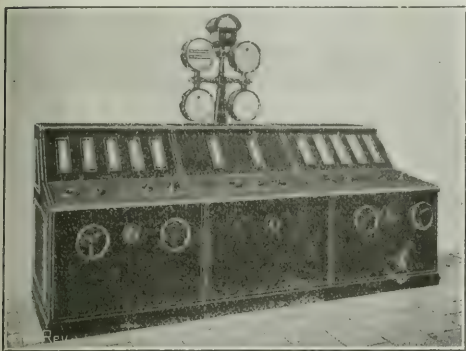


FIG. 9.—HEEMAF CONTROL BOARD.

readily to the extension of the number of generator or supply circuits which may be required. It is constructed of steel plate panels with nickelled corners and framework, and is mounted with flush fitting instruments, control switches, regulators, and indicators. The example shown has been constructed for an installation in the Dutch East Indies, and comprises two generator and synchroniser panels; the generators each have a capacity of 2,500 kW at 3,500 volts. The voltmeters, amperemeters, and kilowattmeter for the generator and exciter are of the flat scale edgewise type, mounted flat

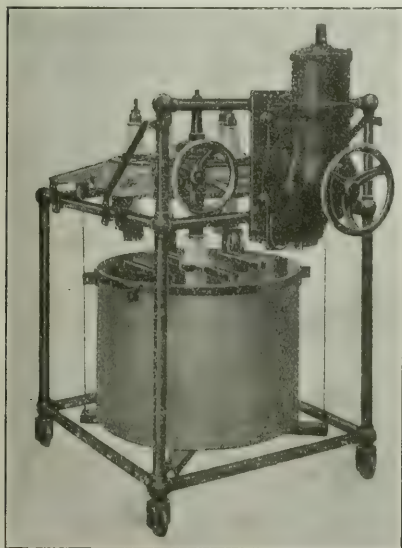


FIG. 10.—HEEMAF H.P. OIL SWITCH.

In the upper panels. On the table part of the desk are push-button switches for operating electrically-actuated oil switches and indicating lamps, also a synchronising plug. On the lower panels are main and shunt regulators for the exciters, and special regulator for adjusting the engine speed while synchronising. At the back of the desk are integrating kilowatt-hour meters. The centre section is used for synchronising and has mounted on it a pillar, voltmeter, periodicity indicator, synchroscope, balance voltmeter, and an automatic synchroniser by means of which the generators can be synchronised automatically, independent of the skill of the attendant. This centre section also contains an ammeter and voltmeter, relay switches, indicators, and a regulator for a small rotary

converter used for supplying d.c. to the auxiliary circuits for operating the oil switches. The connections are run inside the desk in a neat and substantial manner, all wire ends being marked clearly to assist re-erection.

With the Heemaf automatic synchroniser it is imperative that electrically-operated auxiliary switches be used for connecting both machines or systems in parallel. The apparatus is very simple and consists essentially of two Ferraris aluminium disks, each provided with a pointer. One of the disks is subjected to the magnetic force of two peculiarly shaped magnet systems, which produce a rotating field by current taken from each of the two machines to be synchronised. The magnetic fields produced by these coils when synchronism is reached have a phase displacement of 90 deg., thus placing the disk against the action of an increasing force in its extreme position. Against this magnetic force acting upon a disk, the action of a spring is exerted which tends to bring the pointer back to its central position. As soon as the pointer reaches the extreme position, it closes an auxiliary circuit which, in turn, energises the various control circuits for operating an oil switch to connect the incoming generator. By using this synchroniser it is claimed the angular displacement between phases of the two machines to be synchronised cannot exceed 7.4 deg. which corresponds to a maximum current rush of 19 per cent. that only lasts from 1 to 3 cycles, and can hardly be detected on a meter. This clearly shows that the percentage of error when synchronising units is practically negligible. The two pointers will meet only with equality of phase and frequency, and with a predetermined difference of voltage not exceeding 10 per cent.

A model transformer kiosk illustrates a compact and inexpensive design of sub-station for use in street distribution or isolated plant. The kiosk consists of a concrete base with a sheet-steel superstructure mounted on rollers to enable it to rotate and bring the doors opposite to any part of the internal compartments to give access to the fittings and connections as required. In co-operation with Philips lamp works, the company has designed a current rectifier that consists essentially of a double-electrode argon gasfilled valve, a transformer, and an overload release all contained in a neat enclosing case. On the 1.5 and 3-amp. sizes when the cathode filament is burned out the bulb is simply reversed in its fitting so that the other side becomes the cathode; thus the life of the bulb is doubled. An automatic overload switch is used in conjunction with the device in such a way that when the supply of d.c. exceeds a certain value the current is cut off.

Fig. 10 is a reproduction of a h.p. oil switch mounted on a pipe framework with the control mechanism and lowering device for the sheet-steel welded tank.

MESSRS. I. & M. STEINGOLD'S exhibit consists of preparations and electrically-driven machines for use in the "Simplex" system of treating wooden floors, ships' decks, &c. Planing, sandpapering, and polishing machines are supplied, each of which is operated by an electric motor, and to avoid raising dust or scattering shavings, a hood and suction tube attachment is provided.

THE LONDON ELECTRIC FIRM has on view searchlights and projectors of various sizes and types, also current-carrying cable drums, lamp-lowering gear and winches, small d.c. motors and dynamos, &c. The soldering-iron heating oven that was described and illustrated in our last issue is shown in addition to electric irons, kettles, and other heating apparatus that is made by the company's branch firm, the Electric Heating Co. It should be mentioned that a speciality is made of low-voltage apparatus to suit conditions prevailing on board ship.

MR. W. HAMILTON WILSON'S stand contains a selection of wireless telegraph transmitting and receiving apparatus, an X-ray spark coil, and various transformers, condensers, and thermo-electric instruments for the measurement of small a.c. currents, radiation, and temperature measurements, &c.

THE RADIO COMMUNICATION CO., LTD., also exhibits devices of this nature, including emergency equipment; the sets range in power from $\frac{1}{2}$ to 5 kW, one of the former size being portable, is designed for use on lifeboats, and has a range of 60-80 miles.

The products of MESSRS. OZONAIR, LTD., by the aid of which pure ozone is produced electrically are too well known to need detailed description. Plant of various sizes is shown.

The models on the stand of MESSRS. HYDRAULIC GEAR, LTD., illustrate useful and interesting applications of the Hele-Shaw variable delivery pump to ships' gears, allowing, as it does, the electric driving motor to run continuously, and protecting it from the severe shocks of the sea. The pump acts on hydraulic rams connected to the tiller, and the gear constitutes a closed hydraulic system in which the operating fluid is oil. It is operated by means of a telemotor from the bridge, is under perfect control, and quick to respond.

THE SPERRY GYROSCOPE CO., LTD.—The instruments on this stand are always attractive on account of their delicacy and the beautiful way in which they are made. The gyro compass and high intensity searchlight have been described in our pages; the former has been adopted as standard in all the Allied Navies, and since the war the merchant service has used it with satisfactory results. The odograph is another electrical instrument (invented by Admiral Villiers, of the British Navy) that combines the readings of the gyro

compass and the electric log, and traces on a sea chart the actual course traversed by the ship.

MESSRS. S. G. BROWN, LTD., show a gyro compass of equal interest to that mentioned above; it has also been described in our columns. Wireless telephone devices, electrical and cable instruments, and the "Cyclux" self-generating lighting set for bicycles are also exhibited on this stand.

MEDWAY'S SAFETY LIFT CO., LTD., demonstrated a complete electric passenger lift controlled by push buttons as well as by a switch worked to the attendant in the cage. The firm's electrically-operated device for opening and closing lift doors and gates is operated by merely pressing a button, and is practically noiseless in operation.

Electric soldering irons (Wheatcroft's patent applied for) are to be seen on the stand of MESSRS. ELLIS & COE, their feature being that the bits are renewable without having to dismantle the iron itself.

Another type of iron is shown on the stand of ACME ATELIERS (JEAN LEBRE) DE CONSTRUCTIONS MECANIQUES, of Switzerland (Agent, Mr. E. Fehr), and has the copper bit screwed to the head of the iron so that bits can be changed from one position to another as required.

THE TELEPHONE MANUFACTURING CO., LTD., claims to cater for the needs of all and sundry, whether it be for shipyard, ship, office, works, warehouse, private house, or other uses, and it accordingly exhibits a large and varied assortment of its products.

(To be continued.)

ELECTRICITY IN COAL MINES.

A CONFERENCE was recently held between the Switchgear Section of the B.E.A.M.A. and Mr. J. A. B. Harvey, H.M. Electrical Inspector of Mines, with regard to the rules governing the construction and use of switchboards in mines; Dr. Garrard, chairman of the Switchgear Technical Committee, was in the chair. As some of the matters for discussion also had their counterpart in factory switchboards, H.M. Electrical Inspector of Factories, Mr. G. Scott Ram, was also invited to attend.

After Mr. Ram had explained the bearing of the factory regulations on the points in question, Mr. Horsley dealt with the requirements of the mines rules, and called attention to the information contained in "Mines and Quarries Form No. 11 (April, 1921)," which contains the electricity regulations and the revised official memorandum thereon.

After full discussion, it was agreed to place on record the following views:—

1. *The Isolation of Circuit-breakers for Cleaning or Repairs.*—In colliery surface switchboards, when a switchboard circuit comprising air-break circuit-breakers or contactors cannot be shut down regularly, say, once a week, exclusive of Sundays, to permit of cleaning and adjustment being carried out with safety, means must be provided for isolating such circuit-breakers or contactors.

2. *Screening.*—In view of the foregoing rule, provision for fixed or movable partitions may or may not be necessary, depending upon the nature and design of the switchboard.

3. *Insulating Barriers.*—When a switchboard has open-type bus-bars arranged in the horizontal plane, insulating barriers must be fixed between them projecting at least 2 in. above the upper surface of the bus-bars.

4. *Shrouded Circuit Contacts.*—When a surface switchboard contains cut-outs having surface contacts fixed on the front, and the distance between opposite poles is less than 6 in., such contacts must either be shrouded or protected by fillets provided between the poles.

LIGHTING IN FACTORIES AND WORKSHOPS

THE following is an abstract of Welfare Pamphlet No. 7, issued by the Home Office (pp. 20; illustrated. H.M. Stationery Office, Price 4d. net).

1. THE IMPORTANCE OF LIGHTING.

The lighting of a factory or workshop is a matter which should receive the special consideration of every occupier, since it has an important bearing both on the health, safety, and efficiency of the worker, and on the general efficiency of the work. Since 1913 the subject has been extensively studied by the Departmental Committee on Factory Lighting, which has issued two reports.*

Effect on the Worker.—Complaints as to eyestrain and headaches attributed to insufficient light are common. Few conditions have a more mentally irritating effect than those

associated with bad lighting, whether the badness is due to inadequacy or to glare and shadow, and a worker continuously subjected to such conditions clearly cannot be expected to work at his maximum efficiency.

Lighting is undoubtedly an important factor in accident incidence. A statistical investigation carried out by the Departmental Committee on Lighting in Factories and Workshops indicates that accidents of certain types occur more frequently during the winter months when daylight hours are short.* It is also obvious that proper lighting of dangerous parts of machinery is often an essential factor in rendering them safe.

Further, light helps to maintain sanitary conditions in the factory by preventing the unnoticed accumulation of waste and dirt, and is essential for the maintenance of order and decorum.

Effect on the Work.—Defective lighting tends to affect detrimentally both the *quality* and the *quantity* of the work turned out. The former point is self-evident, as proper critical examination of the work by the worker is impossible without sufficient illumination. This principle is already usually recognised for processes of special delicacy, for which care is taken to secure adequate illumination just as care is taken to provide proper tools. Still, even here, it is doubtful whether sufficient attention is always given to the requisites of good lighting other than mere adequacy—for example, shading and relative position of light sources and work. In the case of less fine and coarse processes, the importance of good lighting is apt to be overlooked, though its effect in diminishing the proportion of spoiled or defective work is often considerable. Again, defective lighting may affect output *quantitatively*, though, of course, in different degrees according to the nature of the work. Some part of an operation may be slightly delayed at every performance owing to imperfect lighting, and if the operation is repeated thousands of times daily, the cumulative effect of these delays will be very large.

Broadly, therefore, illumination, to be satisfactory, must fulfil the following conditions:—

- (a) That there are no lighting conditions prejudicial to the health, comfort, and safety of workers.
- (b) That it is sufficient for the proper carrying out of the work both as regards quality and output.

2.—FUNDAMENTAL REQUISITES OF GOOD LIGHTING.

The conditions determining whether a given system is satisfactory or not are so complex, and vary so much with the class of work carried on, that it is impossible to do more than enunciate certain fundamental principles, and occupiers who have reason to think that these are not fulfilled are advised to consult a lighting engineer with special experience of industrial conditions.

The factors which contribute to a good system may be summarised as follows:—

1. Adequacy.
2. Suitability, comprising:—
 - (a) Constancy and uniformity.
 - (b) Prevention of glare.
 - (c) Avoidance of shadow.

1. ADEQUACY.

For most workrooms it is necessary to consider the amount of illumination that may be regarded as adequate:—

- (a) For affording safe access from one part to another.
- (b) For efficient carrying on of the work.

The first of these has been studied by the Departmental Committee on Lighting in Factories and Workshops, and numerical standards have been recommended for adoption as fulfilling the *minimum* requirements.

Briefly, these are:—

(a) Over the "working area," or that portion of the floor occupied by or in the immediate neighbourhood of the machines, benches, plant, or material at which the operatives stand or sit in execution of their work, including the gangways and alleys between or around such working places,† 0.25 foot-candle.

(b) All other parts of the factories and workshops over which persons are liable to pass, e.g., passages, stairways, lobbies, 0.1 foot-candle.

(c) In all open spaces in which persons are employed during night, and in dangerous parts of a regular road or way forming the approach to any place of work, 0.05 foot-candle.

These standards are to be regarded not as embodying ideal conditions, but as suitable for legal minima. Owing to the diversity of illumination existing with any system of lighting, a given minimum means a much higher maximum and average.

2. SUITABILITY.

A more common fault than inadequate lighting is its *unsuitability*, due generally to inattention to one or more of the points described below.

(a) *Constancy and Uniformity.*—A flickering light is always a cause of irritation and may cause accidents.

* See first report, p. xii.

† An exception is made in the case of iron foundries, for which, owing to the dark surroundings and want of contrast a standard of 0.4 foot-candle is recommended.

† The measurements are to be made on a horizontal plane at floor level.

* First report of the Departmental Committee on Lighting of Factories. Vol. I. Report and appendices. (Cd. 8,000), 1915. Price 11d. Second report of the Departmental Committee on Lighting in Factories. (Cmd. 1,418), 1921. Price 1d.

Attention may also be drawn to the importance of adequately lighting the whole of the plane of work, including parts regularly but infrequently used. For instance, whilst the work may be excellently lighted, the place where the tools are kept ready for use is neglected, and time and temper are lost on every occasion when a change of tool or materials is required. Uniformity of lighting is especially necessary on machine work which requires the operative to give attention to more than one small part of the machine.

(b) *Prevention of Glare.*—The term glare may be used to cover any of the following phenomena:—

(i) The effect of looking directly at a bright source of light, so that the worker is prevented from seeing other objects properly. Vision is impaired for a short period after the light has ceased to enter his eyes.

(ii) The effect which is produced by the presence of bright sources of light towards the edge of the field of vision. A worker may never look directly at such sources of light, but is nevertheless troubled by their presence. This is the commonest form of glare.

(iii) The effect which is produced when the surface being worked upon is shiny or polished, and reflects light directly from some source into the eyes of the worker.

The first two of these forms of glare can be avoided either by the proper shading of the light sources or by fixing them at a sufficient height above the worker.

It is still common to find shallow shades which were suitable for the small electric lamps for which they were originally made, used for the modern type of large bulbs which extend far beyond the shade and dazzle the eyes when hung in the direct line of sight.

The third form may be remedied by suitable adjustment of the light source or by shading with translucent material.

(c) *Avoidance of Shadow.*—The shadow may be that of the worker himself, of parts of the machinery or plant, or of the material being worked upon. The remedy consists either in suitable shading or adjustment of the lamp, or in increasing the illumination over the part of the plane of work affected so as to neutralise the shadow.

3.—NATURAL AND ARTIFICIAL LIGHTING.

Two separate problems in illumination have to be considered, one relating to the natural and the other to the artificial lighting, though the same fundamental principles apply to both.

The two problems are quite distinct; in natural lighting the positions of the sources, *i.e.*, the windows, are definitely fixed, whereas in artificial lighting there is almost unlimited scope in the arrangement of sources.

4.—METHODS OF ARTIFICIAL LIGHTING.

The methods of artificial lighting of workrooms may be classified as follows:—

1. General lighting, whereby an illumination is produced which is approximately uniform throughout the whole room.

2. Localised general lighting, whereby an illumination is produced which is approximately uniform over a portion or portions of the room in question.

3. Local lighting, with the object of lighting some particular portion of a machine or locality by an arrangement of individual lamps acting independently of one another.

4. Combined local and general lighting.

[Examples of alternative methods are given, with illustrations.]

Where general lighting is adopted, there is little risk of the floor being insufficiently illuminated. With localised general lighting there is danger of some parts being neglected, whilst with local lighting the contrast between the brightly illuminated work and the comparatively dark surroundings necessitates careful attention to the general lighting.

5.—CAUSES OF UNSATISFACTORY LIGHTING.

The principal causes for unsatisfactory natural lighting may be classified as follows:—

1. Old and unsuitable buildings.

2. Obstruction of light.

3. Dirty windows. A very common cause of insufficient illumination, and arrangements should be made for periodical cleaning, as is already the practice with many firms.

4. Dirty walls and ceilings. This effect is specially marked in factories lighted from saw-tooth roofs, where much of the light entering the windows is reflected from the sloping ceiling down on to the work.

The effect of light-coloured walls and white ceilings on the general brightness of the room and in affording an effective background to dark objects is often overlooked, and special attention should be directed to this means of increasing the illumination in workrooms at a minimum of expense.

(1) and (2) are specially noticeable in large towns where space is limited, and cannot be completely removed without rebuilding or change to another factory. Additional daylight may be secured thus:—

1. The windows should be of adequate size and extend to as near the ceiling as practicable.

2. They should be kept clean, and free from unnecessary obstruction within.

3. Vertical light can be reflected into the room by means of reflectors or prismatic glass.

4. It may be possible to white the surface of an external wall or building which obstructs the light.

5. The inside walls and ceiling should be white or nearly white.

6. The positions of the permanent working points should be so adjusted in relation to the windows and to internal obstructions of whatever kind to secure as far as practicable adequate daylight for each.

The chief causes of unsatisfactory artificial illumination may also be classified under a few headings:—

1. *The Provision of too few or too weak light sources.*

2. *Antiquated Methods of Lighting.*—As a rule, the methods now adopted are modern and efficient, but instances are still found of the use of antiquated systems. Gas jets are objectionable in many ways—they vitiate the air, are liable to flicker, and are so uneconomical that the small capital outlay required to replace them by a modern system is rapidly repaid by the greater efficiency and diminution in running expenses.

3. *Inadequate Supply.*—Inadequate illumination is sometimes caused by the diminished pressure in the gas mains during the period of maximum consumption, and, where the electrical energy is generated on the premises, by the installation of a dynamo or engine of insufficient output.

4. *Neglect of Upkeep.*—Systematic attention to the light sources is always necessary in order to obtain maximum efficiency.

5. *Inside Obstruction.*

6. *Shadows and Placing of Lights.*

6.—ILLUMINATION REQUIRED FOR THE ACTUAL WORK.

Perception of Detail.—The illumination required for the work itself varies so much with the nature of the process that every process has to be considered on its merits, and depends not only on its nature and the degree of detail to be made visible, but also on the reflecting power of the material worked on; further, after a certain limit is reached increase of illumination has no effect in assisting the eye to distinguish detail.

Direct and Indirect Lighting.—Modern methods of artificial illumination are commonly divided into three classes:—

Method.	Application.	Suitable types of lamp.
(1) Direct	(a) General Lighting ...	Single low candle power gas-filled or high candle-power metal filament (single or in groups) in shades or enclosed fittings.
	(b) Local Lighting ...	Single low candle power metal filament in shades.
(2) Semi-Indirect ...	General Lighting ...	Single high candle power gas-filled.
(3) Indirect ...	General Lighting ...	Single high candle power gas-filled.

The principal distinction between these systems is that in the direct system the light emanates from points, and in the indirect from surfaces, whilst the semi-indirect system is a combination of both.

The conclusion indicates, in the form of questions, the various ways in which the lighting of a factory may be defective. Appendix I is extracted from the First Report of the Departmental Committee already referred to, and deals with "Illumination and its Measurement," while a second appendix shows by means of excellent reproductions examples of bad and good lighting.

A Glasgow Sale.—Our local correspondent writes:—"A three days' sale of machinery including 200 generator sets, and 500 searchlight projectors, was conducted at Georgetown Factory, near Glasgow, by Mr. Matthew Marshall, Waterloo Street, by direction of the Disposal and Liquidation Commission last week. Buyers were present from industrial centres in England and Scotland, while firms in Natal were also represented. Throughout the three days of the sale there was keen competition. The prices realised were highly satisfactory and compared favourably with those current months ago, notwithstanding the slump in trade. Four hundred and thirty-two small switchboards for 60 cm. projectors, containing voltmeter, ammeter, knife switch, &c., £864; 15 No 3 Herbert combination lathes, with fittings, about £400; a 5-ton electric overhead crane, with lifting, travelling, and traversing motions, controlled from the ground level, with motors of 220 volts, d.c., £355; 6 in. submersible electric pump, complete with oil-driven alternator, 220 volts, output 350 tons p.h., £225; 3-ton crane, with 60 ft. steel jib, fitted for motor drive, £200; 30-h.p. electric motor, by Laurence Scott & Co., £160; 50-h.p. electric motor, d.c., 220 volts, totally enclosed type, £125; 30-h.p. electric motor, d.c., 220 volts, with pulley, £120; a 30-cwt. electrically driven winch, with parallel drum, fitted with Westinghouse motor of 15 h.p., 400 volts, £100; 24-kW generating set by Boothroyd, £100; 507 parabolic reflectors for 60 cm. projectors, £100."

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

- Compounded expressly for this journal by MESSRS. SEPTON-JONES, O'DELL and STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C.1.
- 2,244. "Commutator operators." Metropolitan-Vickers Electrical Co., Ltd. September 1st. (United States, October 22nd, 1920.)
- 2,246. "Liquid rheostats." Metropolitan-Vickers Electrical Co., Ltd. September 1st. (United States, October 18th, 1920.)
- 2,253. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.), September 1st.
- 2,259. "Sound signalling systems." H. Baron (Signal Ges.), September 1st.
- 2,261. "Electron discharge amplifiers." British Thomson-Houston Co., Ltd. September 1st. (United States, October 29th, 1913.)
- 2,264. "Electrically heated soldering iron." A. Albrecht and J. Albrecht. September 1st. (Switzerland, May 1921.)
- 2,285. "Aerials for wireless signalling." T. L. Eckersley, A. McLeilan, and H. J. Rounte, September 1st.
- 2,288. "Means for fixing insulator, &c., bolts." W. F. Ennis. September 1st.
- 2,291. "X-ray appliances." M. R. J. Hayes. September 2nd.
- 2,294. "Electric traction." R. C. Sayer. September 2nd.
- 2,292. "Electric filament lamp holders." W. W. K. F. Griffiths. September 2nd.
- 2,314. "Electric motor." W. C. Fairweather (Diel Manufacturing Co.), September 2nd.
- 2,315. "Motor attachment for sewing machine." W. Fairweather (Singer Manufacturing Co.), September 2nd.
- 2,316. "Motor-driven sewing machine." W. Fairweather (Singer Manufacturing Co.), September 2nd.
- 2,317. "Electrically-controlled sewing machine." W. Fairweather (Singer Manufacturing Co.), September 2nd.
- 2,318. "Lighting attachment for sewing machine." W. Fairweather (Singer Manufacturing Co.), September 2nd.
- 2,319. "Electrically-lighted sewing machine." W. Fairweather (Singer Manufacturing Co.), September 2nd.
- 2,320. "Electric sewing machine." W. Fairweather (Singer Manufacturing Co.), September 2nd.
- 2,321. "Electrical connectors and terminal blocks." W. Fairweather (Singer Manufacturing Co.), September 2nd.
- 2,345. "Mechanical relays." A. Barr, Barr & Stroud, Ltd., and W. Stroud. September 2nd.
- 2,349. "Electric apparatus for waving hair." G. Baudo. September 2nd. (France, March 26th, 1920.)
- 2,376. "Electric discharge devices." British Thomson-Houston Co., Ltd. (General Electric Co.), September 2nd.
- 2,377. "Means for rectifying low-tension alternating currents." W. H. Frith. September 2nd.
- 2,404. "Electrically-operated brakes for self-propelled vehicles." W. Paddon. September 2nd.
- 2,419. "Telephone systems." E. A. Graham. September 2nd.
- 2,434. "Electric batteries or accumulators." W. H. Exley and G. H. Handyside. September 2nd.
- 2,437. "High-frequency telegraphy and telephony." Ges. fur Drahtlose Telegraphie. September 2nd. (Germany, September 20th, 1920.)
- 2,451. "Electrically-heated utensils." A. G. Bratt. September 3rd.
- 2,452. "Insulating blocks for lamp holders." A. B. Goldsmith and Proprietary Smallwares, Ltd. September 3rd.
- 2,453. "Holders for electric lamps." A. B. Goldsmith and Proprietary Smallwares, Ltd. September 3rd.
- 2,469. "Combined collector and terminal block." W. P. Thompson (Splitdorf Electrical Co.), September 3rd.
- 2,475. "Testing points for use in electrical work." G. S. Wilson. September 3rd.
- 2,501. "Permanent magnets for electric machines." C. F. Dufaux. September 3rd. (Switzerland, September 7th, 1920.)
- 2,518. "Terminal blocks for electric conductors." A. Kirk and R. C. Miliken. September 3rd.
- 2,523. "Switch for controlling electric circuits." W. J. Pritchett. September 3rd.
- 2,535. "Composition for screening X-rays and for electrical insulating." R. J. Reynolds. September 3rd.
- 2,537. "Cycle electric lighting system." W. H. Bentley-Humphries. September 5th.
- 2,539. "Commutators or distributors for electric ignition systems." F. W. Baker. September 5th.
- 2,579. "Signalling systems." Radio Communication Co., Ltd., and J. Scott-Taggart. September 6th.
- 2,594. "Miners' electric safety lamps." A. P. Ford. September 6th.
- 2,604. "Armatures of direct-current electrical machines." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. September 6th.
- 2,610. "Spark testing gear for dynamo-electric machines on railway vehicles." E. C. Astington, E. T. Flann, and Vickers, Ltd. September 6th.
- 2,612. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.), September 6th.
- 2,617. "Frictional driving gear for dynamo-electric machines on railway vehicles." E. C. Astington, E. T. Flann, and Vickers, Ltd. September 6th.
- 2,633. "Electric switches for railways, &c." W. S. Every. September 6th.
- 2,640. "Electric heating apparatus for waving hair." E. F. Suter. September 6th.
- 2,648. "Dimming devices for electric lighting on vehicles, &c." H. J. Bedford. September 6th.
- 2,668. "Fittings for electrical conduits, steam pipes, &c." J. A. M. P. September 6th.
- 2,676. "Dynamo-electric machines." Electro Dynamis Construction Co., Ltd., and N. Prinschke. September 6th.
- 2,686. "Commutators." T. A. Pembrey. September 6th.
- 2,694. "High-tension apparatus." M. A. Codd. September 6th.
- 2,699. "Spark testing device." J. R. Robertson. September 6th.
- 2,703. "Connections for securing sparking plugs to their leads, &c." G. H. Ward and W. L. Yeo. September 6th.
- 2,710. "Electric radiators, &c." Metropolitan-Vickers Electrical Co., Ltd., and J. A. Orange. September 6th.
- 2,721. "Electric lamps and batteries." R. Haddon. September 6th.
- 2,730. "Electric motor control." British Thomson-Houston Co., Ltd., and R. D. Given. September 6th.
- 2,731. "Frictional driving gear for dynamo-electric machines on railway vehicles." E. C. Astington, E. T. Flann, and Vickers, Ltd. September 6th.
- 2,760. "Automatic selectors, &c., for wireless signalling systems." H. R. Rivers-Moore. September 6th.
- 2,762. "Timing switches or commutator devices." W. P. Thompson. September 6th. (United States, September 7th.)
- 2,790. "Directional wireless systems and apparatus." H. L. Crowther, T. H. Gill, G. P. Grenfell, J. Erskine-Murray, and J. Robinson. September 7th.
- 2,791. "Electric instruments." W. Whitehead. September 7th.
- 2,796. "Telephone instruments." Automatic Telephone Manufacturing Co., Ltd., T. C. Jordan, and S. R. Smith. September 7th.
- 2,836. "Magnetron ignition for internal combustion engines." C. F. S. Houston, F. A. Schmidt, L. V. Slesman. September 7th. (Australia, September 7th, 1920.)
- 2,861. "Telephone junction or terminal boxes, &c." H. J. Palmer. September 7th.
- 2,869. "Automatic switching arrangements." H. Baron (F. Allendoff. September 7th.
- 2,872. "Circuits and electromedical apparatus for transforming and utilising electric currents." General Electric Co., Ltd., B. S. Gossling, H. B. Gough, and Watson Sons (Electro-Medical), Ltd. September 7th.
- 2,891. "Arrangements of cables and transformers in electric high-tension transmission lines." A. M. Taylor. September 7th.
- 2,895. "Electrical transmission systems." A. M. Taylor. September 7th.
- 2,896. "Electric automatic clock." A. C. Glover and H. Unwin. September 8th.
- 2,912. "Electric rotary contact maker." R. Silcock. September 8th.
- 2,938. "Electric irons." C. W. Denny. September 8th.
- 2,953. "Protective devices for electric transformers." Metropolitan-Vickers Electrical Co., Ltd., and T. W. Ross. September 8th.
- 2,954. "Electromagnetic regulating devices for dynamo-electric machines." J. Etchells and Vickers, Ltd. September 8th.
- 2,962. "Apparatus for damping third higher harmonic wave in three phase transformers." A. G. Brown, Boveri et Cie. September 8th.
- 2,964. "Sound conducting tubes." Signal Ges. September 8th. (France, September 9th, 1920.)
- 2,974. "Acoustic apparatus for telephonic communication." Signal Ges. September 8th. (Germany, September 27th, 1920.)
- 2,980. "Testing devices for electric ignition systems." J. H. Runbaken and W. Torrance. September 8th.
- 2,982. "Means for operating, from high-tension, direct current, electric means, apparatus adapted to be operated by low-tension current." L. de S. Zagury (Buscha Ges.), September 8th.
- 2,996. "Electric fuse boards." J. B. Tucker. September 9th.
- 2,4016. "Electric switch mechanism." H. W. Cox. September 9th.
- 2,4028. "Vacuum tubes and method of making same." Western Electric Co., Ltd. (Western Electric Co., Inc.), September 9th.
- 2,4035. "Means for mounting and driving magneto-electric machines." J. White. September 9th.
- 2,404. "Electric apparatus for electric heating." A. C. Bartlett and General Electric Co., Ltd. September 9th.
- 2,457. "Electric arc devices." British Thomson-Houston Co., Ltd. (General Electric Co.), September 9th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses show those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1910.

- 18,357. "Wireless telegraph apparatus operating with relays." J. B. Bolitho. May 25th, 1920. (108,072.)

1920.

- 5,988. "Magnets for the ignition of internal combustion engines." K. F. Riese. February 27th, 1920. (108,090.)
- 8,026. "Electric lamp holders." British L. M. Ericsson Manufacturing Co., Ltd., H. H. Huxley, and A. G. Gould. March 18th, 1920. (108,085.)
- 10,233. "Rotary transformers and converters for electrical purposes." Accles & Shelsley, Ltd., and H. F. L. Stevenson. April 13th, 1920. (108,082.)
- 11,109. "Track circuit signalling systems for railways." A. E. Tattersall. April 21st, 1920. (108,104.)
- 11,182. "Magneto-electric machines." British Thomson-Houston Co., Ltd., A. P. Young, and H. W. H. Warren. April 22nd, 1920. (108,106.)
- 11,242. "Electronic relays." Igran Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.), April 22nd, 1920. (108,107.)
- 11,580. "Electric welding apparatus." T. E. Murray, Jun. March 2nd, 1919. (142,904.)
- 13,538. "Thermionic devices." Western Electric Co., Ltd. November 1st, 1916. (Addition to 143,202.) (143,519.)
- 13,674. "Collectors or commutators for electric dynamos and the like, their manufacture, and means to be employed therein." H. Herrmann. February 27th, 1920. (108,048.)
- 13,692. "Apparatus for regulating the voltage of dynamo-electric machines." A. J. Jullin. April 30th, 1918. (140,547.)
- 13,797. "Automatic cut-out devices for electrically-heated appliances for heating or boiling liquids." E. W. Johnston. May 19th, 1920. (Cognate application 36,522, 1920.) (108,128.)
- 13,839. "Contrivances for applying the metal filament to the earler in electric incandescent lamps." Sprengstoffwerke, Dr. R. Nahnsen & Co., Akt.-Ges. August 11th, 1919. (149,652.)
- 13,861. "Means for securing globes, shades and the like to incandescent gas burners, electric glow lamp holders, and the like." A. C. Jones and S. P. Stubbs. May 20th, 1920. (108,129.)
- 13,895. "Automatic telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. May 20th, 1920. (108,134.)
- 14,172. "Dynamometers." Heenan & Froude, Ltd., and G. H. Walker. May 25th, 1920. (108,145.)
- 14,354. "Means for regulating the speed of electrically-driven rolls such as are employed on paper making machines." A. L. Boyle. May 26th, 1920. (108,152.)
- 15,762. "Systems of electrical distribution." A. E. White (U.S. Light and Heat Corporation). June 10th, 1920. (108,181.)
- 16,745. "Lifting magnets." Igran Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). June 21st, 1920. (108,193.)
- 17,658. "Thermionic tube electromagnet wave amplifying arrangements." Ges. fur Drahtlose Telegraphie. November 16th, 1915. (145,630.)
- 18,643. "Radio transmission system." Western Electric Co., Ltd. October 2nd, 1916. (146,319.)
- 18,798. "Telephone sub-station circuits." Western Electric Co., Ltd. September 9th, 1916. (146,890.)
- 18,844. "Spark plugs." Champion Ignition Co. September 25th, 1918. (146,909.)
- 18,911. "Telephone sub-station circuits." Western Electric Co., Ltd. August 27th, 1917. (Addition to 146,890.) (146,909.)
- 19,810. "Moulds for insulating armature conductors." V. G. Apple. May 17th, 1918. (147,782.)
- 19,819. "Manufacture of armatures for dynamo-electric machines." V. G. Apple. May 20th, 1919. (147,791.)
- 20,655. "Multiple electric fuses." M. Reichel. December 23rd, 1914. (148,817.)
- 23,541. "Electric resistance devices." British Thomson-Houston Co., Ltd. (General Electric Co.). August 11th, 1920. (108,238.)
- 24,683. "Electrically-actuated guns and like sound-producing apparatus." E. Magerle. February 24th, 1919. (150,350.)
- 25,172. "System of winding multi-layer electric coils for use as inductances for wireless radio-telephony, radio telephony, and the like." W. W. Burnham. September 1st, 1920. (108,249.)
- 26,035. "Electric controllers and operating mechanism therefor." Electric Control, Ltd., and J. J. Fisher. September 10th, 1920. (108,253.)
- 26,081. "Electric water-heater." W. Colebrook. October 7th, 1919. (150,012.)
- 26,875. "Electric light fittings." E. Stroud. October 12th, 1920. (Cognate application 30,805, 1920.) (108,263.)
- 27,284. "Battery ignition and timing devices for internal combustion engines." Bosch Akt.-Ges. R. November 13th, 1919. (153,865.)
- 31,804. "Process of manufacturing electrical resistance material." Akt.-Ges. Kummeler & Matter. November 10th, 1919. (153,602.)

1921.

- 3,490. "Method of cleaning sparking plugs." J. Chabrolle. January 29th, 1920. (153,575.)

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SEPTEMBER 30, 1921.

No. 2,286.

ELECTRICAL REVIEW.

THE THIRD PARTY.

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THE stress and turmoil of the Great War gave rise to many changes in our social system, some of which have already matured, others are still developing, and others, again, are doubtless in the embryonic stage, and will come to the birth in later years. Not least of these innovations was the new spirit engendered in the relations between employer and employed, which led the latter to claim the right to share in the control of the industry by which he gained his livelihood, and to assert that he also was a man and not merely the tool of an acuter brain. The recognition of these claims was embodied in the Whitley reports, which outlined a rational scheme enabling the representatives of both parties to meet in council and discuss all matters pertaining to their common interests. That system is still in course of evolution, but already it has been so successful, at least in the electrical industries, as to demonstrate its immense potentialities for good.

But in all the discussions which took place on this and kindred questions, under the aegis of the Government, there were but two parties—the organised employers, and the organised employees—and the Government declined to deal with any section of the community that possessed no organisation. Thus it came about that of the three essential constituents of industry—capital, brains, and labour—only two were represented in the Whitley scheme, for the brain workers were unorganised and therefore inarticulate. Hasty endeavours were made to make good the deficiency and to secure representation on the Whitley Councils, but without a particle of success, for the manual workers would not agree to the inclusion of the brain workers as a third party, and the latter would not accept alliance with either side. In the case of the Electrical Power Engineers' Association, the outcome was not unhappy, for a separate board was formed on which its representatives met those of the employers; but the objects—and latterly the methods—of that Association tended towards assimilation to those of the manual workers, with the inevitable result that an understanding developed between them, and is now crystallising into a definite agreement. We are merely recording facts, and not discussing the merits of this case. Examples are at hand of other associations, with more or less similar objects, which have definitely thrown in their lot on the one hand with the manual workers, and on the other with the employers; and we know of at least one sectional association which firmly holds aloof from alliance with either of the other two parties.

In the meantime an entirely different movement has been on foot, embracing all grades of executive engineers in all branches of the profession, and seeking to unite them in one powerful association, under the style of the Society of Technical Engineers. Although the initial steps were taken in 1917, and the first formal meeting of the Society was convened in February, 1918, its constitution and objects have been more or less veiled from public scrutiny up to the present, and its secretive policy has been the target of many critical comments in the technical Press, including our own pages, emanating both from within and from without the ranks of its membership. Nevertheless, the Executive Council has held on its chosen course, deliberately settling the constitution and rules of the Society, defining its objects, and finally formulating its policy. It has now concluded these preliminary labours, and in the second issue of the *Journal* which it recently inaugurated, the

policy of the Society is at last set forth in full. The exact terms of the policy are given elsewhere in this issue; we understand that it has been submitted to all the branches of the Society, and has been endorsed by them "without a dissentient note which would necessitate a reconsideration of essential principles."

This long-considered policy differs from that of any of the sectional associations with which we have previously been acquainted, in that it contemplates improvement of individual circumstances by advancement of the engineering industries and not by operations directed against employers; yet the interests of individuals are not to be neglected. A careful study of the summarised policy clearly indicates that the Society intends to be a third party, neither allied with nor opposed to employers or workpeople, but yet in friendly association with both. So far the interests of individuals and of the profession are concerned, *vis-à-vis* the employers, the Society will "attempt to establish communications" with employers as individuals and with employers' organisations, but in pursuing its aims "consideration will be given to the effect of any such action on the firm to which the members concerned belong," and to the interests of the industry in general. Put into plain English, we take this to imply that any such action as striking for higher salaries, &c., is wholly outside the society's programme; friendly discussion with the employers, on questions not only relating to conditions of service but also to technical matters, will be the mode of working, and for this purpose the Society hopes to bring about the establishment of joint councils of employers and technical staff. Some few such councils are already in existence, independently of the Society.

On the other hand, the Society will not ally itself with the manual workers in the pursuit of improved conditions of service, but it will seek to co-operate with them in efforts to promote the advancement of the engineering industries.

It is not easy at first sight to grasp precisely the purport of this declaration of policy, but on reflection and study it will be found that there is much more in it than might appear. The Society is, in fact, striking out on entirely new lines, and aiming at higher ideals than any of its contemporaries. Employers who have watched with some suspicion the development of the new body will certainly be relieved to find that it will not pursue an aggressive policy; where the conditions of service are unjust or oppressive, or otherwise fail to conform with reasonable standards, no doubt their attention will be drawn to the matter, and proposals will be made for their amelioration. That there is ample scope for improvement is undeniable, for the brain worker often receives less consideration than the manual workers under his control, though without his skilled co-operation and trained judgment neither employers nor manual workers could accomplish anything; we hope that steady progress towards adequate appreciation of the technical staff's services will result from the efforts of the Society.

The manual workers, on the other hand, will be interested to learn what steps the Society will propose with a view to promoting the advancement of industry with their co-operation. We have no doubt that the influence of the Society will be directed towards the adoption of saner methods than those which have hitherto been favoured by the workers, and which have so disastrously crippled industry in the recent past. At the Trade Union Congress the bankruptcy of the strike policy was demonstrated as plainly as that of the trade unions which had so recklessly pursued it. Many trade union leaders are well aware of the fatuity of that policy and of the direction in which safety and recuperation can be found, but they dare not or cannot lead along that path. If it be the purpose of the Technical Engineers to educate their comrades and to show them how high wages, comfortable living conditions, and guaranteed employment can be attained for all ranks in the industry, good luck to them!

The only excuse for so prolonged a period of gestation as has been undergone by the Society is that the infant

shall possess a sound constitution and an intellect of the highest order; granted those endowments, the labour has been well worth while. We believe that these conditions are fulfilled, and we welcome the declaration of the Society as evidence of its high aims and public spirit. The door is now open for the many thousands of eligible candidates for membership who are guiding and controlling our engineering industries to demonstrate their faith in the future of those industries, and to share in the task of reconstruction and reform, by joining the Society.

A GERMAN PRICE CONTEST IN INSULATED CONDUCTORS.

At the present time a trade price contest of national dimensions is proceeding in Germany in the department of the manufacture of cables and insulated conductors, excluding those for telephony and telegraphy, in connection with which the old and familiar method of big firms trying to freeze out the smaller has again been brought into practical operation.

The production of insulated conductors in Germany is controlled by two groups. The first comprises 24 works, including the A.E.G., the Siemens-Schuckert Co., Felten & Guilleaume, the Duisburg Cable Works, &c., which are combined in the form of a syndicate under the title of the Sales Bureau of the United Manufacturers of Insulated Conductors of Berlin. The syndicate maintains an office in that city which regulates all sale transactions of the members. In the second group, which consists of 14 works of average size, the lead is taken by the West German Wire and Cable Works Co., of Duisburg.

During the first half of 1920 the situation of the market in Germany was such that about 40 per cent. of the inland requirements was being covered by the outsiders forming the second group. About the middle of the year business experienced a considerable falling off, and sale prices naturally declined; supplies exceeded the demand, and the competition of the outside works was felt keenly by the syndicate. With the object of securing stability in the market, the outside works are said to have entered into negotiations with the syndicate so as to endeavour to conclude a mutual price convention. This was refused by the syndicate, which, however, suggested that the firms in the second group should agree to be incorporated in the syndicate. But after the annual turnover of the independent works had been communicated to the syndicate, which had not expected such large figures, the negotiations were broken off, as the syndicate was not prepared to concede a share in the business of the extent represented by the turnover of the outside works. The rejection of the proposed understanding was followed by the issue by the syndicate of lists quoting prices, it is reported, below the costs of production, in order in this way to start a trade contest with the ring-free makers. As most of the latter were either unwilling or unable to sell at the syndicate prices, they proceeded to make decisive restrictions in working, and the syndicate had to meet practically the whole of the inland demand. At the same time, a brisk export demand set in, as German prices were far below those of the world's market quotations. Speculators also appeared on the scene and took large quantities out of the market, and the final result was that the syndicate works became unable to cope with the growing demand, particularly as some of the syndicate members, in their turn, began to restrict production on account of the large losses which were being incurred on manufacturing.

During the past few weeks the peculiar situation has arisen that owing to the existence of large orders on the books of the syndicate, the members are far from being

able to meet requirements, and are scarcely able to accept new business. As a consequence many customers find difficulty in obtaining deliveries, and they are now reverting to the outside makers who, under the prevailing circumstances, are able to realise sale prices which are declared to be about 33½ per cent. higher than the syndicate quotations, which were reduced on July 1st to from 25 to 40 per cent. under the costs of production. The situation has consequently turned to the advantage of the outside works, as the "cutting prices" of the syndicate are no longer of any practical importance under the influence of the existing demands. It remains to be seen whether the syndicate will now maintain its prices. The further depreciation of the mark has increased the cost of those raw materials which have to be imported, and the proceeds from the export trade have diminished, while the prospect is at hand that merchants and speculators may now be able to throw on the market insulated conductors cheaper than the actual cost of the raw materials to the works. It is suggested that the best solution of present difficulties would lie in the conclusion of an understanding between the two groups, seeing that market conditions have frustrated the original object of the syndicate in initiating a price war.

Electrifying England.

In the *Daily Chronicle* last week Mr. S. L. Bensusan, with a true novelist-cum-journalist ability, set out to tickle the public fancy on what is now happening in the way of "electrifying England" (as the head-line has it).

We quite agree that "the time should not be far distant when railway, factory, house, and farm will receive their power from some great electricity station," and when fogs shall be unknown, and so on. He goes on to tell how England has been mapped out into electricity districts, and we are quite at one with him in his evident desire that all this should be accomplished as quickly as possible. Mr. Bensusan himself evidently thinks it will. But with a quite touching naïveté he introduces into his penultimate paragraph just the point which has delayed and which (if allowed) will delay the Utopian prospect depicted in his article. The paragraph reads:—"It does not require much imagination to realise that all these undertakings represent private interests, and that many of these interests will resist national development on personal grounds. Here the public common sense may be expected to intervene." And if it *does* intervene, the old interminable wrangle between the principles of municipal and private enterprise which has thwarted nearly every great project in the industry up to now will take on a new lease of life. If there is one thing more than another which should now drop out it is this very question of politics. On the one hand the whole industrial world is waiting for a cheap and abundant supply of electricity, and on the other, we are swamped with reorganising projects on paper. The only discriminating rule to apply to such schemes at such a juncture is that whoever is willing to start improving supply *at once*, whether company or municipal, should be told by the Electricity Commissioners to go ahead—a simple rule, but one which would certainly cut this Gordian knot of interwoven politics.

South Africa as a Market.

RATHER more than twelve months ago H.M. Senior Trade Commissioner in South Africa (Mr. W. G. Wickham) pointed out in a report which was reviewed in these columns that the Union constituted a very large potential market for materials for railways, harbours, building, and industry, as well as public services such as electric light, power and traction, telephones, &c. His statement was based partly on his knowledge of arrears of work that had accumulated during the war, and partly on an intelligent anticipation of pending develop-

ments. A year has passed, and Mr. Wickham's expectations cannot be said to have been realised. Our comment is not intended as a criticism of the accuracy of the Trade Commissioner's deductions. The combination of circumstances which arose later was strong enough to hamper progress in many countries besides South Africa. Our desire is to emphasise the importance of cultivating this market now that the time is gradually growing nearer when the development of many industrial plans may come to fruition. For a long period subsequent to the Armistice schemes were held up owing to the impossibility of obtaining from British manufacturers either firm prices or definite promises of delivery. Mr. Wickham says that in the larger industrial centres large-scale production of power directly connected with railway electrification on the lines recommended in the report of Messrs. Merz and McLellan may do much to cheapen manufacture. Continually increasing demands for smaller electrical plant and apparatus should result. The problems of marketing are discussed in a very outspoken chapter in which Mr. Wickham pleads for more method in overseas distribution. He defends the merchant against the manufacturers who rashly decide to dispense with his services before they have properly studied his manner of working. Coincidentally with the appearance of H.M. Trade Commissioner's report, one by the United States Government representative in Johannesburg has reached us, which deals with this same problem of marketing, and arrives at the same conclusions as Mr. Wickham, though for somewhat different reasons. We give in another column a summary of the statements contained in each report.

The Electrical Trades Benevolent Institution.

THE annual Festival Dinner of the Electrical Trades Benevolent Institution will be held at the Trocadero Restaurant on October 26th, and Sir Tom Callender will preside. This year the Committee has decided to adopt an innovation—so far as the Festival is concerned—in that ladies will be present at the dinner.

It is the function of this Institution to play the part of the Good Samaritan to those members of the electrical industry who are neither able themselves to provide for a rainy day nor in a position to join a trade union or benefit society. Unlike other branches of industry, the electrical industry has enjoyed comparative prosperity for many years; yet the provision which it has made, through the medium of the Benevolent Institution, for the relief of those of its members who fall on evil days is ridiculously inadequate to meet present and prospective needs, and is indeed so niggardly as to be utterly unworthy of a great and important department of engineering and commerce. We earnestly hope, therefore, that there will be a large gathering at the Festival to support Sir Tom Callender, and that the list of contributions to be announced on that occasion will break all previous records.

This, we venture to suggest, is a personal matter touching the honour and humanity of every one of our readers. Each can help—if not by gifts of money, then by getting new members to join the Association. So long as we leave the matter for the other fellow to attend to, progress cannot be hoped for. "The objects of the Institution are to grant pensions and to dispense temporary relief to deserving and necessitous persons who are or have been engaged in the electrical trade in the United Kingdom as employers, managers, teachers, or on the engineering, designing, drawing, sales, or office staff, or in other similar capacities, or to their dependents." The qualification of a member is a subscription of 10s. per annum, or the collection of the subscriptions of five members or of £5 in honorary contributions. Surely these conditions are easily met! And in meeting them one not only helps one's comrades, but provides for one's own future needs in the event of a reverse of fortune.

ELECTRICITY IN MINES.

By M. I. WILLIAMS-ELLIS.

(Concluded from page 397.)

ELECTRIC HAULAGE.

There are comparatively few collieries and mines in which electric haulage gears are not operating. It is no uncommon thing to see main-and-tail and main rope haulage gears aggregating over 1,000 h.p. in one colliery, and in addition, one finds underground a large number of small haulages for dealing with cross-roads and gateways. Portable haulages, too, are now slowly increasing in numbers, and these form very handy auxiliaries.

In the case of horse haulage, the cost of working a mine is considerably increased by the fact that roads have to be kept at a height of at least five feet to allow the necessary head room, but this extra cost can now be eliminated by the adoption of electric haulage and locomotives. The principal cases to be dealt with are the following:—

1. Where a single road is to be worked, and where there is a sufficient gradient, exceeding, say, 3 in. per yard, which will allow the tubs to run back to the loading point by gravity.

2. Where there is only a single set of rails available, and the gradient is too slight to allow the tubs to return under gravity.

3. Where two tracks can be laid, i.e., for endless rope haulage.

4. Where the tracks are more or less level, but with a large number of bends and turns.

It may be of interest to give a case in connection with an incline haulage as altered from steam to electric haulage to-day, with power supply at 2d. per unit.

STEAM.					
Coal bill per annum.	Stoker.	Repairs.	Interest at 7%.	Depreciation 5%.	Total annual cost.
£840	£180	£30	£140	£100	£1,290
ELECTRIC.					
Energy bill.	Repairs.	Interest at 7%.	Depreciation 5%.		Total annual cost.
£273/12	£20	£280	£200		£773/12

On the above figures a saving of £516 8s. per annum is shown, with coal at £2 10s. per ton. It must be

economy shown above, there are other savings effected, namely, faster and more even manipulation of haulage, less wear and tear on ropes, &c. As regards winch work, greater use can be made of small electric winches

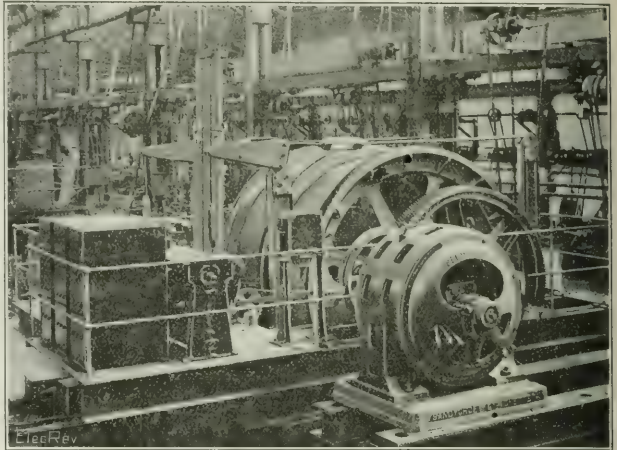


FIG. 9.—100-H.P., 3-PHASE SANDYCROFT INDUCTION MOTOR, SLIP-RING TYPE, 290 R.P.M., 2,200 VOLTS, 25 CYCLES, DRUM 9 FT. DIAM., DEPTH OF WIND 1,500 FT., ROPE SPEED 750 F.P.M.

in many cases, although for the sake of ventilation in some cases air winches only could be adopted; they can not only be used more largely for running tubs from the working face, but also for the actual loading of tubs. The endless rope system is widely used in colliery work, both for underground and for surface work; it is, of course, an essentially slow running system, the speed of hauling rope being usually about two miles per hour. In nearly all cases the old steam engine has now been abolished, it being a system most suitable for the electric drive; the only disadvantage in connection with endless rope work is the large ratio of reduction in gearing that is required.

Still for a uniformly loaded system with gradients this system is undoubtedly the best, and can be made to increase the output of a mine considerably,* but in cases where the track is level advantages are now to be found in the electric battery locomotive.

Small winders and hoists are shown in the accompanying figures.

Electric locomotives fall into two classes: (1) Self-contained battery locomotives; (2) trolley locomotives. Both systems have their advantages, but it is only during the last two or three years that the battery

locomotive has come into competition with the trolley locomotive; it has the advantage of being able to be used

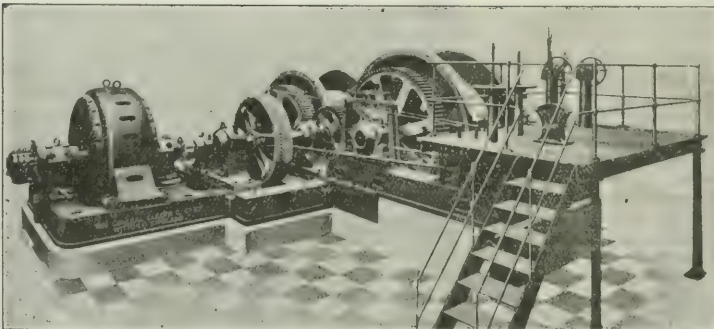


FIG. 8.—MAIN AND TAIL HAULAGE AT BRANCEPETH COLLIERY, DRIVEN BY A 400-H.P. "WITTON" INDUCTION MOTOR WORKING AT 3,000 VOLTS, 40 CYCLES, 400 R.P.M.

taken into account that the steam plant was at a pre-war and electric at a post-war price.* In addition to the

* A typical instance of economy which can be effected by electric haulage was shown not long ago on a road 500 yards long. When driven by steam haulage, the working cost was 1.77d. per ton, but when electric haulage was installed the cost fell to 0.39d. per ton on an output of 300 tons per day, a saving of 1.38d. per ton, aggregating £500 per annum.

*The motor required is only about one-third the size required for a main rope or main-and-tail work. It gives a steady load, which is a great asset to the power station, and uniform delivery of tubs at the mine bottom prevents congestion and reduces the cost of handling.

in situations where the trolley system could not be used, there being no danger of sparking on overhead lines or tracks, while the locomotive itself can work in the smallest of levels, and shunting, &c., underground can be carried out far more quickly. Pit ponies could be largely done away with, if the battery locomotive were more generally adopted; a 3-ton weight locomotive will

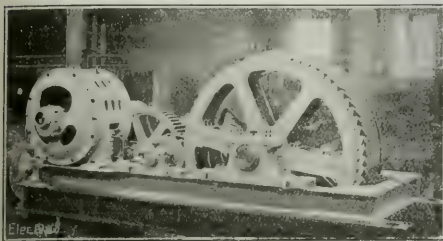


FIG. 10.—SANDYCROFT 60-H.P. ENDLESS ROPE HAULAGE GEAR.

do the work of from three to four horses. Of course it is necessary to have a fairly heavy track, and one better cared for than is usually found in our mines; this applies more especially in connection with locomotives weighing over 4 tons.

For long distances, where the roads are crooked and the gradients suitable, electric locomotives are more efficient than wire rope haulage. It must be borne in mind, however, that locomotives are not well adapted for gradients steeper than 1 in 50. Small battery locomotives are now built that will take 12-ft. radius curves, a photograph of one such being shown in fig. 11, built by the British Electric Vehicles, Ltd.; performance curves for this locomotive are given in figs. 12, 13 and 16. The most satisfactory arrangement, where two locomotives are not justified on the same floor or level, is to have a spare set of batteries, which are charged at the end of each day's work. Fig. 17 shows a simple arrange-

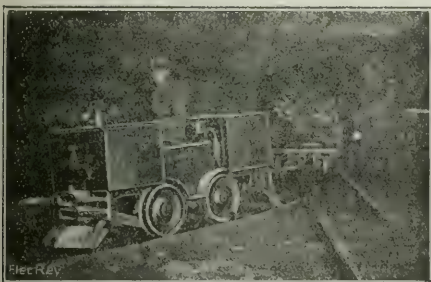


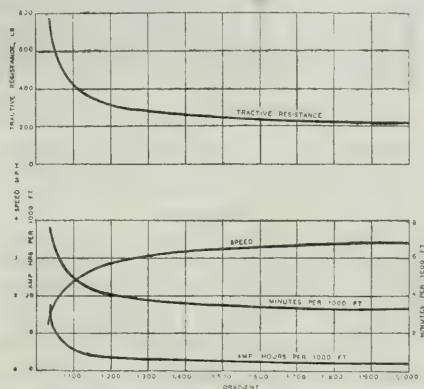
FIG. 11.—B.E.V. 10-TON BATTERY LOCOMOTIVE.

ment including charging plant, the locomotive coming in on the far side of the platform on which the batteries stand; the batteries are withdrawn on the sliding rails shown, and fresh ones are pushed in, the change being completed in five minutes by one man. With such an arrangement great care should be taken in working out the right size of battery for the day's work.

A well laid-out scheme for battery and trolley locomotive work may be seen at the Ebbw Vale Iron Mines at Irthlingborough. The locomotives have been supplied by the B.T.H. Co. and the B.E.V., Ltd., the battery ones by the latter and the trolley type by the former. The trolley locomotive system is operated at 260 volts d.c., each locomotive being equipped with two 38-h.p. motors, and weighing approximately 7 tons (fig. 14). In this mine the loaded tubs are brought up separately from the face by the small battery locomotives, and are then drawn from the marshalling point to the surface in trains of 25 by the trolley locomotives. The weight of a loaded truck

is 3 tons, so that the total load behind each locomotive is 75 tons. These locomotives are rated at a draw-bar pull of 2,800 lb. at 7 miles per hour, and of course the maximum draw-bar pull which can be exerted is only limited by the condition of the rails, the motors being powerful enough to slip the wheels in all conditions. The gauge is 3 ft., and the locomotives are fitted with series parallel controllers. The brake is a hand brake acting on all wheels, and a sanding device is also fitted.

The characteristic curves of the motors used in the above locomotives are given in fig. 15. The work done by gathering and hauling locomotives calls for a large amount of starting and stopping, and for this reason alone it may be claimed to be more advantageous to use the trolley system when head room is available. Where, however, the trips are short and the output low, although battery locomotives are primarily gathering locomotives, they may also be considered as suitable for haulage, under favourable conditions. The main objection to electric locomotives in a pit is the uncertainty of gradients and the fact that locomotives are not well adapted for gradients steeper than 1 in 50, also in some cases questions are raised as to the cost of the



FIGS. 12 & 13.—PERFORMANCE CURVES OF B.E.V. 10-TON LOCOMOTIVE; TRAILER LOAD (INCLUDING WEIGHT OF TRAILER) 10 TONS.

extra heavy roads, &c.; the great weight of the locomotive always entails a more expensive road with heavy rails, and sleepers, than that required for pit-pony traction, as the consequences of the train getting off the road might be serious. The writer does not advise the use of rails lighter than 25 lb. per yard even for small 3-ton weight locomotives. The electrical equipment is selected with due regard to the weight of the locomotive and battery capacity. In order to get economic working great care must be exercised in the selection of a suitable battery, which can be determined by comparison with similar operations, or calculated from data of loads, gradients, speed, length of run, &c.

It may be of interest to mention that a B.E.V. battery locomotive at Messrs. Greaves's slate mine, North Wales, gives a net saving over horse traction in running costs of over £400 per annum, all horses having now been done away with. There are certain prejudices against the use of mechanical transport in the mines, particularly coal mines, where there is risk of explosions being caused by sparking in the case of an electrical installation. One feels, however, that many prejudices will be overcome, as it is not difficult to render safe a self-contained electric locomotive, which is a very different thing to trying to prevent current picked up by a trolley system from sparking. It is now quite obvious that where mechanical power can be used in lieu of animal or man power, the saving is great, given suitable conditions, while the prime cost will not be so heavy as some imagine.

The question of providing springs for electric locomotives of large size is important, the most satisfactory

arrangement being semi-elliptical springs with an equaliser bar, such as is adopted by the G.E.C. of America.

From the writer's experience of small locomotives of, say, 2 and 3 tons weight, with short wheel base, springs

can be obtained, and when the machine is not working, no power is being consumed.

One of the secrets of success in coal cutting from an electrical standpoint, is to have the motor of ample size; owing to a too small margin of power having been allowed, in a good many cases, resulting in overheating and break-down, the electrical coal cutter has sometimes been condemned.

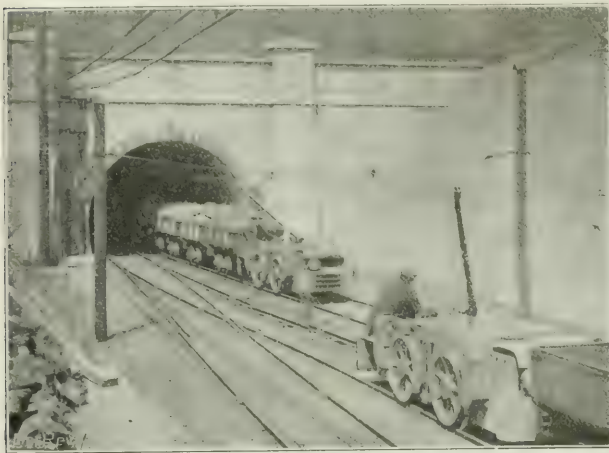


FIG. 14.—B.T.H. 7-TON ELECTRIC MINING LOCOMOTIVES.

are unnecessary even in the case of battery locomotives, but it must be remembered that a good class of battery such as the Chloride, D.P., or Edison, must be used.

COAL CUTTING.

The advantages of machine holing, as compared with hand holing, are well known to all, while the motive power of these machines is limited to electricity and compressed air. Electricity for a long time had a great disadvantage in the chances of sparking, when d.c. was more generally employed for mines than it is to-day.

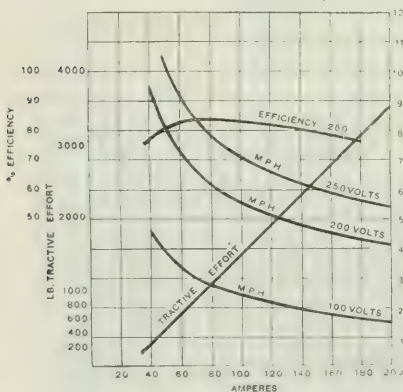


FIG. 15.—CHARACTERISTIC CURVES OF B.T.H. 7-TON MINING LOCOMOTIVE.

But with the advent of the induction motor of special design, such as the "Cascade" motor, these disadvantages have almost all been removed, and with such machines this is to-day the most economical method of getting coal, provided circumstances permit of it.

As in drilling so in coal cutting, the great loss with compressed air arises from leakage in the pipes, which proves very expensive. A great deal of time, also, is taken in laying the pipes and in coupling them to the machines. With electricity the cables are easily laid along the gates and coal face, a greater speed of cutting

In America the value of the coal cutter has been more fully recognised than here, as the cost of working is greatly reduced, and, owing to the greater output, the quantity of coal raised per man is much greater, and in many cases the wages earned are higher, than where holing by hand. The increased rapidity with which the face is advanced enables a large tonnage to be got from a shorter length of face, and so reduces the length of roads to be kept open. The rapidly increasing popularity of the electric drive has come about through the recognition of the principle that an increased output

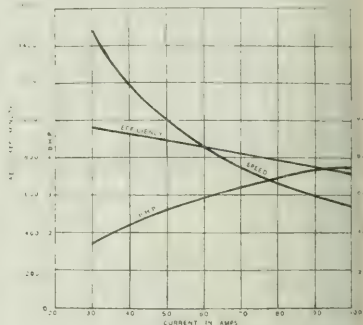


FIG. 16.—CHARACTERISTIC CURVES OF MOTORS OF B.E.V. 10-TON BATTERY LOCOMOTIVE.

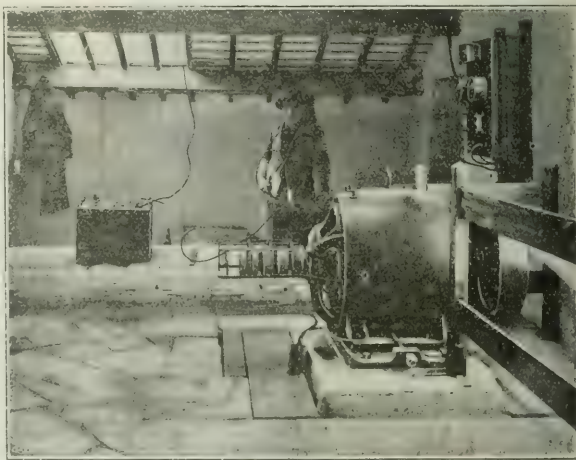


FIG. 17.—CHARGING STATION FOR B.E.V. BATTERY LOCOMOTIVE AT MESSRS. GRAVES & SON'S SLATE MINES, NORTH WALES.

of coal cutters can largely be obtained by the adoption of electrical operation, and the future holds very bright prospects for the application of electricity to the driving of coal-cutting machinery.

According to recent statistics, of all the coal-cutting machines in operation, 40 per cent. were electrical, and there were twice as many electrical as compressed air accessions to the ranks per annum; this proportion may, however, be a good deal higher to-day.

THE CONTRACTOR'S FUTURE.

By E. P. BENNETT.

A SERIOUS malady requires accurate diagnosis and drastic remedy. It is doubtful whether the writer of the article in your issue of September 16th on "The Contractor's Future" has done more than to focus attention on the malady again. This alone is desirable, as the position of a contractor, in relation to the sales side of his business, is a serious one, and leaving it to its own development will prove fatal to his very existence as a sales medium.

It is doubtful whether the early education or business training of the majority of contractors has fitted them to handle the sales side of their business adequately. Such training—from its commencement—is usually on the technical side, and it is not until this training has run its ordinary course that the individual, developing an idea of running an electrical contracting business, begins to secure some knowledge of the sales side.

It is an acknowledged fact that a very large number of the present-day contractors started their business career in comparatively humble circumstances, and as your writer indicates, their offices and shops are to be found in the back alleys of our cities and towns. The early development of the business was devoted exclusively to installation work, although a contractor may eventually have specialised in any of the following categories:—

1. Ordinary house installations.
2. Industrial and factory installations.
3. Marine wiring and equipment, &c.

Development of sales in these sections, with the possible exception of No. 1, has not led towards appliances and the lighter type of apparatus, but simply to the securing of orders for heavy plant and equipment. Therefore, it is fairly obvious that the successful development of the last two sections can be as easily—in fact, better—attained by a contractor locating himself in industrial centres and in such positions therein where rent, rates, and taxes are least burdensome.

Let us, however, endeavour to trace the steps of progress of the wiring contractor who has specialised largely in house installations.

There are quite a number of such concerns now established in the main thoroughfares of our cities, the principals of which have, for years, been putting their best efforts forward to develop the sale of electrical appliances. It is very questionable whether their deserving efforts have met with even partial success.

This is not due in any way, on their part, to insufficient finance, inability to handle sales, or disregard of the scope of the field of operation, or on the part of the manufacturers, disregard of their position as distributors of electrical appliances, but due to circumstances over which neither the contractor nor the manufacturer has direct control.

The field of operation in England! Your correspondent refers to the growing importance of the electrical sales shops of the United States, but the successful development of these shops is governed entirely by conditions which are scarcely in existence in this country, let alone predominant as they are in the States.

The home conditions and requirements are best known to the "home" manufacturers, and in perhaps not a lesser degree to the contractors and those retail houses which have with limited success endeavoured to foster the sale of electrical appliances, and have opened up special departments, thus showing that they also have realised that with proper external conditions business in these lines could be developed, and reasonable financial success assured. One has not to seek far for instances, as indicated by the way in which the bigger stores are pushing their electrical department to the forefront, which department, until quite recently, was located in some obscure corner or on the top floor.

It will, indeed, be of interest to watch the success or otherwise of the large foreign manufacturing concern

which, your correspondent states, has opened its first electric shop in London, which, we are further told, is the first of many to be inaugurated throughout the principal centres of this country.

If electrical appliances could be handled as regards management, bulk, and distribution in a similar way to the common commodities of every-day consumption, there is no reason to doubt that the establishing of a retail shop for electrical appliances would meet with a fair measure of success; but if the attempt be made by one concern and this concern a foreign one—it is very doubtful whether the experiment will warrant its continuance.

To sell electrical appliances necessitates a certain amount of technical knowledge; in this respect the establishment referred to could quite easily be adequately equipped with such salesmen. It is not, however, always the salesman who has "the last word" in the completion of the purchase of electrical apparatus. Often, and perhaps we may say it is the general rule, it is here that the influence of the contractor becomes apparent, the practice of many would-be purchasers of electrical appliances, before spending their money on such articles, being to seek the advice of those who undertook their original installation, or who are now responsible for its maintenance.

Seeing that this portion of his business is in jeopardy, it is quite natural to suppose that a contractor is not going to be too anxious to influence for good the turnover of a firm—be it home or foreign governed—which has established a retail electrical shop in his vicinity.

In earlier issues of the ELECTRICAL REVIEW articles have appeared in connection with the electrical appliance sales shops in Switzerland, Italy and Spain. There the conditions permit of the successful running of such a type of shop, and in many of the Continental cities similar shops are to be seen, which are supported almost entirely by the demand created from window displays and showroom demonstrations. Thus, there is no necessity to look so far afield as America to find an example which we can turn to good effect.

Given the right conditions in this country, the contractor would be able to make an equal success.

The co-ordinated efforts and finance of a combine of twenty or more contractors—establishing one or two retail shops—are not going to serve as a remedy, for one can quite easily foresee the chaotic conditions which would ultimately result from such a combine; for despite pooled finances and central control, with local co-operation between the contractors, as suggested by the writer, one cannot conceive of harmonious working amongst so many combined business heads.

Rather let those who are interested in the successful development of the electrical appliance trade generally, and the safeguarding of the legitimate interests of the contractors in particular, turn their efforts towards the really effective remedy of:—

Influencing supply authorities to offer the service of free or cheaper mains and power circuit connections, and to supply electricity at cheap rates.

Influencing standardisation of voltages throughout the country.

Influencing regulations relative to power mains wired in all new houses.

Influencing protection for the home manufacturers from foreign imports of appliances.

Influencing effective co-operation between manufacturers and the wholesale distributors for the rapid dissemination of technical and sales information to contractors throughout the country.

Influencing protection for the contractor-retailer against illicit quoting of trade terms.

With these conditions secured, and ample allowance made for the possible maximum demands of all appliances in this country as governed by the population factor, national prejudice overcome, and the influence of the gas interests effectually counteracted—the successful development in the hands of the contractor of sales of electrical apparatus, arising from the demand thus created, could quite reasonably be anticipated.

THE SHIPPING, ENGINEERING, AND MACHINERY EXHIBITION.

(Continued from page 422.)

ONE of the most noticeable features of this year's exhibition, which, closed on Wednesday last, was the increased number of firms that showed welding apparatus, and we were particularly interested in the demonstrations of MESSRS. BUCKLEY, SACHS & CO., LTD., which firm supplies a large variety of plant to cover practically the whole field in which electric welding is a commercial proposition. Perhaps the most

tion in certain directions, but makes it possible to do a given amount of work in less time than it could be effected in by the usual methods.

The apparatus is portable, and comprises two main parts, one of which is the welding tool, fig. 11, that weighs approximately 18 lb., and consists of a solenoid, the plunger of which carries at its outer end a chuck like holder to take the stud

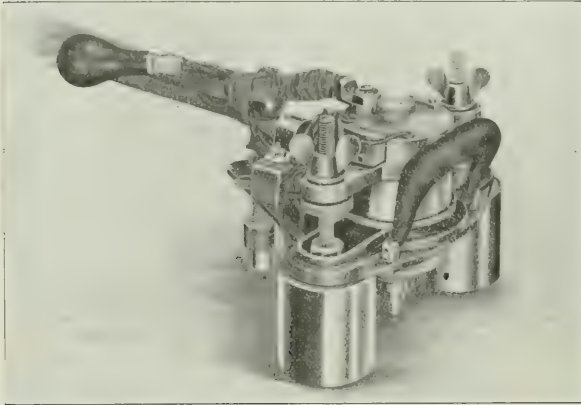


FIG. 11. THE CYC-ARC WELDING TOOL.

interesting exhibit was the Handstock Cyc-Arc welder, so called on account of the regular cycle of operations by which the weld is carried out. The system is the most recent development in electric welding, and has now been put on the market after having been in use in the Admiralty dockyards for some time. The apparatus possesses interesting features; first, it is accurately termed an automatic machine, for all the operator has to do so as to effect a weld is to press a switch button, though the welding tool has to be set, of course, for each weld. Secondly, it successfully welds together metals of (a) ferrous and non-ferrous, (b) non-ferrous and non-ferrous natures, and (c) it will deal equally well with ferrous metals alone. By this process metal studs, rods, tubes, and the like can be automatically and directly welded by semi-skilled labour on

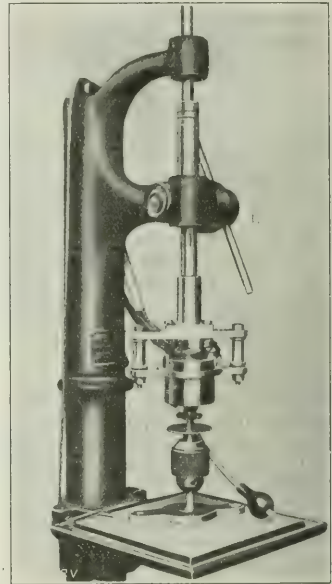


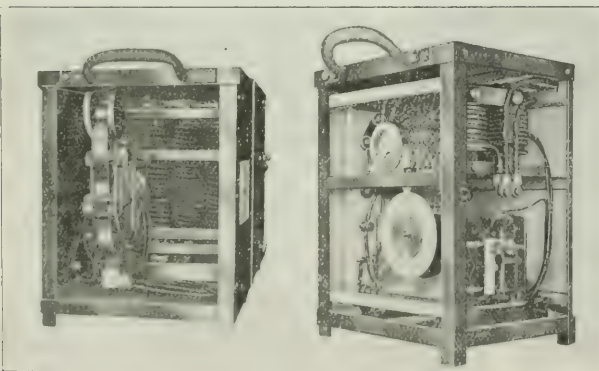
FIG. 14. A BENCH TOOL FITTED TO A STANDARD DRILL.

or other fitting to be welded. The solenoid is attached to a pair of magnets from which it is, however, insulated; the magnets serve to hold the welding tool in position when working on steel or iron surfaces, and a small switch is provided for making and breaking the magnetising circuit. The solenoid with the stud holder is adjustable relative to the retaining magnets in order to provide for the welding of different lengths of stud, &c., and a simple arc-striking and limiting device is located at the end of the solenoid, remote from the stud holder, by means of which a uniform and correct length of arc is ensured. Each welding operation is effected by a single depression of the bell push seen in the illustration.

The other portion of the outfit is the enclosed container that is divided into three compartments which contain the following items of apparatus: Compartment A, automatic timing and control devices, marble connecting and regulating panel, adjustable resistance, non-inductive resistance, and a carbon-filament lamp resistance. Compartment B, resistance coils for current regulation. Compartment C, automatically-operated contactor. Fig. 12 shows the latter with the resistance coils, while fig. 13 is a view of the timing disk, voltmeter, and resistance. The precision of the automatic timing and control of the arc during the welding operation is the most important feature of the plant, and it is guaranteed not only to time accurately and repeatedly arc welds varying from 0.1 to 2.5 seconds

in duration, but also to be capable of making about 400 welds without the clockwork mechanism having to be rewound.

The latter comprises a double spring motor which, by means of a suitable train of wheels and under the control of a reliable speed regulating governor, rotates a spindle fitted with a number of cams that, during one complete revolution of the spindle, make contact with insulated fingers to carry out the sequence of operations necessary to make each weld. The

FIG. 12.
CYC-ARC WELDING RESISTANCE COILSFIG. 13.
TIMING GEAR AND RESISTANCE

to metal sheets, plates, bars, tubes, forgings, &c., with extreme rapidity and without preparation or the use of fluxes. It is claimed to be the only known method whereby brass and similar alloys can be directly welded to iron, steel, or steel alloys, and also by which it is practicable to directly weld metal tubes on to thin metal sheets or plates. Moreover, by avoiding perforation this system of stud welding prevents weakening of the structure, and not only cheapens construc-

adjustment of the time period of the arc is made by the rotation (with a key) of a spindle to which is attached the illuminated dial marked in seconds and fractions thereof, as shown in fig. 13.

The operations necessary for making a weld (after the controller and the surface on which the weld is being made have been connected to the supply mains) are as follows: The stud or other fitting to be welded is first placed in the holder of the welding tool, and the latter is secured in the desired position by means of the hold-on magnets. The arc-limiting device is then set, after which a single action of the bell push starts the timing and control apparatus, thereby making the weld; the weld having been made the tool is removed by de-energising the hold-on magnets and withdrawing the tool from the stud, which remains welded in position. Once the apparatus has been set for a particular size of stud it can be manipulated continuously by unskilled labour.

The Cyc-Arc machine is designed to operate on a 60/100-volt d.c. supply, the normal range of current being from 200 to 500 amperes, according to the size of the article to be welded. The actual energy consumed per weld, however, is very small, as the usual duration of the welding current is only about one

duction motors. On the same stand B.K.B. feather-weight motors of from 1/100 to 2 h.p., fitted totally enclosed machines, and "Magnum" welding specialties were also shown.

Messrs. J. W. Ray & Co.'s stand represented the bridge of a liner, and was equipped with automatic reply telegraphs, electric direction indicators, steering gear control apparatus, and a representation of the engine room illustrated the use of electrical engine signal gear, tachometers, counters, &c., all of which were in actual operation.

Messrs. VARIABLE SPEED GEARS, LTD., showed working models of Williams-Janney variable-speed gears and variable-delivery pumps. The electro-hydraulic ram type of steering gear is smooth working and protected against any tendency it might have to hunt, while overloading of the driving motor of the firm's winches is prevented by means of a small ram that is operated by the fluid pressure and mechanically connected to the stroke mechanism of the pump end. The fluid pressure of the gear is proportional to the shaft torque; thus if a heavy lift is attempted, the pressure operates the control ram and the lift is effected at the correct proportionate speed. It is even claimed that should the lifting hook catch on an obstruction, the auto control would bring the gear to rest without blowing the fuse, actuating the cut-out, or damaging the motor.

A good selection of electrically-heated furnaces was to be seen on the stand of MESSRS. AUTOMATIC AND ELECTRIC FURNACES, LTD., who exhibited several types of Wild-Barfield furnaces, all of which were fitted with excess temperature cut-outs that automatically interrupt the heating current at a pre-determined temperature, to exceed which would be dangerous to the life of the heating winding. Pyroscopic detectors can also be incorporated so as to announce the moment at which the specimen being treated in the furnace has reached its critical temperature.

Messrs. SCHOLEY & Co., LTD., had their well-known products represented by fractional horsepower motors (1/50 up to 1/4 h.p.), "Kutmore" portable electric drills, "Croydon" suction cleaners and blowers for both domestic and industrial uses, and also "Copes" boiler feed-water regulator.

Electrically-driven battery trucks for industrial uses were displayed on three stands. MESSRS. H. C. SLINGSBY make some 1,900 varieties of trucks, and amongst the 60 selected vehicles that were shown were several "electrics," as well as elevators, while BRITISH ELECTRIC VEHICLES, LTD., exhibited 1/2 and 2-ton trucks, besides a battery rail locomotive which has been employed for many purposes, including haulage in mines. MESSRS. W. GOODYEAR & SONS, LTD., showed two 2-ton "Greenbat" trucks, one of which was a low-platform model.

Messrs. R. M. RADIO, LTD., showed 1 1/2, 1, and 1/2-kW complete ship's wireless equipments, including the "Thermagion" receiver, direction-finding devices, and various receiving apparatus suitable for use on yachts and amateur work.

The ELECTRO-MECHANICAL BRAKE CO., LTD., had a representative display of its manufactures, and claims that the "E.M.B." jointless grid-type resistance is unbreakable and rustless. A feature is that the elements are made in one length, and there is, therefore, no risk of open circuit, it is said. The advantage of the firm's steel case controllers is the combination of strength with lightness and the arrangement by which the drum can be withdrawn and replaced is exactly in alignment. The company's products are used largely in steel works in this country and by many tramway undertakings, including the L.C.C. and Manchester, Birmingham, Glasgow Corporations, &c. Their particular advantage for export is that they will stand very severe handling without being damaged.

Tramway and light railway material, such as track, rails, gear cases, &c., were shown by WILLIAM LITTLE & SONS, LTD., while such articles as current collectors, trolley standards and the Municipal Tramway Association's standard overhead fittings were to be seen on the stand of MESSRS. BRECKNELL, MUNRO & ROGERS, LTD.

The a.c. motors manufactured by MESSRS. E. BROOK, LTD., were represented by machines ranging from 1/4 to 100 h.p. in size, and one size was shown in five different types—namely, protected, enclosed, pipe ventilated, drip proof, and slip ring.

The exhibits of MESSRS. BOW, McLACHLAN & Co., LTD., included "Guided Segment" steam and electric steering gear; the latter was shown controlled by a switch that was actuated by means of shafting, but any of the usual means may, of course, be employed for the purpose.

The INSTRUMENTAKTIEBOLAGET, NAVIGATOR, of Stockholm, showed an automatic onboard log which measures and registers the speed of the vessel as well as the sailed distance. The pilot tube which projects from the bottom of the ship contains no moving parts, and the electric accumulators that actuate the device do not need to have their pressure regulated.

The LEEDS ELECTRICAL CONSTRUCTION CO., LTD., had a large stand on which many types of electric furnaces for the heat treatment of steels and the melting of non-ferrous metals were displayed, including the "Lecfur" rotary rivet heater and samples of refractory materials and alloys.

Messrs. HANCOCK & Co (ENGINEERS), LTD., also showed a small tool-room size of electrically-heated furnace, the feature of which was its capability of reaching a temperature of 2,500 deg. C.

Messrs. JAMES SCOTT, LTD., showed a selection of ships' electrical fittings, such as plugs, switches, bell and fire alarms, &c.



FIG. 15.—A PARSONS SHIP'S AUXILIARY SET.

second. The entire equipment weighs approximately 2 cwt., and can be easily transported by two men; the tool itself is readily handled by one operator, and is adapted to fit uneven and curved as well as flat surfaces.

A motor generator is provided where difficulty is experienced in obtaining the necessary d.c. supply at a suitable voltage. The set is quite small compared with the momentary demand it meets during the welding operation, and by its use the average load per welder is less than 1 kW, and the momentary peak load during welding does not exceed 5 kW, i.e., 11.5 amps. at 400 volts d.c. This result is obtained by fitting a heavy flywheel to the motor generator which stores enough energy to provide the necessary current for one weld even after the power supply to the driving motor has been interrupted.

Modifications of the Cyc-Arc apparatus were shown, including a bench type machine for rapid repetition work, which can be attached to any standard drilling machine, fig. 14, or bench standard. There was also exhibited a heavy machine with compressed air return action, designed particularly for work where a heavier pressure is required at the weld.

PARSONS MOTOR CO. had on view three sets incorporating its well-known internal-combustion engines, which are suitable for driving dynamos to give outputs of from 4 to about 50 kW, and which have been particularly successful for emergency lighting purposes on board ship. So far as the ship's auxiliary set is concerned, it will be seen from fig. 15 that it comprises a 14-h.p., 2-cylinder, vertical enclosed paraffin engine, direct coupled to a Crompton 7.5-kW dynamo, generating d.c. at 100/160 volts, and also driving a Reavell 2-stage air compressor by gearing. The whole set is mounted on a special steel bed, and has proved very useful where large Diesel engines are employed, either ashore or afloat, but especially on board ship. The compressor is used for charging the starting bottles for the Diesel engine, while the dynamo supplies energy for battery charging or direct ship lighting, &c. The compressor is of the Duplex water-cooled type that runs at 400 r.p.m., and has a piston displacement of 25 cu. ft. per minute. It will be noted that the compressor is driven by means of gears through the dynamo, and a neat arrangement for putting it in and out of gear takes the form of sliding the motor pinion out of engagement. It is claimed that the engine can be stopped, the sliding pinion moved in or out, and the plant started up again within two minutes. It should be mentioned that the firm has experimented largely with engines consuming alcohol or mixtures thereof, and has now placed on the market a specially designed machine to consume fuel of such a nature.

Messrs. BERKELEY & YOUNG, LTD., exhibited fans of various types and "Bandy" single-phase repulsion and repulsion in-

On Messrs. DIENY & LUCAS's stand were to be seen electric drilling and grinding machines, made by Messrs. Coudinhal; fractional horse-power motors, including "Universal" machines, manufactured by Messrs. Lilliput; "Champion" fans of several sizes; and Messrs. Becat's electrically-operated lifting tackle.

On the gallery the NORTHERN STEEL & HARDWARE CO., LTD., demonstrated the labour-saving properties of two useful household appliances—the "Northern" vacuum cleaner and the "Laundry Queen" washing machine, both of which were electric.

The exhibit of MESSRS. EDISON ACCUMULATORS, LTD., consisted of a number of batteries ranging in capacity from 1.5 to 450 ampere-hours, and varying in application from wireless wave circuits to the propulsion electric vehicles.

The name of the MULTI-WAY EARTHING CLIP CO. indicates the nature of its products, while those of the IONIC ELECTRIC CO., LTD., are too well known to need detailed description. Amongst those shown the bi-polar drum armature winding machine may be mentioned, which enables armatures to be wound by such semi-skilled workers as apprentices and girls. An 800-amp. auto-reclose circuit breaker for the protection of d.c. feeder circuits not only opens on the occurrence of a short circuit or the failure of the voltage, but also re-closes automatically after (but not until) the conditions of the protected circuit have been restored to normal. A complete water-tight Dean valve controller, for the remote electric control of steam, water, or other valves, was also shown, in addition to numerous other ingenious devices.

The CONSOLIDATED PNEUMATIC TOOL CO., LTD., had a small stand on which were displayed samples of electric lifting blocks, drills, and grinders, in addition to pneumatic tools of a similar nature.

The LONDON ELECTRIC WIRE CO. & SMITHS, LTD., had a show case containing a selection of their manufactures, and the CONCORDIA ELECTRIC WIRE CO., LTD., products were also represented by numerous samples.

All kinds of measuring, indicating, and recording instruments were exhibited on the stand of JAMES PITKIN & CO., LTD., and it is needless to record that the representative collection of instruments shown by the CAMBRIDGE & PAUL INSTRUMENT CO., LTD., well repaid the time spent in inspecting them.

A fine selection of electric winches, windlasses, cranes, capstans, and haulage gear composed the exhibit of MESSRS. CLARKE, CHAPMAN & CO., LTD. The Scott-Bentley load discriminator fitted to the control gear of similar machines that were shown by MESSRS. LAURENCE, SCOTT & CO., LTD., gets over the objection sometimes raised against electric winches—namely, that they are slow compared with steam winches at light and moderate loads. The discriminator allows the winch to be speeded up automatically on the last step of the master controller, provided so doing would not overload the motor, in which case it keeps the speed down to that of the previous step of the controller until the load is eased. The practical result is a considerable speeding up of the average rate of working without the risk of bringing out the overload circuit breaker. The steering gear made by this firm (a purely electric system) has been in practical operation on ships since 1914. There is a sliding rheostat connected to the wheel and another (in the steering flat) to a small telemotor. The latter is excited on the Wheatstone bridge principle when the wheel rheostat is moved and tends to bring its own rheostat back into coincidence. In doing so it drives on a limiting gear connected to which is a master controller. The motor starts, drives back the other side of the limiting gear, and switches itself off; the rudder has then come to rest in the position indicated by the steering wheel. Various types of machines were exhibited by the firm, a feature being the use of wooden wedges in the armatures of even the smallest size, thus obviating the use of binding wire on the cores.

Lighting fittings and accessories were to be seen on some half-dozen stands other than those we have already mentioned—namely, on those of WM. MCGEOCH & CO., LTD.; F. SMITH & SONS (SOUTHAMPTON), LTD.; NETTLEFOLD & SONS, LTD., including a locking device for electric lamps; MR. WALTER WHITE, including starting equipments for motor boats; THEO AND CO., hand and torch lamps actuated by a lever, strap, or pedal in place of the usual dry cell; and the ENGINEERING AND LIGHTING EQUIPMENT CO., LTD., including the Gobb non-dazzle lamp which appears to be really good.

With regard to heating and cooking apparatus, the display of electrical devices of this nature was much more satisfactory than has been the case at other shows within the last few years. CARRON COMPANY had a large and imposing stand; it is impossible within the space at our disposal to describe the representative display of this company's manufactures, but the examples on view were sufficient to indicate the wide range of appliances it specialises in. It has installed cooking equipment in many of the largest liners, &c., for coal, steam, electricity, and oil. The appliances for use with electricity included an ordinary galley range as well as a native range, besides appliances suitable for ships, hotel or restaurant use, including a steaming oven, fish fryer, boiling pans, and a grill. An electric range with hot plate, together with several electric fires, complete the display of electric cooking and heating appliances. Of recent years Carron Company has devoted special attention to haulage gear and two examples of the latest types were shown. One of these was a double drum, worm-

geared, main-and-tail rope haulage, fitted with gear-box, motor and controller.

The JACKSON ELECTRIC STOVE CO., LTD., also had a large stand on which it exhibited a complete electrical equipment for a ship's galley that was sufficient to cater for between 40 and 50 persons. The firm equipped over 400 of H.M. submarines during the war period, besides supplying a large number of other appliances for cooking and heating on board capital ships and auxiliaries. A range of fires, cabin heaters, and domestic devices was also on view on the stand.

Another firm that showed domestic heating and cooking apparatus, including the dome type of oven which has been described in our pages, was the HOTPOINT ELECTRIC APPLIANCE CO., LTD., while a combination electric iron and heater and the "Midget" electrically-heated geyser found a place on the stand of MESSRS. SUMNER, VAUGHAN & CO., LTD.

Finally, self-contained electric generating sets suitable for supplying energy for lighting and power purposes on board ships or in isolated houses or farms were exhibited by about 15 firms, in addition to those that we have already mentioned. As will be seen from the following list, the sets shown were driven by steam engines, turbines, or internal-combustion engines, and varied largely in size and type:—The De Laval Steam Turbine Co. (a 10-h.p. single-stage turbine connected to a 2-kW high-frequency alternator for wireless telegraph purposes and also driving a 4.5-kW d.c. generator); Douglas & Grant, Ltd. (20-kW steam set); James Howden & Co., Ltd. (steam); Sunderland Forge & Engineering Co., Ltd. (2.5/15-kW steam); Aster Engineering Co. (1913), Ltd. (semi-Diesel, petrol, paraffin and town's gas semi-automatic, 2 kW/100 h.p.); John I. Thornycroft & Co., Ltd. (36-kW paraffin); Norris, Henty & Gardners, Ltd. (1 kW/134 h.p. heavy oil); Peter Brotherhood, Ltd. (steam engine, turbo-alternator and petrol sets); Boulton & Paul, Ltd. (petrol); Vickers-Petters, Ltd. (semi-Diesel, paraffin and petrol, 1 kW/152 h.p.); Mark Webber, Ltd. (petrol, paraffin, and town's gas, 2/16 h.p.); Stuart-Turner, Ltd. (petrol semi-automatic); and Campbell and Isherwood, Ltd. (steam 3/55 kW); the latter firm also showed a 7-h.p. watertight motor suitable for use in exposed positions on a ship's deck, &c., a B.S.C. centrifugal pump driven by a 3-h.p. totally-enclosed electric motor, electric drills, and electromagnetic drill stands, switchboards for ships, &c.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Short-sighted Employers.

One would think in these days of advancement that there would be very few of the above-mentioned employers, but nevertheless (to the writer), they seem to be growing in numbers. One such employer engages a handyman to look after his works plant and imagines by doing so that he is saving money, but I am certain that any practical electrical engineer will agree that that is a very short-sighted policy. The writer has been called to innumerable "break-downs" to ascertain and rectify the cause of trouble and has found in nine cases out of ten that the trouble could have been lessened if not prevented altogether, had it not been for the fact that the plant attendant usually seemed more suited to looking after pot plants than electrical machinery. The employer of the handy-man is surprised when a serious break-down takes place, and is more surprised when he has to foot a heavy bill for repairs; the fact of the matter is, he is proverbially "penny-wise and pound-foolish." Of course every employer has the right to conduct his business as he thinks best, but it does seem a pity that he should throw money away when there are at present so many really first-class electricians who would be glad of a job. I could give many instances where trouble has been caused by the employment of handy-men to look after electrical apparatus, but one or two will suffice. Having been called to examine a 4-h.p., 440-volt, shunt-wound motor, I was met by the engineer-in-charge (!) who assured me that the trouble was only slight, and that the motor just "fizzed" and stopped. On examination, I found that the windings were completely burnt out, and on making my way to the fuse boxes I found that the fuses consisted of pieces of No. 11 S.W.G. galvanised wire: "nuff sed!" Another plant attendant called at my employers' place of business for a starter for a shunt-wound motor, and I asked if we should send someone along to erect and connect it for him; this he declined and seemed annoyed at my suggestion. However, he had not left the above-mentioned establishment more than an hour, when he returned with the starter, the no-volt coil being completely burnt out, and remarked that we had given him a bad starter. After considerable trouble the writer managed to convince this plant attendant that he had made a mistake in the connections, and the attendant admitted that he had no idea which was the field or the armature wire.

Of course the writer does not blame the handy-man for the

above state of affairs, as it is almost entirely due to the short-sighted employer, who, after all, is not a bad sort as he creates plenty of work for electrical engineers.

Contractor's Foreman.

September 24th, 1921.

A Motor Problem.

With reference to the correspondence under the above heading, I sincerely wish to thank "A. C." Mr. Swindlehurst, and Mr. Pinkerton for their interest in the problem, and for their very helpful suggestions. Mr. Swindlehurst seems to deplore my lack of experience with a.c. motors. I hope he does not expect a "treatise on single-phase induction motors" or anything of that nature from the pen of a merely practical man.

He is also interested to know how I discovered the h.p. of the machine with the name-plate missing. I discovered the h.p. from the starting-switch installed with the machine, which was marked 0.5 h.p., and judging by the size and weight of the motor as well. I rightly or wrongly stated it was 0.5 h.p. Of course, he may assume the motor to be anything from 0.25 h.p. to 0.75 h.p. Within those limits I do not think we can be far wrong, and I fail to see how it materially affects our problem. Then he asks how I know the motor to be suitable for 230 volts. Dealing with the voltage, perhaps I had better quote my exact words: "I examined the system and found it was a single-phase, 230-volt, 25-cycle supply," obviously meaning the supply system. Mr. Pinkerton's correspondence of the 12th inst. is very interesting, and I am very pleased to furnish these further details, in addition to diagram: Weight of motor, 60 to 70 lb.; rotor diameter, 5½ in.; width (across laminations), 2½ in.; length of shaft, 14 in.; diameter of shaft, 2 in.; pulley diameter, 2 in., face 4 in. The terminals of the winding were marked L.F.A., which at first glance made me think it was a d.c. motor. Evidently it is a 6-pole machine, and synchronous speed on a 25-cycle circuit would be $25 \times 120 / 6 = 500$ r.p.m. (adopting Mr. Pinkerton's formula). But I question whether the speed was anywhere near it. I fancy the slip was very great. The motor is of the split-phase starting type, as he assumes. In the shops we used to designate the two windings as "running winding" and "starting winding." Mr. Pinkerton's alternative method of putting in a 2-pole winding is very interesting; does he mean reducing the voltage in the ratio of 60 to 25; 230 to about 96 volts? From my limited experience with motors I have found that decreased speed may be due to many causes: wrongly connected stator coils, loose bars on rotors, badly worn bearings, &c. It did not occur to me until as a last resort to question the design of the machine. I took it for granted it had been ordered for a 25-cycle supply. But I think that now we are all agreed that the trouble is due to the frequency of the supply mains, and I hope shortly to test it on a 50-cycle supply.

D. T. Davies.

Porth.

September 24th, 1921.

The Shipping, Engineering and Machinery Exhibition.

I understood that the exhibition held at Olympia was for the purpose of advertising British goods, and was therefore very much surprised when one of my staff returned after a visit to the exhibition with a pencil case, which I enclose herewith.

You will notice that just under the head of the same is marked "Germany," which I presume is the country of its manufacture. This pencil was purchased for 2s. 6d. on a stand, of which unfortunately the name was not taken, but it was a stand devoted to recording clocks and similar mechanism, on the ground floor of Olympia.

I should certainly have thought that we had quite enough to do to advertise our own goods without advertising German-made articles at our exhibition.

I shall be pleased to hear the remarks of other English manufacturers on the subject.

G. Farquhar.

Luton.

September 23rd, 1921.

Organ Blowers.

The letters in reply to "Organ Blower" appearing in the current Review with their abundance of practical detail will no doubt prove helpful to your correspondents and readers, but it seems to me they do not deal specifically with the actual problem of converting existing d.c. plants to a.c.

Stating a preference for d.c. or suggesting that feeder blowers cannot be driven by a.c. is small comfort to the engineer who has the job to do. Similarly depreciating the use of single-phase will not help if it is a case of Hobson's Choice.

From this point of view I would put forward the following suggestions.

Where 2 or 3-phase supply is available, squirrel-cage motors can be used as effectively as d.c. On rotary fan equipments

the existing wind valve control will apply. On feeder bellows, where rheostat control is fitted to the d.c. motor, this must be adapted to operate fast and loose pulleys. In either case the problem of speed control is eliminated.

Where single-phase supply only is available, or preferred owing to length of wiring necessary to connect to 3-phase, the same general remarks apply, with the vital difference that the question of starting must be carefully considered.

The prevailing prejudice against a.c. organ plants is almost entirely due to trouble experienced in connection with the poor starting characteristic common to all single-phase induction motors.

This may be overcome by centrifugal clutches or other automatic engaging gear, but whatever method is adopted complication and expense is involved. The best solution of this, the only real difficulty in the whole problem, is the repulsion type single-phase commutator motor, such as the "Parkinson," or "Century," possessing a high starting torque.

An interesting point arises in a conversion job, such as is under discussion, where a single-phase induction motor is decided upon; the h.p. is invariably in excess of that of the d.c. motor replaced, principally to counteract the starting difficulty; add to this the very low power factor of this type of motor and the result is seen in a remarkably high amperage for the old wiring to carry and dimming of the lights when the organ is started, to say nothing of the mains engineer being alarmed.

The noise objection in my opinion is over-stated; a.c. motors vary, even from the same works, but generally are as silent as d.c. and certainly quieter than the rotary fans they drive. Maybe the "unpleasant noise" referred to is the mechanical click during starting and stopping of some types of repulsion motors.

F. J. S.

September 24th, 1921.

Supply without Statutory Powers.

May I ask for a little more of your infinite patience, to deal with "Northwalian's" letter of last week? It is an easy task.

He says "A.O.G." is getting alarmed; perhaps "Northwalian" will explain why. I have no financial interest in, nor have I for nearly two years been employed by, any electricity supply whatever. In fact, I am one of the consumers for whom "N.W." is so solicitous! So that's that.

It seems they have had the field pretty much to themselves. They have; very much so. In 1909 the idea of a little village having its own supply was the subject of almost universal derision in the village itself, and some of the very people who, like "N.W.," seem to think the affair is now a gold mine, were then among those who said it could not be made to pay. And a few years after it started a long letter appeared in the Review from an A.M.I.E.E., pointing out that the idea of a village supply was preposterous, and that electricity supply was a doubtful enough venture in a town of 10,000 population.

In this particular village a scheme was started, and current supplied to 30 consumers, on an outlay of £270. A second-hand semi-portable steam engine with loco-type boiler was bought for £45, and this engine ran the supply till quite lately. It may interest "N.W." to know that the amount of coal used per unit sold, with this tiny plant running non-condensing, was the same as that used by two other much larger plants in North Wales, according to figures published, one of the latter selling a million units a year.

In 1915, with nearly 70 consumers, the total capital expended was under £400. To the best of my knowledge this is a record for the kingdom. In these conditions, giving a 24-hour supply year after year without a single failure, a net return of six to eight per cent. was obtained on the above little capital, five per cent. being distributed. The charge was 8d. per unit. In 1918, owing to dearer coal and labour, this was increased to 11d., with similar financial results. Repairs and renewals had averaged £5 per annum all through.

These results were only obtained by minute attention to economy—careful firing, clean boiler surfaces, hot feed, tight piston and valves, shortest possible runs at full load, attendance a part-time job, &c. An article of mine on the subject of making these small affairs pay was published in the Review in 1914. The total coal consumption was 17 cwt. per week, and often a summer evening's run was done on a single barrowful of coal, including raising steam.

In 1919 the little group of local people who owned the concern sold it, for purely personal reasons, and at a profit. Then all the methods which had made it a moderate success were thrown to the winds, and at the present time it is being run at a substantial annual loss.

The foregoing, with my last week's letter, is my reply to some of "N.W.'s" questions. At the same time, it must be pointed out that the 3d. per kWh he mentions, was originally assumed by me as a possible charge for power in a town, and I do not accept it as the final all-in rate to small village lighting consumers, having anything from two to twenty lamps. Does he?

"N.W." says, "it is the dearth of supply that has

hindered the progress," &c. After years of experience, with more than one plant, I say, emphatically No! When a cottager having 40-watt lamps running three hours on a penny (at 11d. per unit), compares his 14d. or so per night with his next-door neighbour's 4d. for paraffin (actual cases), it gives the measure of the truth of the statement. What has hindered progress, absolutely without doubt, is the cost of wiring.

The reason of the "bitter feeling" was given last week. "N.W." can take it from me that the Council in this case notoriously does not represent the feeling of the villagers on the question, and any attempt to stop the present supply, leaving nothing in its place, would lead to "ruinations."

A. O. G.

September 26th, 1921.

The Test of Salesmanship.

With reference to the very interesting article in your current issue, unless it is already in practice it might be arranged, more especially by the supply houses that make these household electrical appliances, to draft some of their smart female works' hands or forewomen into the sales department to explain the apparatus in a practical way to their potential lady customers, thereby effecting the "rare achievement of genius" necessary, as by this you have the combination of the one person in the sales department uniting the two practical sides, i.e., manufacture and use of the apparatus, which mere man can hardly ever hope to attain.

Interested.

London,

September 26th, 1921.

The Contractor's Future.

Your article of September 16th on the contractor's future is very interesting, and, unfortunately, much of it is true.

At first sight one would thank the author for the interest he has taken, but on closer investigation one is surprised to find that it is really one of the biggest pieces of Yankee bluff in the shape of advertising disguised as an article that I think has yet appeared in your columns.

What do we really find the article boils down to? It is that a gentleman, who for years has sold American electrical apparatus on the British market, now finds that an American firm has started an intensive campaign, which will affect him probably more than anyone else in this country; he therefore rushes into print, and seems very aggrieved that anyone else should dare to put up a fight against his organisation.

We all know the pathetic figure of the budding contractor with a few pounds and a coil of wire, but then Mr. Hawkins must realise that the "financial cramp" of this poor fellow is often due to the fact that he was probably away for nearly five years at a little job that we had on in France and other districts, and during this period the Americans were busy collecting British gold by means of which they could build up their wonderful sales departments.

There is something sweet in having one's own business, however small it may be, and it is certainly not to the advantage of the poor contractor that the few pounds' capital that he has should be paid out to keep American workmen busy.

Of course, magnificent showrooms are very nice, but there are some excellent showrooms in London where goods of British manufacture can be seen working, and to which the contractor who cannot afford his own showroom is always at liberty to send his clients.

We are often told that some Trade Unions are financed by Bolshevik gold, but heaven forbid that any Contractors' Association should have to appeal to an American factor for protection and advice as to how to run its affairs.

Britain First.

London.

September 21st, 1921.

Referring to the article under the above heading in your issue of the 16th inst., although agreeing in many ways with the view that the contractor will have to look to his laurels if he wants to come out top in future, we do not think that the scheme advanced will be practical when applied in the business sense.

The average local contractor would absolutely refuse, we think, to join hands with his rivals, especially if he had a more commanding position in his district—the only contractors willing to do this would be those who only had a slight connection and small capital.

Again, the average contractor is not in a financial position to lay much capital out in displays, although we think that this side of the business should receive a lot more attention than it has. The windows should be made as striking and interesting as possible to the buying public and to the feminine side especially in order to prove that electrical appliances, particularly those dealing with heating, lighting and labour-saving devices, are really practicable commodities, and since nearly every contractor thrives on account of his installation business, he should, as far as possible, develop his sales, and especially his displays, on these lines.

Local contractors when tendering for an installation have to compete with large companies who have had far greater experience, both as regards buying suitable plant, &c., and as regards economical installing. Contractors should therefore avail themselves of all assistance offered them by the manufacturers, and before buying any lighting plant of which they have had no previous experience, should make a special point of seeing the sets on test, and should observe any special adjustments in running that an experienced man makes. It is surprising to what a small extent contractors consider this necessary, and yet this, no doubt, is the prime cause of failure of many local businesses.

As an alternative to the above scheme, a contractor could arrange with the manufacturer to superintend the erection and first charge, and from a manufacturer's point of view, this is far more satisfactory.

The contractor, now having a good knowledge of what he is selling, can put his experience at the disposal of his clients and can give a lot of good advice, when they are either anticipating a future installation or overhauling an existing one. Besides, when a contractor can show that he knows what he is talking about, he has far more chance of obtaining the order.

Were contractors to realise that the above details form a very important factor in their business, their future success would be assured, and the fact that private house plants would be more satisfactorily installed would lead many people, who have at present declined to have electric light, to order an installation from that contractor who understands his work.

This letter is not an attempt to prove that contractors do not know their work (as a rule they do); but the general experience of manufacturers is that the contractors do not give them sufficient assistance, and that they imagine that, because they have installed one make of engine, or have read some literature regarding the engine they propose installing, they are in a position to run any make or type of engine on any kind of fuel, and that, because they cannot do this, it is of course the fault of the plant.

Were every electric light plant to run as well when installed as it does on test, there would not be a single house without electric light in the whole country.

Harry Hodges.

London,

September 22nd, 1921.

Patents in Ireland.

A separate Irish Government is likely to affect inventors detrimentally if it means setting up another Patent Office with the usual red tape and extra fees to pay.

At present an inventor is given patent protection for the whole of the British Isles, and at the recent Conference of Premiers a scheme was considered whereby one fee would give protection for the British Empire.

With a separate Patent Office in Ireland all sorts of difficulties are likely to arise, and the chances are that as with other small nations, the fees will be excessive.

The world's progress depends very largely on inventors, and the increasing of Government patent departments and fees would be a further handicap.

E. Kilburn Scott.

Farnham.

September 20th, 1921.

Russian Electrical Schemes.

The articles and notes on various electrification schemes in Russia which from time to time appear in your paper, such as for instance, "Russia's Electrification," in the issue of August 19th, are really an imposition upon the intelligence of your readers. However little Russia is known in this country, yet there are here perhaps not a few men who have visited and lived in Russia, and know something about that country, yet these men, after reading all about the "ambitious schemes" as you characterise them in your above-quoted article, would simply shrug their shoulders and say "booh."

The source of the information contained in these articles is obvious, and its purpose is clear—sheer propaganda to mislead business men and financiers in this country into believing in the great opportunities in Russia, but it is a pity that your valuable paper has been unconsciously made a tool for this propaganda. Truly, the opportunities are there, but not under the existing régime; they will come when the present régime goes, and not before.

I could say much an every scheme described in your paper, but it would take too much valuable space, and therefore I confine myself to asking: How is it possible to reconcile the alleged materialisation of all the schemes with the simple fact that Russia's production at present is about 5 per cent. of what it has been formerly, and the importation of foreign goods is hardly more than one per cent.?

According to *Ekonomicheskaya Shism*, the Soviet Government's official organ, the four large electric factories in Russia produced in 1920, generators, motors and transformers, of a total capacity of 18,250 kW (!) as against 350,000 kW in 1913, and all the Russian cable and wire factories had in 1920 an

output of about 300 tons, as against 6,300 tons in 1913. But perhaps the imports were bigger?

The same source quotes that for five months of 1920, all kinds of machinery with a total weight of only 6,800 tons (as against 450,000 tons for five months of 1913), were imported into Russia, but this item consisted mostly of agricultural machines, spare parts, iron hinges, rivets, manufactures of wire, nails, iron, babbitt, saws, and incandescent lamps.

When you put these facts against such gorgeous contemplated schemes as the electrification of Murmansk railway, going across a desert, and with a traffic of one train a day each way, or the transmission of a million horse power from the deserts of the White Sea for a distance of 400-600 miles, &c., &c., (issue of April 29th), while at the same time the highly up-to-date power and tramway plants of Petrograd and Moscow are permitted to fall into decay and have ceased to be public utilities, is it not permissible to suggest using a little discrimination when giving place to such kinds of information coming from the Soviet propaganda organisations?

A Reader.

[In the desire that the exact truth should be known regarding the situation in Russia, we yield to none; we therefore welcome our correspondent's comments, in so far as they tend to that end, but we strongly demur to his suggestion that our reports impose upon the intelligence of our readers. We quote the sources of our information, and if we publish the grandiose schemes of the Soviet Government, we do not fail to publish also other statements showing to what a deplorable condition the industries of Russia have been brought under that régime.

The industrial prospects in Russia are of interest mainly to readers who are concerned with the development of our export trade—men of intelligence and experience, who are as competent to draw correct conclusions from what we publish, as our correspondent—and we have no fear that they will be imposed upon.—EDS. *ELEC. REV.*]

Accumulator Froth.

I should like to add a little comment to the growing correspondence on the above subject. While I should say that the froth appears most readily in those sets made of inferior celluloid, yet I have also noticed it in sets by well-known makers. However, in the latter case the froth apparently does not appear until the cells have been in use for some considerable time (say about four years). I think that it is then due to the treatment that the battery has been given by the user.

Some people are continually topping-up their cells with acid, with the result that at the end of a recharge the specific gravity of the acid is considerably above the working Sp. G. The observed Sp. G., for some cells which have been recharged by the writer, has been as high as 1.350 when only designed to work at 1.215 or 1.250. Thus the result of such treatment will be seen. The acid of higher Sp. G. attacks and weakens the celluloid, and the result is that apparently a new chemical compound is introduced, which I should say was the cause of the frothing. I have only known of three

cells behaving in the fashion complained of, which were made by the firm I am with, viz., the Chloride Electrical Storage Co., Ltd., whereas, on the other hand, I have seen at least 500 cases of cells by other makers. In each of the three cases mentioned the cells were old (one being nine years) and the Sp. G. of the electrolyte at the end of the charge had risen considerably above the normal. Celluloid separators in the cells seem to render them more liable to frothing.

J. Plummer.

London, S.E.,

September 24th, 1921.

I have read with interest the letters appearing in response to an inquiry for the reason of frothing of celluloid-cased accumulators.

Mr. Frost's 12 years' manufacturing experience is certainly unique if he has not had a case of frothing. I have been in the accumulator industry for 20 years, and my experience is that frothing will occur with the finest of celluloid. The frothing action is certainly more pronounced with poor quality celluloid, but even when of best quality it is not the ideal material for accumulator containers, but is preferred by users on account of its light weight, and transparent qualities.

Mr. Hesketh's suggestion of painting the inside of the boxes would eliminate the transparency and remove the chief reason for celluloid being used.

In addition to the reasons put forward by Mr. Peto, other causes can be traced, such as high rate of charging and high temperature, while a good deal of the frothing action emanates from the celluloid separators, and not so much from the container. This is due to the perforations being unpolished, which is not the case with the face of the separators or the box, except where joints are made.

There is a wide field where celluloid can be utilised satisfactorily, but for certain classes of work it is fatal, for instance, in tropical climates. Mr. Hesketh is wrong in assuming that makers are indifferent. They have to cater for the demand, not dictate to the public what they shall use.

W. C. Coates,

Manager, Accumulator Dept.,
Edison Swan Electric Co., Ltd.

Ponder's End.

September 26th, 1921.

My own personal experience with small batteries, both glass and celluloid cased, is that all of them will gas too freely unless ample ventilation is provided.

I put in a set of glass cells with Fuller Block interiors and very small openings at the top. These gassed very freely and set up a lot of froth until the tops were opened up. I had the same experience with celluloid cells, and ebonite-cased accumulators as well.

D. S. Wilson.

Glasgow,

September 24th, 1921.

BUSINESS NOTES.

Bankruptcy Proceedings.—E. E. MATHERS, electrical engineer, Allen Dale, Springwell Lane, Baby, York.—Receiving order made September 21st on debtor's own petition.

W. H. S. WARD, electrical engineer, 56, High Street, Acton.—First and final dividend of 74d. in the £ payable at the Official Receiver's Office, 29, Russell Square, W.C.1.

A. C. A. WARMACH, electrical engineer, Fornby Lodge, Seabrook Road, Hythe.—Supplemental dividend of 64d. in the £, payable at the Official Receiver's Office, 68a, Castle Street, Canterbury.

JOHN HENRY TAYLOR, 99, Blackhorse Street, Bolton, Lancashire, electrical engineer and contractor.—The public examination of this debtor was held on September 21st at the Court House, Mawdsley Street, Bolton.—The statement of affairs showed liabilities £639, and there was a deficiency of £669. Debtor stated that he was brought up in the electrical business, and commenced business on his own account in 1919 after being demobilised from the army. He was fairly successful until about July, 1920. At that time he developed a severe illness, and was ill for six months. During that period he put a manager in charge of the business, but it suffered through contracts being delayed. He attributed his position to illness, personal and family. The examination was closed.

L. J. NICHOLS, motor and electrical engineer (carrying on business in co-partnership with Margaret Parks (widow) under the style of the Scarborough Motor and Accessories Supply Co.), 19, South Street, Scarborough.—Receiving order made September 24th on debtor's own petition.

Dissolution of Partnership.—B.S.T. ELECTRIC FITTINGS Co., engineers, Dixon's Green, Dudley.—Mr. W. Barnett, Mr. F. Saunders, and Mr. P. J. Thompson have dissolved partnership. Mr. F. Saunders will attend to debts.

Trade Announcements.—THE CABLE ACCESSORIES Co., LTD., announce that they can now supply material from their depots at London, Glasgow, and Newcastle-on-Tyne. They have taken over the B.S.T. Electric Fittings Co., Dixon's Green, Dudley, and the hand lamp referred to in our "New Devices" section last week (p. 401) is now being manufactured by them.

MESSRS. CUTLER, ROBERTS & Co. have commenced business as electrical engineers at 7, New Street, Herne Bay.

MESSRS. GOODENHAY & FLECK, of Liverpool, are opening to-morrow new suburban branch show rooms and stores at 62, Smithdown Road, where manufacturers' specialities can be demonstrated.

Catalogues and Lists.—THE METROPOLITAN-VICKERS ELECTRICAL Co., LTD., Trafford Park, Manchester.—Circular No. 1,440/1, giving full particulars of waterwheel alternators.

THE BASTIAN ELECTRIC Co., LTD., 185, Wardour Street, London, W.1.—Illustrated and priced leaflet showing various makes of Bastian electric fires and heaters.

ELECTRICAL COMPONENTS, LTD., 90, Great Charles Street (Snow Hill), Birmingham.—Price list No. 91 of electrical accessories.

MESSRS. L. G. HAWKINS & Co., 116, Charing Cross Road, London, W.C.2.—Illustrated and priced leaflet of "Miller" lighting fixtures.

THE ST. HELENS CABLE & RUBBER Co., LTD., Warrington.—A well-produced, illustrated booklet, fully describing the numerous uses of C.T.S. wiring.

THE SUN ELECTRICAL Co., LTD., 118-120, Charing Cross Road, London, W.C.2.—An illustrated and priced leaflet of "Sunco" fires: also an introductory pamphlet relating to the "A.B.C." Electric Laundries.

THE EDISON SWAN ELECTRIC Co., LTD., Ponders End, Mid-

dislex.—An illustrated and priced leaflet of electric lighting fixtures, including bowl fittings, desk lamps, &c.

Messrs. Belling & Co., Edmonstone, London, N. 18.—An illustrated and priced booklet of "Belling" electric fires, cooking apparatus, heaters, &c., with much information on electric cooking and heating that will be of interest to consumers and contractors.

The Engineering Trade Negotiations.—The meetings, reported to in our last issue (p. 413), have been held and have been protracted, but unfortunately the negotiations on the question of the withdrawal of the 12½ per cent. bonus for time workers and 7½ per cent. on piece rates have not been successful. The position appears to be that an agreement has not been reached and the employers' notices to discontinue payment of the bonus will take effect from October 12th. The *Daily Telegraph*, in referring to the matter, says that the result will be to reduce wages by from 8s. to 10s. a week, following upon a recent cut of 6s. a week, and in all over 3,000,000 skilled and unskilled workers in the engineering establishments and shipyards throughout the country are affected. A joint conference of delegates of the engineering and shipbuilding trade unions was held at the Memorial Hall, London, on Sunday, to consider the position and decide what further action should be taken. The proceedings were private. Some 400 delegates were present. At the close the following official statement was made to a Press Association representative by Mr. J. T. Brownlie, president of the Amalgamated Engineering Union:

"A report of the negotiations that took place yesterday between the shipbuilding trades and the Shipbuilding Employers' Federation was submitted to the conference and fully considered. It was afterwards decided that the Unions' Negotiating Committee report to the Minister of Labour the result of the negotiations that had taken place between the National Federations of Engineering and Shipbuilding Employers and the representatives of the men's organisations, with a view to procuring his good offices to avoid dislocation in the industry. The Negotiating Committee has been empowered to convene a conference of the trade union representatives at a later date if necessary."

It is stated that during last week's negotiations, various proposals were submitted on behalf of the men, who asked that the matter should go to arbitration, or, alternatively, for an independent inquiry into the position. The employers declared that they were unable to accept either of these suggestions. The proposal was again put forward that wages in the industry should be regulated by a sliding scale based on the cost of living. This the employers declined, arguing that the bonus was a war-time grant, awarded as compensation to skilled engineers who were then training dilutees and receiving only a flat rate of pay for so doing, with the result that dilutees on piece work were earning in some cases more than their trainers. An attempt was subsequently made by the men's leaders to ascertain how the employers would view a proposal to spread the withdrawal of the war bonus over three instalments in October, November, and December on lines similar to those proposed by the engineering employers to the other unions.

On Monday, Dr. Macnamara, Minister of Labour, received a deputation of the trade unions and discussed the deadlock. At the close of the interview Mr. J. T. Brownlie stated that the deputation requested the Minister to exercise the powers under the Industrial Courts Act, with a view to effecting a settlement. He said that there would be no ballot of the unions until after the Minister had acted.

The *Financial Times* stated on Tuesday that large Tyneside engineering firms had suspended and cancelled orders until the war bonus was taken off the workmen's wages.

Sale of Plant at Gretna.—Messrs. Edmiston, auctioneers, Glasgow, completed a four days' sale of plant and machinery at Gretna Munitions Factory, by order of the Disposals Board. Buyers were present from the large centres of England, Scotland and Ireland. Prices were generally low, but purchasers have to bear the cost of dismantling. Electric motors of 50 h.p. realised from £90 to £100.

French Patents.—The suspension or postponement of legal obligations connected with patents instituted during the period of the war comes to an end on September 30th, after which the usual obligations connected with patents, designs and models will again come into force.

Book Notices.—British Engineering Standards Association, report No. 102-1921: "British Standard Specification for Tramway Axles." London: Crosby Lockwood & Son. Price 1s. net, post free 1s. 2d.—This specification follows very closely the lines of the revised British standard specification for railway carriage and wagon axles (with analysis), which is included in Part I of the new edition of report No. 24. A percentage of 0.05 of phosphorus or sulphur is permitted in the steel as in the case of the railway axle specification, but for the manufacture of tramway axles, no particular process of steel-making is specified. Falling-weight, tensile, and cold-bend tests are required, the latter being for use only where the order is for a number of axles under 15, when it is to take the place of the falling-weight test. A diagram is included illustrating the method of performing the cold-bend test. Normalising (of which a definition is given), or oil-treating is specified, the choice to lie with the purchaser. The specification may be obtained from the offices of the

British Engineering Standards Association, 25, Victoria Street, S.W.1, or from the publishers.

Reports Nos. 109-1921, "Air-Break Knife Switches and Laminated Brush Switches, for pressures not exceeding 660 volts"; and 110-1921, "Air-Break Circuit Breakers for pressures not exceeding 660 volts."

These specifications form part of a series at present under consideration by the Association. During their preparation it was found that many of the conditions could not be laid down with any certainty until a large amount of research work had been done, particularly with regard to rupturing capacity for large sizes and safety of insulation. A comprehensive research is therefore being undertaken by the Electrical Research Association, and when the results of this work are available it may be possible to extend the specifications.

It is recognised that the breaking capacity of switchgear is dependent on many factors other than the kilo-volt-amperes to be broken, and it is necessary to take into consideration all these factors in deciding on the size of control gear to be employed. The specifications do not include switches and circuit breakers for use with series motors, circuits of high inductance or traction circuits, all of which may require a higher breaking capacity than is specified therein.

A number of terms used in modern switchgear practice have been defined, and a series of standard sizes has been included. Dimensions of back connections and the distance apart of the stud centres of knife switches have been agreed upon so as to secure a reasonable amount of interchangeability without interfering with details of design. Since it is not practicable to take out a complete range of tests on every switch or circuit breaker, the tests have been divided into two categories, i.e., tests which are carried out on every switch or circuit breaker and those which are carried out only on a switch or circuit breaker of a type.

The issue of these specifications marks a step towards the simplification of switchgear generally. As usual, the co-operation of the interested electrical Associations has been secured in the preparation of the specifications, as well as that of the Government Departments, the Institution of Electrical Engineers, the Electricity Commissioners and the National Physical Laboratory. The Committee has also had the benefit of the assistance of Mr. E. B. Wedmore (director, British Electrical & Allied Industries Research Association), and Mr. C. H. Wordingham, C.B.E.

The *Electrical Contractors' Year Book*, 1921-22, which has been issued by the Electrical Contractors' Association (Inc.), price 2s. 6d. net, is considerably bigger this year, in the ratio of 218 to 274 pages. A portrait of Mr. J. Oringe, the president, forms the frontispiece, and the membership of the three Associations occupies about 45 pages.

At the first meeting in February, 1921, Mr. H. Alabaster occupied the chair, but in the sketch of the history of the E.C.A., on p. 112, his name is misprinted as "H. Alabaster Gatehouse." Particulars are given of the constitution and functions of the Electrical Contractors' Association (Inc.), the N.E.C.T.A., Ltd., and the National Federated Electrical Association, and the report of the immediate past president, Mr. F. Collinson, for the year ending April 30th last, follows; it states that the electrical contracting industry is suffering extreme depression, and that the cost of installation work should be reduced as far as possible in order to restore normal conditions. The membership on May 1st was: E.C.A., 668; N.E.C.T.A., Ltd., 573; N.F.E.A., 694, and for the first time the income from subscriptions covered the expenditure. The profit on the year's working of the N.E.C.T.A., Ltd., was £1,957, and the C.M.A. agreements brought to the members more than £25,000 in excess of their ordinary trade discounts. Amongst other features of the Year Book are an article on "The Position of Apprentices," by Mr. R. Tweedy Smith, wages schedules, working rules for various districts, and a variety of information on matters of interest to the members.

We have received from Victor M. Berthold, of the American Telephone and Telegraph Co., New York, an interesting booklet entitled "History of the Telephone and Telegraph in the Argentine Republic, 1857-1921."

"Automatic Telephone Systems," by W. Aitken. Vol. 1. Circuits and apparatus as used in the public services. Pp. xv + 282; 211 figs. London: Benn Bros., Ltd. Price 25s.

The Shackleton-Rowett Antarctic Expedition.—A "Magical" electric fire (Berry's patent), was installed by Messrs. Berry's Electric, Ltd., in the ward room of the R.Y.S. *Quest* to provide a home comfort for Sir Ernest Shackleton and his staff during their 30,000 mile voyage to the Antarctic and Pacific. Masta fuse-switch gear is in use for controlling the entire electric heating, lighting, power and wireless equipment. At the request of Capt. Williams, biologist to the Shackleton-Rowett Expedition, a 100-c.p. "Pointolite" outfit has been provided for his use as a source of light for critical examination and microscopic work, by the Edison Swan Electric Co., Ltd.

For Sale.—Messrs. Green & Son will sell by auction on October 6th at 13, High Holborn, W.C., a wholesaler's stock of electrical accessories and telephone equipment.

Westminster Electric Supply Corporation, Ltd., has for disposal 13 generators, 15 boilers, several feed pumps, water heaters, &c. (See our advertisement pages to-day.)

German Bid for Australian Trade.—According to a cable received by the Acting High Commissioner for Australia in London from the Prime Minister's Department, Melbourne, commercial houses report that German traders, irrespective of existing Australian barriers, are making a keen effort to secure business. Their offers are temptingly low, some quotation being one-fourth of the prices at which British and Australian made goods are now being retailed in Sydney and Melbourne. One effect of the German circulars is the hardening of the demand for drastic anti-dumping legislation.—*Board of Trade Journal*.

Change in New Zealand Preference.—When Mr. Massey was here the Federation of British Industries brought to his notice the disability from which British exporters to New Zealand suffer in competition with countries with an appreciated currency. A writer in the *Manchester Guardian* hears that the New Zealand Government has just informed the High Commissioner here that from the beginning of next year the duty on goods imported into New Zealand from any country with an appreciated currency will be assessed on the basis of the current rate of exchange instead of on the Mint parity value. This is regarded by the manufacturers as an important concession. Mr. Massey was informed when he was seen on the subject that the present method of arriving at the duty payable on goods arriving in New Zealand from a country like the United States has the result of largely cancelling the preference granted to British manufacturers under the New Zealand tariff. In future British exporters will apparently get the full benefit of the preference.

The Machinery Position in China.—If one thing more than any other is to-day seen in relation to the machinery requirements of China, says the *North China Daily News*, it is that low-priced plant intended to work for a very few years and then to be scrapped in favour of something of a later pattern, is unsuited to the peculiar genius of the country. So much has been greatly in evidence during the present year, when there has been a distinct return on the part of the Chinese to machinery of the type to which they were previously accustomed. It is, of course, recognised that low initial costs naturally make a strong appeal to the Chinese, but once such plant is installed the inevitable tendency occurs to work it to death. Not only is overloading a commonplace with Chinese engineers, but very often the efficiency of the engineer falls far below what would be considered essential in Western countries. This being the case, an undue strain is undoubtedly placed upon machinery in a great number of cases, and when this happens the lightly-built plant intended for short service inevitably has its life curtailed.

This particular type of machinery came into vogue in China during the war, largely for the reason that the long-service plant to which the Chinese had been accustomed was not to be had. Sufficient time has elapsed for it to be tested in the light of Chinese requirements and ideals in machinery, and the result is now being seen in a return to the style of plant in general use before the war. It is here that British machinery has had its chance, and in recent months representatives of engineering firms in the country have been able to report a considerable degree of success. The industrialisation of the Yangtze Valley continued interrupted only by political disturbances, which seem to be the only factor blocking progress in these days. Additional cotton mills have been planned and contracts for the work allotted; extensions to electric light and power plants are in progress; and a striking movement is seen in the establishments of cement factories. All these have called for machinery, and it is understood that for the mills and electric plant, British tenders have largely been accepted, while as evidence of the strong competition now to be faced, the cement factories have principally gone to German firms. The factors operating towards this end are especially important for the engineer selling his goods in China. The margin of safety, the capacity to take an overload and stand rough usage, are greater in British machinery than probably in any other produced. British firms have long adopted this as a principle in their work, and the efficient service to be obtained over a great number of years is what the Chinese can for. German machinery does not allow anything like so great a margin, but still it is there to a certain extent, more so than in the case of several other countries. There is a further consideration, namely, that the Germans have specialised largely in machinery for cement works.

The trend of purchases of machinery extending now over several months seems to show the lines in which engineering in China will proceed in the future. Nor is it likely that with a better understanding of plant and a higher efficiency on the part of her engineers the particular type in favour will tend to change. Much more likely is it that the future will see a vast extension of its use, halted only by the political feuds leading to pseudo-military operations. It is extremely difficult to get at the exact effect of these outbursts on a business such as machinery. For instance, up to a month ago orders for plant were being given freely, but then the whole trade seemed to collapse right throughout China, and prices offered were severely reduced. No doubt this is partly a temporary natural reaction after a period of fair activity, but at the same time it coincided with the first rumblings of the Hupeh storm.

Few people expect any noteworthy resumption of ordering until the close of the year, now that something almost approaching a slump has shown itself. The year opened with

business in machinery very nearly at a standstill, but almost immediately it reached a state of activity which was maintained until a month ago. Now the course of events has again brought dealings to a close, and the ultimate prospect is that more than half the year will have been wasted, largely, it appears, as the outcome of political bickering.—*Reuter's Trade Service*, Shanghai, August 13th.

E.D.A. Activities.—We have received from the ELECTRICAL DEVELOPMENT ASSOCIATION a brochure from light and heavy ordnance, of the details of which even a list would appear overwhelming. Amongst the many items are samples of literature for the edification of consumers, a dissertation on the hiring of domestic electrical apparatus, a report on concessions to contractors who maintain displays of electrical apparatus, a report on the classification of consumers' supply pressures and frequencies, notes on the use of electricity in a Norwegian home, and a variety of pamphlets, cards, brochures, folders, and book markers. We must confess that we have been so engrossed in reading some of these that we have overlooked the flight of time, and metaphorically throwing up our hands we surrender unconditionally to the summons of E.D.A. to "make it a rule to use electricity"!

Czecho-Slovak Travelling Fair.—On October 10th a railway train consisting of 33 coaches and containing samples of Czecho-Slovak industrial products will leave Prague for a two months' tour of Rumania, Bulgaria and Poland.—*Reuter's Trade Service* (Prague).

Lecture Season: Lantern Slides.—The Electrical Development Association, 84, Kingsway, W.C.2, has a large collection of lantern slides dealing with the generation, distribution, and use of electricity for industrial, business and home purposes. The director will be glad to hear from persons desiring to obtain the use of slides for lecture purposes during the coming winter.

J. & P. Athletic Club.—A fancy dress dance and carnival was held at Charlton by the Victoria Works Athletic Club (Johnson & Phillips, Ltd.) on the evening of September 22nd, in the Club Buildings attached to the works. Its object was to celebrate the first anniversary of the opening of these buildings. The president, Mr. H. J. Sheppard, presented the Blundell Maple Shield and Medals to the club football team, as winners of the Eastern Section of the Southern Suburban League, 1920-21. Mr. C. Stewart afterwards presented the Senior and Junior Departmental Cricket Cups and Medals to the winners, the Switchgear and Telegraph Departments respectively. Prizes were awarded during the evening for the best fancy dresses (ladies' and gentlemen's). The music was provided by the Club String Orchestra.

Lead.—Messrs. James Forster & Co., reporting under date September 24th, state:—"The premium on early lead, which has been a pronounced feature of the lead market for months past, has now almost disappeared, and at the close is only 2s. 6d. per ton. This is due not to any increase in imports (which, as a matter of fact, are not by any means up to the figures of past months) but to bad home trade. Consumers have scarcely been in evidence on the market recently, and trade reports are uniformly bad, not only in the domestic, but also in the electrical trades. The one favourable feature this week is a better demand for export, both France and Holland being in the market, but not for any large quantity."

The E.P.E.A. and the E.T.U.—According to the *Electrical Power Engineer*, the final draft of a proposed working agreement between the Electrical Power Engineers' Association and the Electrical Trades Union has been submitted this month to the sections of the former for approval.

It is remarked that the common interests of the two bodies are the following:—

(a) The necessity for such standards of remuneration in the electricity supply industry as will attract able men of all grades.

(b) The desirability of all employees enrolling in a bona-fide trade union.

(c) The affording of the greatest amount of employment through the steady development of the industry, which depends upon "a cheap and abundant supply of electricity," which must be reliable.

(d) The support of Joint Councils and agreements made by the employees' representatives thereon.

These interests will, it is believed, be considerably advanced by the adoption of the means for regularising the informal machinery of co-operation now in existence.

Inquiry into Trade Boards.—The Committee appointed by the Ministry of Labour to inquire into the working and effects of the Trade Boards Acts, and to report what changes, if any, are required, is as follows:—President, Viscount Cave; Lord Weir of Eastwood; Dame Adelaide Anderson, Dame Edith Lyttonell; James Bell, M.P. (Oldham Weavers' Association); W. T. Layton, Director of the National Federation of Iron and Steel Manufacturers; Sir Arthur Pense, Bt.; E. L. Poulton, Chairman of the Parliamentary Committee of the Trades Union Congress; A. Pugh, Secretary of the Iron and Steel Trades Confederation; A. MacCallum Scott, M.P. Mr. H. D. Hancock, of the Ministry of Labour, Montagu House, Whitehall, S.W.1, will act as secretary.

Copper and Lead Prices.—Messrs. F. Smith & Co. report September 28th: Copper electrolytic bars, 274 10s., 10s. increase; ditto electrolytic sheets, no change; ditto (electrolytic) bars, 270 10s., 10s. increase; ditto bar wire, 114d., 3/16d. decrease; silicon bronze wire, 1s. 3 3/4d., 3d. decrease.

Messrs. Thomas & Sanderson report September 28th: Copper wire, best selected, sheet and rods, no change. Eng. lead, 42 1/2s., 3s. increase on last week's quotation.

Staff-Poaching.—"Complaints have reached the Federation of British Industries on several occasions, of the indulgence by competitive firms in industry in the undesirable practice of poaching. In one instance, which has been brought to our notice, a firm is alleged to have sent a representative to the establishment of one of its rivals more than a hundred miles away, with the object of trying to persuade members of the skilled staff to transfer their service."

While it is true that the decision in such cases rests with the employes, and that they are entitled to sell their skill in the most favourable market, it is also undeniable that there are certain usages between rivals in commerce which mark a distinct line between fair and unfair competition.

"Staff-poaching" has the quality of the boomerang in that the poacher may find himself injured by the missile he has thrown. Not to put it on a higher plane, we believe it to be the view of the ordinary straightforward business man, that it serves best in the long run to recruit staffs by the accustomed methods, and that advantages gained by a departure from this rule are usually discounted by loss of good repute if not by actual "reprisal."—*Bulletin of the F.B.I.*

Gas Stove Prices.—A number of manufacturers of gas stoves, acting in association, are again reducing the prices of these goods. They anticipate a greatly increased demand and a lower cost of production, as a result of a widespread advertising campaign. Manufacturers of electric heating and cooking apparatus will hardly shut their eyes or restrict their enterprise at such a time.

The Gas Light & Coke Co., which some time ago ceased to let gas stoves out on hire, is now resuming that practice.

Swedish Telephone Industry.—Svensk Handelstidningen learns that the Swedish telephone industry, although affected by the general depression, has good prospects. The demand for telephonic material is increasing, especially in several foreign markets, principally Holland, the Dutch Indies, South Africa, Egypt, Spain, Australia, and Mexico. As regards business done through London, India is expected to prove a most important market in the near future. *—Reuter's Trade Service (Stockholm).*

Indian Stores and Indian Students.—The Legislative Assembly has passed a resolution recommending the Government to instruct the High Commissioner in London to purchase Indian stores in the cheapest market consistent with the requisite quality being obtained. The second part of the original resolution, which said that the High Commissioner, when placing large orders, should insist on the contracting parties giving every facility for the admission of Indian students to their works to enable them to gain a practical knowledge of manufactures, was withdrawn after a representative of the Government had pointed out the difficulty of insisting on such a condition in view of the pending report of the Lytton Committee, which is investigating the whole question of the training of students. *—Reuter (Simla).*

Works Committees and the Unemployment Problem.—Works Committees and their Values as a Constructive Unit in Industry formed the subject of a week-end conference organised by the Industrial League and Council held at Givons Grove, near Leatherhead, on Saturday last. Mr. S. Ratcliffe introduced the subject. He spoke enthusiastically of the committee of which he is chairman (Metropolitan-Vickers Co.), one of the first which drew up its own constitution and gave itself a representative basis. No works in any industry, he said, could be successful without a works committee, no matter under whose control or management. There must be room for every man to find expression; the committee must be so framed that each section and each individual in each section could come forward and have any particular matter dealt with by the committee. This could be done by sub-committees, and if the committee was properly constituted any special question fell automatically into the province of a particular sub-committee. Having, as members of a works committee, accepted responsibility, the men were more careful to put themselves in the position of the manager, more careful in their demands, and, to some extent, knew how far they could press a demand. Works committees were a valuable training ground for any and every school of thought. They taught the men to think of the processes which an article passed through; they opened their eyes to the fact that in mass production they had to do with only a part of an article's progress, and they then liked to know something of what had happened before, and what was to follow. At the end of the conference all present expressed the opinion that the existing works committees were in an exceptionally favourable position to give authorities advice on the grave question of unemployment.

Fires.—On Thursday last week a fire broke out at the works of the Wandsworth Electrical Manufacturing Co., Lodge Hill, Birmingham. A fairly large amount of damage was done, but manufacturing output is proceeding steadily.

LIGHTING AND POWER NOTES.

Argentina.—**WATER POWER.**—The commission of Argentine and Brazilian engineers has completed its investigations relating to the Iguazu falls, and has reported to the Ministry of Public Works that the possibility exists of utilising an immense amount of power. *—Reuter's Trade Service (Buenos Aires).*

Bexhill.—**STREET LIGHTING.**—The Highways Committee proposes to enter into an agreement with the Electricity Committee for the lighting of the district for the ensuing year at a cost of £3,500, on the understanding that the restricted system of lighting which was adopted between May and September is adhered to.

Blackburn.—**WHITEBIRK STATION.**—The new electricity station at Whitebirk is nearing completion, and it is arranged that Lord Derby shall formally open it on October 21st. The erection and equipment will cost about £850,000.

Bradford-on-Avon.—**ELECTRICITY SCHEME.**—The Urban Council is to take the necessary proceedings to have the provisional order for electric lighting granted to Mr. Edwards cancelled owing to his failure to carry out the work, and Messrs. Spencer, Moulton & Co., Ltd., have been asked on what terms they would be prepared to give the town a supply of electricity.

Cheadle and Gatley.—**EXTENSIONS.**—The Urban District Council, on September 15th, reported that the Commissioners desired an assurance from the Council that if they grant the Electricity Order applied for, the works referred to in the report of the Council's electrical engineer in connection with the electricity scheme will be proceeded with. The assurance asked for was given.

Continental.—**BELGIUM.**—At the reopening of the Belgian Parliament, the Government will present a Bill drawn up by a Committee which has been engaged in studying economic questions. It relates to a scheme, applicable to all electric generating works, for supplying all the requirements of the nation, including the railways; it contemplates the formation of a National Society of Electricity, for the co-ordination of the various producers with a view to recover energy now lost, supply lighting to small communes, and thus to link up the electrification of the whole land.

Prices of 25,000, 15,000 and two of 10,000 fr. are offered by the Provincial authorities of Liège, for the best scheme or schemes for supplying the whole province with electricity from existing, or to be created, sources. Detailed particulars are obtainable from the Bureau du Gouverneur de la Province de Liège, Place St. Lambert, Liège.

PORTUGAL.—The Commercial Secretary to H.M. Legation at Lisbon reports that there are many schemes for the utilisation of water-power in Portugal. The largest is that on the Douro, estimated at 350,000 h.p. The total water-power available in the country is said to exceed 600,000 h.p. The most important station working is that in the Serra da Estrella, which supplies power to wool manufactories, lights various small towns, and is used for the manufacture of carbide of calcium. The names of many hydro-electric stations are given in the *Board of Trade Journal* for September 22nd; they include the Fabrica de Fiação e Tecidos do Rio Viza Negrelos, 3,000 h.p.; the Empresa de Electricidade da Guarda, 4,000 h.p.; and the Empresa Hydro-Electrica da Serra da Estrella (to be shortly enlarged to 3,000 h.p.), 500 h.p. One of the difficulties met in all these water-power schemes is that the flow of water is very low in summer owing to the prolonged drought, while in winter there are apt to be floods. There is no doubt that hydro-electric power is going to be very much developed in Portugal.

FRANCE.—The price of coals to electricity works fixed by the Ministry of Public Works, in the 21 departments of France, for the second quarter of the year, ranges from 99 fr. per ton (the lowest), in the Département du Nord to 238 fr. in the Département de l'Orne (the highest); the price in four other departments ranges about 200, and in five departments about 150, the remainder being intermediate quotations.

The official examination has just been made of the joint scheme of distribution networks for the Communes of Soturac and Tournac in the department of the Lot. The networks will be served from two existing works in the Sector of Fumel, and the current will be supplied for lighting, motive power, and agricultural and irrigation purposes. The estimated cost for installation of the 3-phase, 500-volt line, three transformers 5,000/215/125 V, and three secondary networks totals 11,000 fr. It being a purely agricultural scheme, the promoters are entitled to a Government subsidy of one-third of the outlay. The energy is to be supplied at 1.50 fr. per kilowatt hour for lighting and 0.80 fr. for power.

AUSTRIA.—The Steirische Wasserkraft und Elektrizitäts-Aktiengesellschaft has been formed at Graz, with a capital of 20,000,000 kronen, for the development of the water resources of Steiermark and neighbouring territories for the generation of electric current for their own use and that of third parties, the formation of, or joining with, other companies for like purposes, &c.

Enniscomthry.—**ELECTRICITY SCHEME SANCTIONED.**—The Urban Council has now received permission to proceed with the electric lighting scheme.

Glasgow.—**ELECTRIC COOKING.**—The Corporation Propaganda Sub-Committee has received a report from the manager that a large number of inquiries have been made at the show-rooms for the hire or hire-purchase of electric cookers, and it is explained that the cost of a cooker suitable for hiring out is £12 10s., and the cost of wiring for it is £5 10s., or a total of £18 per cooker. The sub-committee, after considering the proposal, has agreed to recommend that the manager be authorised to purchase 100 electric cookers, and that it be remitted to him to report as to the charges to be made for the hire or hire-purchase of those cookers.

We are informed by Mr. R. B. Mitchell, engineer and manager, that the price at which the cookers will be let has not yet been decided, but it will probably be in the region of £2 per annum or 10s. per quarter. This new venture on the part of the electricity department deserves every encouragement, and cookers of the type to be hired can be seen on the department's stand at the Ideal Homes Exhibition in the Kelvin Hall, where demonstrations of the use of the apparatus are being given.

Gravesend.—**EXTENSION.**—The extension now practically complete is the first of two which were put in hand in 1919. The first would have been completed twelve months ago but for delays on the part of the contractors supplying the necessary plant and other details. The extension has been carried out to the specifications of Mr. C. F. McInnes, M.I.E.E., the borough electrical engineer. The steam turbine is of the British Thomson-Houston Co.'s "Curtis" multi-stage type with direct coupled exciter, oil settling tank, and cooler mounted together with the alternator on a combined foundation. The alternator, also manufactured by the British Thomson-Houston Co., is of the revolving field type coupled direct to the horizontal shaft of the turbine by a flexible coupling. The turbo-generator is designed for an output of 2,000 kW at a power factor of 80 per cent., speed 3,000 r.p.m.; periodicity 50 3-phase at 6,600 volts. It is also capable of a 2,500-kW overload output without undue temperature rise. The condensing plant, supplied by Messrs. Worthington-Simpson, Ltd., includes a rectangular four-flow condenser with air, circulating and extraction pumps, mounted on a bedplate together with a 65-b.h.p., a.c. three-phase motor. The circulating water is obtained from an artesian well immediately below the pump, which was bored to a depth of 250 ft. by Messrs. R. D. Batchelor & Sons, Chatham; it supplies approximately 2,000 gallons per minute at a temperature of 53 deg. F. The extraction pump delivers into a 3,000-gal. hot well tank situated on the south side of the works. The feed pump is of the Holden and Brooke well-known "Sirius" rotary type, direct coupled to a d.c. 30-h.p. motor. The conveying plant was supplied and erected by Messrs. Edward Bennis & Co., of Little Hulton; it has been designed with a view to supplying the new boiler house plant now being erected in addition to the existing boiler house needs. The 750-kW rotary converter and transformer, supplied by the Metropolitan-Vickers Electrical Co., Ltd., is of the 6-phase self-synchronising type with a pony motor for starting purposes. The transformer for works power motors was supplied by the British Electric Transformer Co., Ltd. The switchgear extensions were manufactured and supplied by the British Thomson-Houston Co., and include an alternator panel with Tirrill regulator, bus bar section, rotary and works panel equipments. There is some detail work still incomplete, but the necessities of the load make it advisable to put the plant in operation without further delay. The second extension now in hand, but incomplete, includes a battery of two Thompson boilers with superheaters, automatic stokers, economiser, chimney stack and fans, rotary feed pump and other accessories. It also provides for a turbo-generator, switchgear, &c., and it will be remembered that after sanctioning the scheme as outlined above the Electricity Commissioners asked the Corporation to substitute a 5,000-kW turbo-generator for the 3,000 one originally contemplated. The 1,000-kW British Thomson-Houston turbo-generator with condensing plant by the Mirreles Watson Co. erected early in 1915 has supplied the total load of the station since first put into commission, dealing with at times as much as 1,500 kW. It has run almost continuously, only being shut down for a few hours on rare occasions between midnight on Saturday and 8 o'clock on Sunday morning. By the invitation of the chairman of the Electricity Committee (Coun. R. L. Priestley) a number of visitors inspected the extensions on September 26th.

Keith.—**ELECTRICITY SCHEME.**—Mr. McEwan, consulting engineer, estimates the cost of introducing electricity to the town at from £10,000 to £12,000. The gross revenue return would be £4,500. Rates suggested were from 10d. to 1s. per kWh for lighting and from 8d. to 4d. per kWh for power.

Melton Mowbray.—**PRICE REDUCTION.**—The Electric Light Co. announces that owing to the recent reduction in the cost of coal, &c., a special discount of 10 per cent. will be allowed on all electricity used for power and heating after September 30th.

Navan (Meath).—**STREET LIGHTING.**—The Council has decided to light the central parts of the town with electric light supplied from Messrs. Spicer's batteries, and the other parts with gas, provided the Navan Gas Co. comes to what the Council considers reasonable terms, or oil. It has been suggested

that Messrs. Spicer's premises be acquired along with the plant and the customers taking a supply of electricity from that firm be taken over. The previous scheme was that the energy should be taken from the Blackwater (Mr. Elliott's) saw mills. A special committee is now dealing with the matter.

Nenagh.—**INADEQUATE LIGHTING.**—At a special meeting of the Council, last week, it was decided that unless the Nenagh Gas & Electric Supply Co. complied with the request of the Urban District Council to light the streets properly under the new scheme, and also kept a certain number of lights switched on during the night, the Council would take steps to protect its interests and restrain the company from supplying electricity for illuminating purposes within the town.

Perth.—**WAGES DISPUTE.**—Recently a strike at the Corporation electricity works was narrowly averted, the question in dispute being the grading and payment of the technical staff. Last week the convener of the Electricity Committee, the electrical engineer, and the deputy town clerk had a meeting with the Scottish Joint Board for the Electricity Supply Industry, when a representative from the employers' side and one from the employees' were appointed to inquire into the duties of the men concerned.

Portrush.—**NEW STATION.**—The Urban District Council has started work at its generating station and on the laying of mains. It is hoped to have this new undertaking in running order by March, 1922.

Ripon.—**WATER POWER.**—At the meeting of the Electricity Committee a letter was read from Messrs. Vickers, Ltd., offering to submit for a nominal fee a report, together with estimate, specification and drawing as to the possibility of generating electricity by water power for the city. A sub-committee was asked to report on the relative advantages of utilising water or steam power.

Rochdale.—**PRICE REDUCTION.**—Owing to reductions in the price of coal and in wages the Electricity Committee suggests a reduction in the price of energy for lighting purposes from 8d. to 7d. per kWh, and it also recommends that the rent of hired meters to all classes of consumers be reduced by 25 per cent.

Shaldon.—**ELECTRICITY SCHEME.**—The Urban Council has asked Messrs. W. & J. Purves, the promoters of an electricity scheme for Teignmouth, to limit the time for commencing the supply of electricity to Shaldon to three years, instead of four. The difficulty in the way is the cost of a submarine cable across the river, and Messrs. Purves are willing to carry this out within four years, and in default to give the Council the option of having Shaldon removed from the area of supply.

South Africa.—**JOHANNESBURG.**—For a considerable time past consumers have not been charged for the full cost of service connections, but in view of the fact that the gas and electric supply department's vote for service connections for the current financial year has been reduced from £20,000 to £2,000, the Council has decided that in future the whole cost, including all material and labour, shall be charged to the consumer.

NEW PLANT.—The Municipal Council is to invite tenders for two or more second-hand boilers having an approximate total capacity of 3,400 kW; one large cooling tower, circulating water piping, &c.; and converting plant, it being estimated that the total cost will be about £47,000.

The Council has in course of preparation a scheme and estimate for a large new generating station, making provision for future extensions as the town grows, up to an approximate total of 54,000 kW of plant, to be installed from time to time as the needs of the town necessitate.

Southport.—**EXHIBITION.**—An exhibition of electrical appliances is being held in the Cambridge Hall, under the auspices of the Electricity Committee.

Southend-on-Sea.—**LOAN.**—Regarding the application for a loan of £14,873, for additional plant at the electricity works, the Commissioners advise the Council to obtain from a consulting electrical engineer a detailed report upon the engineering and financial position, and upon the further development of the undertaking, and state that they have deferred the further consideration of the Corporation's application until such time as the report is available for their perusal.

St. Annes-on-Sea.—**YEAR'S WORKING.**—The statement of accounts of the Urban District Council's electricity undertaking for the year ended March 31st, 1921, shows that the revenue for the year was £35,834 (compared with £27,546 for the previous year), and the working expenses amounted to £23,651 (£19,310). Mortgage interest absorbed £1,368; debt redemption £3,295; and bank interest £843, which leaves a net surplus of £2,526 that has been transferred to the reserve fund to the credit of which £2,951 stood at the close of the year. During the year £1,761 was transferred to the credit of the sinking fund from the net revenue account. The number of kWh sold during the year increased by 21.3 per cent. to 1,523,985, and the number of consumers increased by 304 to 2,513.

Stirling.—**PRICE INCREASE.**—The Town Council has increased the charge for electricity for heating from 2d. to 3d. per kWh, as from October 1st.

Southport.—**NEW PLANT.**—Prior to leaving Southport to take up a similar position at Ipswich, Mr. A. S. Black, borough electrical engineer, reported to the Electricity Committee that the scheme introduced by him in 1914 had now so far been completed that the whole of the old plant had been shut down and the town was supplied entirely by new plant. The latter had been tested and showed that the steam consumption was better than that anticipated by the makers, and the coal consumption showed a further saving than the 31 per cent. estimated by him. The old plant was heavily overloaded, and it was necessary to purchase energy from the Lancashire and Yorkshire Railway Co., and the Birkdale Electric Supply Co. It was also necessary to pay additional interest and sinking fund on money paid for the new plant before it earned any revenue. Mr. Black urged the Committee not to jeopardise the new plant by reducing the staff or placing it under the care of persons not properly qualified. Immediate steps, he said, should be taken for the installation of additional plant for the winter of 1923. The order for the new plant should be placed before the end of the year, so as to be ready for the summer of 1923. He also urged that the scheme for the utilisation of half-watt type lamps in place of arc lamps should be proceeded with without delay.

PRICE REDUCTION.—The Works Sub-Committee of the Electricity Committee has recommended a 25 per cent. reduction in the electricity charges in view of the savings which had been effected by the installation of new plant. The Electricity Committee, however, thought a prudent course would be to wait until the appointment of the new borough electrical engineer before making any revision in the charges. It seems probable that a reduction will be made before the end of the year.

YEAR'S WORKING.—The annual report of the Electricity Committee shows a gross profit for the year ending March 31st of £20,910, and a net profit of £1,759. The total increase in the expenditure over the previous year was £12,515, made up of the following items:—coal £3,734, wages £2,858, rates and taxes £1,419, charges £975, interest and sinking fund £3,529, mainly for new plant not completed and earning no revenue.

Tisbury.—**ELECTRICITY SCHEME.**—The electric light scheme has come to a successful issue, a limited company formed for the purpose of lighting the town proceeding to allotment on September 19th. Mr. E. Doran Webb and Mr. W. W. Kendall were appointed local directors, with Mr. Robert Lush as local secretary, the other directors being Mr. Pippard (of Messrs. Edmundson's), and Mr. A. B. Randall (Salisbury Electric Light Co.), the latter also acting as registered secretary. Messrs. Edmundson's tender for the installation was accepted, and it is hoped to complete the work by the end of November.

Tuam (Co. Galway).—**PUBLIC LIGHTING.**—The Town Council has accepted the tender of the local Electric Lighting Co., for the lighting of the town at last year's price, £4 per lamp of 200 candle power.

Tynemouth.—**PUBLIC LIGHTING.**—The Corporation has asked the electrical engineer to consider a suggestion that steps should be taken to light the whole borough with electricity, and report thereon to the Council.

Worcester.—**COOLING TANK AND SWIMMING BATH.**—The City Council has several schemes for providing work for the unemployed, one being the construction of a cooling tank for the Electricity Committee on the New Road recreation ground. Mr. W. J. Hill, the chairman, states that the committee is concerned about the cooling of the water used for condensing purposes. That water is pumped from the Severn, and the idea is to use the water again should there be a failure of the pumps. The electrical engineer has conceived the idea that a cooling tank might serve another purpose, and has arranged that the tank shall be the size of a swimming bath (100 ft. by 28 ft.).

Wilton-on-the-Naze.—**WATER POWER.**—Referring to the note in our issue of September 16th, we understand that Mr. E. W. Dorey, who is advising the Council with regard to the installation of additional gas-engine-driven generating plant and other extensions, has no knowledge of any water-power proposals in connection with the town.

Yarmouth.—**YEAR'S WORKING.**—The auditor's report states that the net revenue account for the year (after providing for depreciation on transformers, meters and private lamps £1,300) shows a profit of £2,006, and after deducting the deficiency to March 31st, 1920, viz., £1,699, leaves a credit balance to carry forward of £306. It appears that a portion of the stores stock has been taken into account at market value, which is in this case in excess of the cost. During the year several adjustments have been necessary in the charges for electricity, due to past errors in the reading of meters. An improvement on the original system of account rendering has already been instituted by which it is hoped to obviate further errors.

TRAMWAY AND RAILWAY NOTES.

Birmingham.—**EXTENSIONS.**—The Corporation proposes to spend a quarter of a million pounds, at once, on schemes for providing work for the unemployed, from whom a deputation addressed the Council last week. Important schemes for the improvement of the permanent way of the electric tramways, as well as extension schemes, are to be got on with immediately, and it is also hoped to have in operation early in the new year a railless tramway system on the Nechells route. The cost of reconstructing the present permanent way would be £90,000, and that of installing the new system £34,000. Apart from this saving in capital expenditure there will be an estimated profit on the working of railless vehicles (collecting energy by means of an overhead arm) of £3,122 per annum, after paying interest and sinking fund on the new capital required, as against a loss of £3,340 in the case of a tramway service.

Coventry.—**YEAR'S WORKING.**—There was a deficit on the past year's working of the electric tramways of £13,514, and it is recommended that this sum be met from the rates.

China.—**TIENTSIN.**—The report of the Compagnie de Tramways et d'Eclairage Electrique de Tientsin for the year ending December 31st last has just been issued. It shows that although on the tramways section the number of passengers carried during the twelve months increased from 40,540,000 to 42,810,000, the advance in receipts was only 2.7 per cent. owing to the loss on exchange of the "copper cents" money used by the inhabitants. As regards the supply of energy for lighting and power purposes, the receipts from this source show an increase of 22 per cent., the number of lamps connected up, in terms of 10 c.p., having advanced from 212,500 to 253,500; energy was also being supplied for power purposes to the extent of 370 kW, as compared with only 220 kW at the end of the preceding year. During the twelve months 20 new motors for trams were ordered, while orders have recently been placed for 35 trailer car chassis, the bodies for which will be built in the company's own workshops in Tientsin. At the power station two new boilers and a 3,000-kW turbo-alternator are being installed, which, when completed, raise the capacity of the plant to 9,000 kW.

Continental.—**ITALY.**—A beginning with the electrification of the Italian State Railway network has been made, by the invitation of the Railway Administration for tenders from private firms, for the Milan to Bologna section. The tenders comprise the furnishing of materials and energy, and also all the accessory works. The railway will be equipped with two supply lines, a primary and a secondary; the former carrying current at 60,000 volts, and having transformer sub-stations at Lodi, Piacenza, Borgo S. Donorino, Parma, Reggio, Emilia, and Modena; the works for the secondary line exclude the setting up of the contact wires and insulators, which will be carried out by the railway staff. Two telephone lines are also to be erected, one consisting of two wires and the other of four wires, each with its separate posts. The Administration reserves the right to modify any parts of tenders in order that use may be made of material, such as insulators or copper wire, which may be in their possession.

The Italian Government has nominated a Commission to study, with the co-operation of the Ministry of Telegraphs and Telephones, the causes and remedies for the disturbances produced by the electrification of the main railway networks.

SPAIN.—La Sociedad Madrileña de Tranvías has recently applied for a concession for the construction and working of two further lines of electric tramway in Madrid.

SWITZERLAND.—After ten years' work the boring of the second gallery of the Simplon Tunnel, which is 21,570 yards in length, has been completed, says the *Evening News*.

Glasgow.—**REPAIRS.**—The Tramway Committee has asked the manager to report as to the expediency of the department undertaking the whole of the winding of armature coils required by it.

Preston.—**LOAN SANCTIONED.**—The Tramway Committee has received sanction from the Ministry of Transport to borrow £950, repayable in 20 years, in respect of the provision of new switchgear at the Crown Street generating station.

Yarmouth.—**YEAR'S WORKING.**—The Corporation reports a loss of £3,000 on the tramway undertaking during the past year.

TELEGRAPH AND TELEPHONE NOTES.

Canada.—**WIRELESS DEVELOPMENTS.**—The Fort Norman oil fields and other points of the Far North-West will soon be in direct communication with the rest of the world, if the plans of an Edmonton firm materialise. This firm has been granted a Federal licence to construct a commercial wireless plant for this purpose; Marconi equipment will be used under experienced operators, and it is expected that the system will be in operation by early spring.—*Reuter's Trade Service* (Edmonton).

China.—**WIRELESS STATIONS.**—The supplementary agreement signed at Peking on September 19th is expected to make effective the contract between the Federal Wireless Telegraph Co., an American concern, and the Chinese Government for the erection of wireless stations at Shanghai, Harbin, Hankow, and Peking. When the contract was signed last January Britain, Japan, and Denmark protested on the ground that it infringed certain concessions. The supplementary agreement solves the problem by providing a bond issue to finance the project.—*Daily Mail.*

Empire Wireless Chain.—The Leafeld Wireless Station in Oxfordshire, the British end of the Imperial Wireless Chain, which was formally opened by the Postmaster-General on August 18th, has been subjected to tests and will begin regular work on October 1st.

The Cairo station, the next link in the chain, will be completed before the end of the year. It is intended to push ahead with the Imperial wireless scheme as quickly as possible. Experts who have been considering the scheme are expected to produce the plans for other stations in November, and when these have been approved, orders for eight or ten of the stations will be placed without delay, says *The Times*.

Italy.—**TELEGRAPH EXTENSIONS.**—The *Gazzetta Ufficiale* publishes a decree authorising the expenditure of 150,000,000 lire on the systematisation and improvement of the urban and interurban telegraph and telephone networks. A further 16,000,000 lire is authorised for the erection and systematisation of the telegraph and telephone lines along the railway tracks in course of electrification, namely, the Turin-Susa, Turin-Chieri, Turin-Ronco, and the lines entering Voghera.

Uruguay.—**TELEPHONE CONTRACT.**—It is stated in the *Review of the River Plate* that the Montevideo branch of the Siemens Schuckert Co. has addressed a note to the National Council of Administration asking for an extension of time to enable it to present a proposal for the construction of the subterranean telephone system (the contract for which was understood to have been virtually awarded to the Westinghouse Co.). The Siemens Schuckert Co. states that it could do the work for five million dollars (Uruguayan gold) and thus save the State two millions. The proposal is said to be receiving careful consideration.

North Africa.—**NEW WIRELESS STATION.**—The building of the wireless station at Ain-el-Hadjar, near Saïda, on the railway line from Perregaux to Colomb-Béchar, has just been started by a detachment of military engineers. This station, which will be the most important in North Africa, is intended to form the wireless link between France and her African colonies, and, in case of a breakage of the undersea cables, to undertake the forwarding of telephone messages between France and Algeria.

Poland.—**NEW WIRELESS STATION.**—A contract has just been signed by the Polish Ministry of Posts and Telegraphs and the Radio Corporation of America for the construction in Poland of a very powerful wireless telegraph station. The new station will be built at Warsaw, and the system utilised will be that employed for trans-oceanic communication by the Radio Corporation. The transmitting wires, which will be over three kilometres in length, will be supported by ten towers, 120 metres high each; the station will be equipped with 200-kW high-frequency alternators. The normal range of transmission will be 4,000 miles. The cost of the station is fixed at 3,000,000 dols.; it will be ready to start in 1923.

The Baltic.—**WIRELESS TELEPHONY.**—Representatives of the Copenhagen Press had an opportunity on September 25th of talking by means of wireless telephony with the island of Bornholm, in the Baltic, from the wireless station at Lyngby, about seven miles from Copenhagen, says *The Times*.

The Telephone Service.—**NEW LONDON EXCHANGE.**—A new public telephone exchange to be known as the "Minorities" was opened at 98, Mansell Street, Minorities, E.1., on September 24th. The equipment is of the central battery type, and the exchange, which has a capacity of 2,000 lines, will largely relieve the Avenue exchange, and in a lesser degree the London Wall exchange. On Saturday last 800 lines were transferred from the Avenue, 56 from London Wall, and 13 from Bank exchanges, and other batches of lines are to be transferred at a late date.

Wireless Telephony in the Air.—The wireless telephone trials on board the aeroplane "Immatriculé-au-bleu," belonging to the Société Nationale des Transports Aériens, which have been going on since September 21st, have proved successful. On September 21st, the machine left Croydon and remained continuously in communication by wireless telephone with that aerodrome. When the machine arrived over the Channel, it ran into a thick fog, and asked its way so as to be able to fix its position, and Croydon sent out directional messages every two minutes. Both questions and answers were carried out by wireless telephone, and after two directions had been given the pilot was able to regain the direct line with Croydon and to maintain it in spite of the fog.

The trials were repeated on September 22nd, on a line between Croydon and Brussels, and on September 23rd, between Brussels and Paris with conspicuous success. The experiments were to be continued.—*Reuter's Trade Service (Brussels).*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Argentina.—October 21st. State Railways. Twelve months' supply of electrical stores.*

November. State Railways. One year's supply of railway signal material, including telephone and telegraph materials, &c.*

Australia.—**MELBOURNE.**—Victorian Government Railways. October 26th. D.C. arc welding plant (Cont. No. 34,371). Armature banding machine with electric motor and starting gear (Cont. 34,378).

November 2nd. Electric storage battery complete for automatic telephone exchange (Cont. 34,229).*

January 4th. Victorian Government Railways. 150 electric train stops operated by a single-phase induction motor. One set of electric pyrometer equipment for measuring temperatures of 350 to 2,000 degrees Fahrenheit.—*Reuter's Trade Service (Melbourne).*

Belgium.—October 4th. The Service d'Electricité des B.M., 11, Place des Gueux, Brussels. An electrically-operated pump at the Brussels Military School.

Colne.—October 11th. Electricity and Tramways Department. Natural draught cooling tower. (See this issue.)

Edinburgh.—October 10th. Corporation. Electric lighting installation at the city collector's offices, Waterloo Place. Engineer's office, Dewar Place.

October 10th. Tramways Department. Sixteen car bodies. Tramways manager, 2, St. James Square, Edinburgh.

Fife.—Fife Education Authority. Electric lighting work in connection with new school at Crossgates. C. R. Douglas, surveyor, 15, East Port, Dunfermline.

Italy.—The Italian Admiralty authorities at Castellamare have invited tenders for the supply of three sets of steam engines and alternators, each of 180 kW capacity, for the power station at the Castellamare dockyard.

October 6th.—The Italian State Railway authorities. Rome. 50,000 zinc electrodes and 50 tons of copper piping.

London, E.C.—October 5th. East Indian Railway Co. Bare copper strip and wire. (See this issue.)

Loughborough.—October 31st. Electricity Department. Steam-raising plant, h.p. and l.p. mains networks. (September 23rd.)

Portrush.—October 8th. Urban District Council. Work in connection with the public electric lighting of the district. (See this issue.)

New Zealand.—**WELLINGTON.**—November 20th. Public Works Tender Board, Mangahao power scheme. Water wheels, generators, 3-unit exciters, transformers, 110,000-V insulators, lightning arresters, switchboard, switches, and accessories. (September 23rd.)

November 21st. Post and Telegraph Department. 750 red and 750 white switchboard cords, 3 conductor (spec. No. 87).*

Nottingham.—October 21st. Electricity Department. Three 10,000-kW turbo-alternators with exciters, condensers, auxiliary plant, &c. One 1,000-kW combined turbo-generator-alternator with condenser, auxiliary plant, &c. Six water-tube boilers with mechanical stokers, superheaters, forced draught fans, &c. (September 16th.)

St. Annes-on-Sea.—Electricity Department. Four miles (approx.) armoured cable. (See this issue.)

South Africa.—**JOHANNESBURG.**—November 7th. Rand Water Board. Two 350-kW steam-driven electrical generating sets, complete with switchboards and all accessories.*

HUMANDORP, Cape Province. November 30th. Corporation. One water turbine and dynamo, switchboard with connections, battery of accumulators, and accessories, supply main and public lighting, aerial distributing lines, street lamps, fittings and accessories, section boxes, service cut-outs, meters, &c., ferro-concrete pipe line, reinforced concrete tank, buildings, and foundations. Forms, &c. (63s.) from the town clerk, Humandorp, Cape Province.

Workop.—Urban District Council Electricity Department. Supply and erection of an overhead transmission line, complete with underground connecting cables, distance approx. 2,200 yds., pressure 6,600 V. (September 16th.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.**Glasgow.—Tramways Committee. Accepted:—**

Section 1, Glasgow, for new trolleybus system at Pinkston.—Mr. Earlane, Strang
 500 p.m. for new car works.—Crompton & Co., Ltd.
 Armature works, J. R. Jackson & Co., Ltd. Manchester Armature Repair
 Co., The Armature Winding Co.
 Tenders and J. McLeish & Co., James Cookson, Ltd.
 for cable store at Dalmarock Depot.—Carrick & Ritchie.
 Electric battery truck.—Hendry Bros., Ltd.
 Tenders for a trolley and motor buses at Kiddle pumping station, £2,382.
 —Mr. R. Marshall.

London.—HAMMERSMITH.—Electricity Committee. Recommended:—

Platform and flooring for No. 2 engine room in connection with the installation of the first 10,000-KW generating set.—Sanders & Foster, Ltd., £805.

Sunderland.—The Corporation Tramways Committee at a special meeting disapproved of the Town Council deciding to purchase English rails instead of foreign rails as recommended by the Committee, and decided to resubmit its original recommendation that the foreign tender be accepted.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, October 1st, at the Royal Technical College, at 7 p.m. Lecture on "Ventilating and Dust-removing Plants," by Mr. J. E. Bradley.

Society of Engineers.—Monday, October 4th, at Burlington House, W., at 5.30 p.m. Paper on "The Winning of Lidal Lands in British Guiana," by Mr. G. O. Case.

Institution of Railway Signal Engineers.—Wednesday, October 5th, at the Strand Grand Hotel, at 7 p.m. Resumed discussion on "Problems of Automatic Train Control."

Chemical Society.—Thursday, October 6th, at Burlington House, W., at 8 p.m. Ordinary scientific meeting.

Junior Institution of Engineers.—Friday, October 7th, at the Caxton Hall, Westminster, S.W., at 8 p.m. Lecture on "Colour Vision and Colour Blindness," by Dr. E. Green.

Association of Engineers in Charge.—Saturday, October 8th, at the Holborn Restaurant, at 9 p.m. Annual dinner.

NOTES.

Electricity v. Gas.—Competition between gas and electricity, said Mr. D. Milne Watson, presiding at the annual conference of the British Commercial Gas Association at Glasgow on September 27th, was likely to be greater in the future. In view of the reorganisation of electricity supply under the Electricity Commissioners, they, as an industry, must be prepared to sell light, heat and power more cheaply or as cheaply as electricity. They had had enough of the vicious circle of rising prices and shrinking demand. Let them get the "virtuous" circle of increased sale, decreased cost of production, lower price, and increased sale going well, and they would soon solve the unemployment problem. Industry wanted financing, not subsidising.—*Daily Mail.*

Manchester Electro-Harmonic Society.—The first concert of this society for the 1921-22 season takes place on October 26th. The series will be held on the last Friday of the month from October to March. Those responsible for these concerts recognise that Manchester has a reputation as a musical centre which must be maintained so far as the electrical profession is concerned. They hope to have large membership support to assist them in their determination to that end. Any officials and members of the Electro-Harmonic Society (London) who happen to be in the Manchester district on October 26th are cordially welcomed to the concert. The artistes will be as follows: Soprano, Miss Gwladys Roberts; tenor, Mr. Wilfred Hudson; baritone, Mr. Bridle Peters; entertainer, Mr. Foden Williams; solo violin, Mr. Don Hyden; solo pianist and accompanist, Mr. Granville Hill.

Appointments Vacant.—Assistant electrical engineer (Rs. 690 per cal. month), for the East Indian Railway Co.; second assistant mains engineer (350 taels per month), second assistant sub-station engineer (350 taels per month, tael=3s), for the Shanghai Municipal Electricity Department. (See our advertisement pages to-day.)

The Structure of the Atom.—In the second column of our leading article last week the word "proton" was misspelled "proton" in two places. We are indebted to Major L. M. Sandison for drawing attention to the error.

End of Summer Time.—The Home Secretary gives notice that summer time will cease and normal time will be restored at 3 a.m. (summer time) in the morning of Monday next, October 3rd, when the clock will be put back to 2 a.m.

The Design of Bakery Machines.—In the last line but one of Mr. Ellerd-Style's letter on p. 402 of our last issue a misprint occurred: for 390 read 300.

An Electrically-driven Cargo Vessel.—The first electrically-driven ship built in Ireland, the 3,600-ton vessel *San Benito*, has just left the hands of Messrs. Workman, Clark and Co., Ltd., Belfast. Owned by the Unifruitco Steam Ship Co., Ltd., of Glasgow, she is designed for the banana trade, burns oil fuel, and is driven by a turbo-electric motor.—*Daily Mail.*

The Shipping and Engineering Exhibition.—The successful co-operation of employers and workers as exemplified at the Shipping, Engineering and Machinery Exhibition was celebrated on Tuesday last by a dinner at Olympia, over which Capt. H. Riall Sankey, president of the Institution of Mechanical Engineers, presided. Following the loyal toast, the Chairman said that the note of the gathering was one of hope for the engineering industry. They had met to commemorate the excellence of the exhibition, and a particularly pleasing feature was the amount of interest shown by the worker; one employer alone had sent 2,000 of his men to view the exhibits. Mr. W. A. Appleton (secretary of the General Federation of Trade Unions) proposed the "Success of the Engineering Industry" in a manner that proved his optimistic spirit. Revolutions had done nothing, he said, to place the control of industry in the hands of the workers. The design, production, and sales organisations were interdependent, and must react against any violent changes. The buyer was outside the political or commercial spheres, and they could only sell him their products by offering a better or cheaper article than the other fellow did. Operative engineers were amongst the most loyal members of the community. The exhibition was an example of successful co-operation amongst all ranks, and he was glad to say that the spirit of helpful co-operation was showing a tendency to spread.

Dr. H. S. Hele-Shaw, in reply, intimated that there was a growing hope of restoring pre-war prosperity in their industry. He saw signs that the pernicious idea which regarded this country as a watertight compartment that could manufacture, buy, and sell for itself was disappearing.

Mr. W. Reavell, M.I.Mech.E., proposed the success of "Shipping and Commerce," and Mr. T. Chambers (National Sailors' and Firemen's Union of Great Britain and Ireland), in responding, emphasised the need for co-operation if England was to regain her prosperity, and it gave him pleasure to see that there was a large and growing section of workers willing to extend that co-operation. The noisy people really did not count very much, and he believed that the future before this country was bigger than anything they had ever dreamed of. They were now at the bottom of the abyss, but there were signs of an upward movement.

Mr. W. H. Patchell proposed the health of Mr. F. W. Bridges, the organiser of the exhibition, which was specially honoured, and the toast of "The Chairman," proposed by Mr. G. Midgley Taylor, M.Inst.C.E., brought the proceedings to a close.

Educational.—BOROUGH POLYTECHNIC INSTITUTE, Borough Road, S.E.—The new session commenced on Monday last. Evening courses are held in electrotechnics and in wiremen's work. (See our advertisement pages to-day.)

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY (CITY AND GUILDS (ENGINEERING) COLLEGE), South Kensington.—Advanced course in electrical machinery and transformers. In connection with the full-time post-graduate course, which commences on October 4th, a series of 10 advanced lectures on transformer practice will be given on Thursday afternoons (4-5 p.m.), commencing October 13th, 1921, by Mr. A. P. M. Fleming; fee for the series, £4. Application for admission to be made to the Registrar. (See our advertisement pages to-day.)

CLEVELAND TECHNICAL INSTITUTE.—This institute was inaugurated at Middlesbrough on September 22nd by Sir C. A. Parsons, and its career will be watched with interest. First and foremost amongst its objects, says the *Leeds Mercury*, will be the encouragement of the continued technical education of the staffs and employees of the industrial works in the district. Well equipped lecture rooms, library, &c., have been provided, and a bulletin is to be published containing abstracts of all scientific papers which may be of use to the industries of the district. The Institute has established a technical intelligence service which it is hoped all firms and their staffs will make the fullest use of.

INSTITUTION NOTES.

The Society of Technical Engineers.—ITS POLICY SETTLED.—According to the *Journal of the Society* for September, the broad lines of its policy have at last been settled. The branches, in general meetings, have carefully considered the suggestions submitted to them by the Representative Council, and, with many useful comments, but without a dissentient note which would necessitate a reconsideration of essential principles, have agreed to a policy for the Society which will enable a forward move to begin at once with every prospect of a satisfactory result within the near future.

The task has been by no means easy of accomplishment, on account of the extreme delicacy of the various relations which have had to be taken into account. "These included the relations between the technical engineer and his employer on the one hand, and between an organised body of technical engineers and the organised employers on the other. They included also the no less delicate relations between the technical engineer and the manual workers associated with him in his own firm, and between organised technical engineers and the unions of the manual workers. Moreover, apart from these

external relations, those which subsist between technical engineers and technical engineers, both within and without their respective firms, are delicate enough in themselves to render the construction of a society of technical engineers a task which might well give pause to the most fervid and optimistic.

The policy of the Society is summarised as follows:—

1. The Society has recognised and agreed that its objects fall into two groups: The first, objects connected with the interests of individuals and of the profession; the second, those connected with the advancement of the British engineering industries.

2. In the next place it has been decided that in every action taken to secure any of the objects in the first group, i.e., the interests of individuals and of the profession, consideration will be given to the effect of any such action on the firm to which the members concerned belong, and also that the interests of the industry in general shall be kept in mind.

3. Lastly, we have come to decisions as to our relations with employers on the one hand and with the manual workers on the other. In regard to the former the Society will attempt to establish communications with employers and with organised employers in pursuit of both groups of its objects. In dealing with the manual workers, however, while the Society will not associate itself with the labour movement, nor seek to join the Trade Union Congress, nor make common cause with the trade unions of manual workers, even with those connected with the industry, in pursuit of improved conditions of service, it will, nevertheless, most earnestly seek to find some means of co-operation with unions of manual workers, connected with the industry, in pursuit of the second group of its objects, namely, those concerned with efforts to secure the advancement of the engineering industries of the British Empire.

"These being our decisions, it follows that the policy of the Society is, for the present, to secure that technical engineers shall occupy and preserve a position intermediate between employers and workpeople, both within the firms with which they are associated and in relation with the organisations of employers and the organisations of manual workers. For our Society wishes to see the establishment of Joint Councils of Employers and Technical Staff, in suitable firms, and hopes that such Councils will, in the course of time, come to discuss not only questions touching the conditions of service of the staff, but also questions of technical engineering interest. The Society would also welcome the constitution of Joint Committees of technical staff and manual workers to consider means whereby the industry might be advanced."

Having now a defined policy, the Executive Council will proceed to complete the membership of the Society as soon as possible. Unless, and until, the Society can claim to represent a majority of technical engineers in any department of engineering, it will not be possible to make an effective case for being heard in such debates and discussions as may arise regarding the reconstruction of the machinery for the management of the industry. It will be necessary also to put forward a definite classification of the different groups of men whom the Society represents, and this difficult question of classification will, perhaps, be the next piece of detailed constructive work to which attention will be devoted.

Edinburgh Electrical Society.—The opening meeting of the third session of the Society is to be held this evening at the Philosophical Institute, when Mr. W. E. Townsend is to deliver a lecture on "Magnetic Clutches." The following items are included in the syllabus of the session:—

- October 14th.—"Electro-chemistry," by Mr. R. W. J. Stark.
- October 22nd.—Visit to Niddrie and Benhar Colliery.
- October 28th.—Questions and Answers night.
- November 11th.—"Some particulars regarding C.T.S. Cables," by Mr. D. L. Frew.
- November 25th.—"Manufacture of the Modern Electric Lamp," by Mr. A. S. Black.
- December 8th.—"Chat on Wireless," by Mr. A. Whiteley.
- December 23rd.—"Watt on Wheels (Automobiles and Accumulators)," by Mr. E. O. Catford.
- January 13th, 1922.—"Chat on Storage Batteries as Applied to Electric Traction," by Mr. L. Brookman.
- January 27th.—"Some Notes on Country House Plant," by Mr. T. S. Munnoch.
- February 10th.—Apprentices' night. Short papers on "Plant or Installation Work," for the Society's prize.
- February 24th.—"Some Experiments in Electrical Sound Detecting," by Mr. B. A. Pilkington.
- March 10th.—"Installation Work," by Mr. T. M. Buist, or "Fault Localisation," by Mr. D. M. Buist.
- March 24th.—"Magnets," by Mr. J. McEwan Brown.
- April 7th.—"Notes on a.c. and d.c. Plant," by Mr. J. Walker.
- April 22nd.—Visit to Walkburn Hydro-electric Works.
- May 5th.—Annual meeting.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Hammersmith B.C. Salaries and Wages Committee recommends that Mr. J. A. Wood, engineer-in-charge at the electricity works, be promoted to the position of assistant engineer in the boiler house, to act as boiler-house superintendent, at a salary of £675 (variable) per annum.

"SIR CHARLES BRIGHT & PARTNERS" is the style of a new firm of consulting engineers which has recently been formed, its members comprising Sir Charles Bright, F.R.S.E., M.Inst.C.E.; Mr. A. Hugh Seabrook, M.I.Mech.E., M.I.E.E.; Mr. A. J. Stubbs, M.Inst.C.E., M.I.E.E.; and Lieut.-Col. H. W. Woodall, C.I.E., M.Inst.C.E. Most of these gentlemen are already well known to our readers. Sir Charles by virtue of his labours in connection with submarine telegraphy and other branches of electrical communication; Mr. Seabrook as the former borough electrical engineer at West Ham and St. Marylebone, in which capacity he was noted for initiative and ability—both technical and commercial—as well as an authority on questions relating to the combustion of fuel; Mr. Stubbs as the late assistant engineer-in-chief to the Post Office, London, where he acquired a wide experience not only of the technical and commercial aspects of telegraph and telephone engineering, but also of staff organisation, accounting, contracts, &c.; while Lieut.-Col. Woodall, trained as an electrical engineer, is a director of and consulting engineer to gas and water companies. It will be seen that the firm presents a unique combination embracing both gas and electrical experts, a feature which is of importance in view of the probable co-operation of gas and electricity supply authorities in the future, with a view to making the best possible use of coal by carbonisation and gasification. The firm is specialising in advice upon the construction of plant in connection with telegraphs, telephones, wireless, and allied industries; also in the design and construction of power plant, including steam, gas, electricity, water-power, and oil. In connection with this work it makes a special study of the utilisation of low-grade fuels, such as lignite and peat, and the utilisation of carbonaceous materials hitherto regarded as waste products, for the production of power, holding strongly that the future generation of power, whatever form it takes, will be largely by a combination of gas and electricity. In addition to these special subjects the firm advises upon all civil, mechanical, and electrical engineering matters. We offer a cordial welcome to the new concern, and our best wishes for its success. The address of the firm is 146, Bishopsgate, E.C.2.

Mr. LEONARD ANDREWS, M.Inst.C.E., M.I.E.E., who has been engaged during the past three years in the equipment of three of Messrs. Johnson, Matthey & Co.'s factories with new and modern machinery, has now made arrangements for undertaking other private work whilst continuing to assist the firm in a consultative capacity. Since resigning his appointment as borough electrical engineer at Hastings some 19 years ago, Mr. Andrews has acquired a great variety of engineering and commercial experience, both in this country and abroad, with the object of qualifying for practice as a consulting engineer, and he has now opened an office at 101, Victoria Street, Westminster, S.W.1, for this purpose. His exceptional experience in connection with switchgear, internal-combustion engines, &c., should stand him in good stead, and we cordially offer him our best wishes in his new rôle.

At the Rotherham Technical Institute and School of Art last week, Mr. E. CROSS, chief engineer and manager of the Corporation electricity undertaking, was presented with a gold watch, and Mrs. Cross with a gold wristlet watch, in recognition of their services, and as tokens of respect. The gifts were subscribed for by the consumers of electricity in the borough and the staff of the Corporation Electricity department. Ald. D. L. Winter made the presentation. Mr. Cross, in expressing his thanks, spoke of the services of Ald. Winter, as chairman of the electricity department, and of the assistance rendered to him by his staff. He said that during the last 12 months they had coupled up about 500 new customers, or over 20 per cent. increase. Electricity was the poor man's light just as much as the rich man's. Out of the 500 coupled up last year 400 were workmen's houses.

Mr. PHILIP H. COLE, engineer-in-chief and general manager, resumed charge of the Shanghai Mutual Telephone Co., Ltd., on July 25th.—The British Chamber of Commerce Journal, Shanghai.

The Southport Electricity Committee received 150 applications for the position of borough electrical engineer, and a sub-committee has reduced the number to eight. The final selection was to be made yesterday.

It is announced that the Rt. Hon. EVELYN OGBIL, M.P., is making a short stay in Berne in connection with the Telephone Committee inquiry, and that Mr. W. W. Cook, the assessor to the Committee, has left for Canada and the United States to report on the conditions there.

Officials and staff of St. James electric tramways met, last week, for the presentation of a gold watch and smoker's outfit to their traffic manager, Mr. GEORGE W. WOOD, in recognition of 23 years' service. Mr. H. W. LAIN, general manager, presided, and Mr. J. J. Wilkinson made the presentation, as the oldest member of the traffic staff.

The marriage took place, at Stafford, on September 22nd, of Mr. JOHN CLEMENT ELLIS, electrical engineer, of Alington, Market Drayton, and Miss Dorothy Searlett, of Stafford.

Mr. W. E. ROBINSON, who is retiring after 39 years' service from the staff of the Western Union Cable Co., Penzance, has been presented by his colleagues with a silver salver.

Obituary.—COMMODORE E. SUENSON.—We regret to record that Commodore Edouard Suenson, who was so well known to telegraph authorities in all parts of the world, died at Copenhagen on September 21st. He was born in 1842, and was a son of the late Admiral Suenson, known to the outside world

through his skill in leading of the Danish fleet in the naval battle off Hongkong during the war of 1864 between Denmark and Germany. After having attained the rank of lieutenant in the Danish Navy, Suenson served three years in the French Navy, taking part in the French expedition to the Far East against Korea, after which he was, on his return to Denmark, appointed Naval Attaché to the First Sea Lord of the Danish Admiralty, but when in 1870 the Great Northern China and Japan Cable Co. was formed—later on amalgamated with the present company under the name of the Great Northern Telegraph Co.—with a view of laying submarine cables in the Far East, Lieutenant Suenson—as he was then—was asked to join the company for the purpose of proceeding to the Far East as its general manager there to make the necessary arrangements for the landing and laying of the first telegraph cables between Hongkong-Shanghai, Nagasaki and Wladivostok. On his arrival at Hongkong Lieutenant Suenson was soon able to arrange with the British Colonial Government for a suitable landing place for the first cable at Deep Water Bay with right to connect it by a landline, suspended on the Government's own telegraph poles, to an office at Victoria, the main town of the island, but at Shanghai he



THE LATE COMMODORE E. SUENSON.

met with the greatest difficulties from the very beginning, and it required all his skill to overcome them. The European merchants of all nationalities which were established there were anything but delighted at the thought of getting the telegraph introduced in China, as this would put an end to, or at all events limit, the large speculation going on there, and would also deprive the richer merchants of the advantage they had over their poorer *confères* by dispatching their quick sailing steamers to Singapore for the latest news of the state of the European markets.

The natives in and round Shanghai were also strongly prejudiced against the telegraph, having only a few years before destroyed a private telegraph line almost before it was finished, owing to their belief that "Fungshui," the Chinese personification of Nature, was quite against any article protruding into the air, and this superstition had just then been one of the causes of a severe riot at Tientsin, where some Frenchmen having there had erected a church with a high spire on one of the hills of the town.

Even the Chinese Government and the local authorities were opposed to the telegraph, and had only a short time before refused an application from an English company for the landing of a cable, but nothing discouraged Lieutenant Suenson, whose clear insight of human nature and great resourcefulness stood him in good stead, and having obtained the support of some of the more influential Europeans he worked out a plan as to how and where the cables should be landed, the soundness of which has been proved by the fact that after fifty years have passed the cables are still landed at the same place on Gutts Road and at Woosung near Shanghai. After having made the necessary arrangements for landing of the cables in Japan, where in contrast to China no opposition was met with, and after the service had been thoroughly organised, Lieutenant Suenson returned to Denmark for the purpose of resuming his career in the Navy. He was, however, prevailed upon to remain in the company, and after finally resigning his

commission with the rank of captain—subsequently raised to Commodore—he became managing director of the company in 1874, a post which he held without interruption until 1908, when he was elected chairman of the board of directors, having already had a seat on the board since 1890. In 1916 failing health compelled Commodore Suenson to give up the active leadership of the company, and as a slight token of gratitude for his long and valuable service he was elected hon. chairman of the board of directors, a title he held to the last day of his life.

Commodore Suenson was known to practically all the cable companies and telegraph administrations of the world, having up to 1903 attended all the Telegraph Conferences held from time to time in the large capitals of Europe. On account of his great personality, and as he was able to express himself fluently in English, French, and German, he soon gained a leading position amongst the representatives present at the conferences, where he was always listened to with great attention. Owing to his powerful and well-reasoned arguments he was often able to carry the day in favour of the cable companies, as, for instance, was the case when the German Secretary of State, Dr. Stephans, proposed to introduce a uniform telegraph rate within practically the whole of Europe based on somewhat similar lines to those of the postal union. This proposal, which, if it had been adopted, would have been ruinous to private cable enterprise in European waters, and would also have caused a considerable loss of revenue to several of the Government telegraphs outside Germany, was finally dropped after having been discussed at great length at several of the conferences.

Although Commodore Suenson never re-visited China, he was later on instrumental in the opening up of that vast country by constantly impressing upon the Chinese Government the necessity of erecting landlines between the larger towns, and although several attempts met with disappointment, Commodore Suenson's efforts were at last rewarded by the company being entrusted with building a whole network of landlines from 1881 and onwards.

In former years the Commodore frequently visited the capitals of the European countries connected by the company's cables, also London, where he was well known and highly esteemed both by the heads of the General Post Office and by the principal telegraph companies.

Since his earliest days in the company and until he retired as chairman of the board of directors in 1916, the history of Commodore Suenson is that of the Great Northern Telegraph Co., of which he was the guiding spirit. His death means the loss not only of the maker of a great cable company, but of one of the best known pioneers of cable telegraphy, whose name will be found inscribed in bold characters on every page of its early history.

C. B. HARNESS.—The death occurred suddenly on September 26th at Bournemouth, of Cornelius Bennett Harness, aged 74 years. This announcement will recall to the memory of some of our readers the series of actions in which the late Mr. Harness and the proprietors of the *ELECTRICAL REVIEW* figured in 1893, consequent upon electropathic belts and the operations of the Medical Battery Co., Ltd., having been attacked in our pages.

MR. J. H. BALFOUR BROWNE, K.C.—We regret to record the death which occurred on Tuesday last of Mr. Balfour Browne, the celebrated King's Counsel, whose name is a household word in electrical circles. His great ability and knowledge of the law relating to electrical affairs, rating, and other matters, brought him an extensive practice in this department alone. He was 76 years of age.

Will.—Mr. E. L. ODEP, a director of Sir W. G. Armstrong, Whitworth & Co., and chairman of the Still Engine Co., left £24,712 gross and £21,759 net personality.

NEW COMPANIES REGISTERED.

Wimbledon Electrical Co., Ltd. (176,905).—Private company. Registered September 21st. Capital, £1,000 in £1 shares. To acquire a business of manufacturers of and dealers in all kinds of electrical apparatus and accessories carried on in or near Wimbledon, including various patents. *Ac.* The directors are: Joseph B. Bower, 39, Church Lane, Merton Park, Surrey (managing director); Bassett Smith, 34, Fontaine Road, Streatham, S.W. (office manager). Qualification, 50 shares. Registered office: 15, Kingston Road, Wimbledon, S.W.

Artic Fuse and Electrical Manufacturing Co., Ltd. (176,834).—Private company. Registered September 17th. Capital, £5,000 in 4,700 ordinary and 100 deferred ordinary shares of £1 each, and 4,000 founders' shares of £1 each. To acquire and turn to account patents Nos. 123,807 and 154,300 relating to pressure contact self-aligning fuse carriers and link switches, to submit an agreement with F. A. Ross, and to carry on the business of electricians, engineers, contractors, &c. The first directors are: F. A. Ross, 6, Queen's Drive, Whitley Bay, electrical engineer (chairman and technical adviser); G. P. Dennis, G. Normanton Road, Orton, Birkenhead, consulting electrical engineer (managing director and sales manager); with £200 each per annum as remuneration. Qualification of directors, 250 shares. Secretary: J. Crawford. Solicitors: G. F. Lees and Son, 45, Hamilton Square, Birkenhead.

Jeasmond Electrical and General Engineering Co., Ltd. (176,936).—Private company. Registered September 22nd. Capital, £1,000 in £1 shares. To take over the business of an electrical and general engineer carried on by T. Sloan at 239, Back Jeasmond Road, Newcastle-on-Tyne, as the Jeasmond Electrical & General Engineering Co. The permanent directors are: T. Sloan, 108, Shortridge Terrace, Jeasmond, Newcastle-on-Tyne (governing director); Mrs. C. M. Sloan, 103, Shortridge Terrace, Jeasmond, Newcastle-on-Tyne. Qualification of governing director, 400; of other directors, £100. Registered office: 280, Back Jeasmond Road, Newcastle-on-Tyne.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

G. N. Haden & Sons, Ltd.—Issue on September 12th, 1921, of £550 debentures, part of a series already registered.

C. A. Vandervell & Co., Ltd.—Satisfaction to the extent of £15,000 on December 31st, 1920, of trust deed dated July 23rd, 1919, securing £300,000.

Bourne End and District Electricity Corporation, Ltd.—Particulars of £20,000 debentures, authorised August 28th, and covered by trust deed dated August 31st, 1921, in present issue, £13,000, charged on the company's undertaking and property, present and future, including unallotted capital, and land at Bourne End. Trustees: H. S. Dunnington, E. H. Hawkins, and J. R. Sterling.

Chamberlain & Hookham, Ltd. (59,920).—Return dated July 5th, 1921. Capital, £100,000 in £5 shares (50,500 ord. and 9,500 pref.); 10,100 ord. and 8,000 pref. shares taken up, £36,300 paid; £53,510 considered as paid. Mortgages and charges: Nil.

Chile Telephone Co., Ltd. (29,252).—Return dated August 11th, 1921. Capital, £500,000 in £5 shares. 90,000 shares taken up, £250,000 paid; £250,000 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

French Cable Co.

The report of the Compagnie Française des Câbles Télégraphiques, which was submitted at the recent annual meeting, states that notwithstanding the world's economic crisis the company's receipts in 1920 amounted to 23,840,000 fr., or an increase of 6,154,000 fr. over the preceding year, which, in turn, was characterised by a large augmentation over 1918. The working of the Brest-Azores-New York cable, which was entrusted to the company by the French Postal Authorities, had been very fruitful, and negotiations were therefore being continued between the Governments of the allied and associated Powers with the object of the cable being definitely allotted to France. Considerable receipts were derived from the West Indian service, which were principally due to the circumstance that the "West India" line was only in irregular operation, thus permitting the French company to intensify its transmissions. After having participated in the increase in the share capital of the Compagnie Générale de Télégraphie sans Fil, the company subscribed 12,000,000 fr. towards the formation of the Société Radio-France for service on the other side of the Atlantic. Agreements had been entered into with the Compagnie Générale de Télégraphie sans Fil for the establishment and working on joint account of stations at Cayenne and in the North of Brazil, and at the same time the company was improving its methods of working so as to ensure greater efficiency. The net profits realised in 1920 amounted to 10,591,000 fr., and the sum divisible is 3,799,000 fr.; the ordinary shares each receive 42.71 fr., the "parts" of the first series 70.47 fr., and the second series 8.08 fr.

Victoria Falls and Transvaal Power Co., Ltd.

The report for 1920 states that at December 31st, 1920, the issued share capital amounted to £3,000,000 and the debenture capital to £3,351,870, a further £238,210 of the 5 per cent. first mortgage debentures, and £63,380 of the 5½ per cent. second mortgage debentures having been purchased for redemption during 1920. After providing for interest and premium on debentures amounting to £183,893, and for depreciation and income tax, &c., amounting to £409,941, there remains £173,161 as net profit for the year, which together with £54,321 brought forward, leaves a total of £267,482. The directors declared two dividends each of 3 per cent., less income tax, on the preference shares for the year, absorbing £84,000, leaving a surplus of £183,482. In respect of this surplus the directors in June last declared a dividend of 5 per cent., less income tax, on the ordinary shares for the year ended December 31st, 1920, and as the preference shares are entitled to share *pro rata* with the ordinary shares in the surplus profits distributed until the preference shares have received a total dividend of 10 per cent. for the year in respect of which the distribution is made, they also declared at the same time a further and final dividend of 4 per cent., less income tax, on the preference shares in respect of the year 1920. The above dividends were paid on July 8th, and absorbed £91,000, leaving a balance to the credit of the profit and loss account of £92,481 12s. 4d., which will be carried forward. Meeting: London, October 7th.

Stock Exchange Notices.—Deals in the following have been specially allowed by the Committee under Rule 148a:—Lancashire Electric Light & Power Co.—£400,000 7½ per cent. prior lien debenture stock, issued at 95 per cent., £45 per cent. paid and fully paid; and £135,000 7½ per cent. prior lien debenture stock, fully paid (issued in exchange for £135,000 prior lien bonds).

Application has been made to the Committee to allow the following to be officially quoted:—

City of London Electric Lighting Co.—300,000 8 per cent. second cumulative preference shares of £1 each, fully paid, Nos. 1,200,001 to 1,500,000.

Gandy Belt Manufacturing Co., Ltd.—An interim dividend of 1s. per share, free of tax, has been declared.

German Companies.—The *Voigt und Haefner Aktiengesellschaft*, of Frankfurt-on-the-Main, have raised their capital from 20,000,000 marks to 40,000,000 marks by the issue of 20,000 founders' shares. The new shares have been taken up by the Deutsche Bank at 127 per cent., with the obligation that they are to be allotted to the shareholders at 130 per cent. per share for every founder's or preference share held. The new shares rank for dividend from January 1st this year, the funds hence derived being destined for enlargement and new works. Business in the past year has been satisfactory, and the prospects are good, innumerable orders being forthcoming; but the small firms created during the war and now pushing their goods on the market are causing a drop in prices. Big orders in the high-tension department would, however, tide the company over this difficulty.

Spanish Companies.—*Compañía Hispano-Americana de Electricidad*.—The report of the first year's working of this company showed gross profits 32,841,022 pesetas, and after deducting general charges, taxes, interest on obligations, sinking fund, and employees' relief, a net balance of 11,662,659 pesetas remained, divided as follows: 8 per cent. dividend, 9,600,000 pesetas; reserve fund, 583,132 pesetas; statutory charges, 1,666,225 pesetas; and balance carried over, 313,250 pesetas.

Halifax & Bermudas Cable Co., Ltd.—We may supplement our paragraph of last week with the statement contained in the directors' report to the effect that the decrease in the net result of the year's working of £14,321 was made up by a reduction of £4,369 in the receipts, principally due to the increased use of code in messages, an increase of £3,111 in income tax, E.P.D. and Corporation profits tax, and an increase of £1,841 in the general expenses.

Direct West India Cables Co., Ltd.—With reference to the paragraph appearing here last week, the directors' report states that the decrease in the net result of the year's working amounted to £3,147. Income tax, E.P.D. and Corporation profits tax came to £1,531 more than in the previous year, and the general expenses increased by £2,738. On the other hand, traffic and other receipts were £1,132 more than in 1920. The company's cables worked efficiently during the year. The insulation of the Bermuda-Turks Island section remains very low.

Zurich Bank for Electrical Undertakings.—The accounts of the Bank für Elektrische Unternehmungen, of Zurich, for 1920-21, which is the first year after reconstruction, show a surplus of 112,950 fr., which has been carried forward. Thus the 6 per cent. preference shares for 94,500,000 fr. created under the scheme of reorganisation, and the ordinary share capital, reduced to 18,750,000 fr., receive no return for the year.

J. Stone & Co., Ltd.—The profit for 1920, after allowing for depreciation, &c., was £101,889, plus £125,774 brought forward, making £227,663, less dividend on preference shares, £15,000. According to the *Financier*, the directors propose a dividend of 7½ per cent. per annum on the ordinary, carrying forward £152,633.

Rangoon Electric Tramway and Supply Co., Ltd.—The *Financier* reports that the London secretaries of this company recently received cable advice from the company in Rangoon that the balance of the ordinary share capital, amounting to 72,999 ordinary shares recently offered for subscription at par, has been duly allotted.

Newcastle-upon-Tyne Electric Supply Co.—According to the *Financier*, the directors notify that, owing to the adverse effects of the coal dispute, the profit for the six months ended June 30th last is not such as to justify an interim dividend on either the ordinary or the 5 per cent. preference shares.

Clyde Valley Electrical Power Co.—Meetings will be held to pass resolutions authorising the issue of 70,000 8 per cent. cumulative second preference shares of £10 each, and the establishment of a special reserve fund.

Bruce Peebles & Co., Ltd.—The directors have declared a dividend at the rate of 7½ per cent. per annum, less tax, on the 7½ per cent. cumulative participating preference shares for the half-year ended June 30th.

Madras Electric Tramways (1904) Co., Ltd.—The directors have declared an interim dividend at rate of six per cent. per annum, less tax.

Shanghai Electric Construction Co., Ltd.—A first interim dividend of 6 per cent. actual (12s. per share), less tax, is announced.

Traction & Power Securities Co., Ltd.—A dividend of 3s. 6d. per share, free of tax, on the ordinary shares for the half-year is announced.

New Issues.—Next week the *Mersey Power Co.* will offer for sale £500,000 7½ per cent. mortgage debenture stock at 97 per cent. The stock will be guaranteed, both as to principal and interest, by the Salt Union, Ltd.

It is stated that applicants for the recent issue of *Lancashire Electric Light & Power* debentures received about 20 per cent. of the amounts applied for.

There is being offered for subscription until October 5th an issue of £500,000 seven per cent. debenture stock of the *County of London Electric Supply Co.*, at 94 per cent.

It is understood that the *Clyde Valley Electric Co.* is also about to issue 100,000 preference shares bearing interest at 8 per cent.

Cape Town Consolidated Tramways & Land Co., Ltd.—The accounts for 1920 show a loss of £752, £13,432 being forwarded, and the total debit of £14,184 is to be carried forward.

STOCKS AND SHARES.

TUESDAY EVENING.

THE Stock Exchange is still rather inclined to look for an early reduction in the Bank Rate to 5 per cent., and the possibility of this serves as a strengthening influence to investment securities. New issues find no difficulty in obtaining support. People in the provinces, as well as in London, are eager to get hold of underwriting in any good things which are coming along. At the same time, the stages occasionally overshoot the mark, and even where an issue is over-subscribed, it is possible, as the markets this week have demonstrated, for the opening quotations to fall to a discount. This was not the case, however, with the *Lancashire Electric Light & Power Co.*'s 7½ per cent. prior-lien debenture stock offered at 95. The subscription lists closed very promptly, and upon the markets opening on last Monday morning, support became immediately apparent, and the price rose to 3 premium. Even at this, it is contended by some that the security is good enough to render it worth holding. The *Clyde Valley Electric Co.* is making an early issue of 8 per cent. preference shares, of which, it is said, half will be reserved for the North and half is coming to London. And for underwriting in the *County of London Electric Co.*'s 7 per cent. debenture stock, to be offered at 94, there was brisk demand.

Mention of new issues is a reminder of the shock administered by the *Newcastle-upon-Tyne Electric Light Co.* in passing the interim dividends on its ordinary and 5 per cent. preference shares. The official announcement curtly said that, owing to the adverse effects caused by the stoppage in the coal-mining industry, profits for the year ended June last are not such as to justify payment of an interim dividend either on the ordinary shares or the 5 per cent. preference shares. The announcement was particularly unexpected from the fact of the company having sold, in the middle of this present month, £633,000 4½ per cent. debenture stock at 71½ and £100,000 5 per cent. debenture stock at the same price to Messrs. Lazard Bros., who offered it at 73, less a commission of ½ per cent. to brokers, &c. We believe that the buyers of the stock succeeded in disposing of most, if not the whole, of the block, and that the last was taken only a day or so before the company announced the passing of the interim dividend just mentioned. Had this information been available a fortnight before, it is asked whether purchasers would have been found so readily, good as the security is. The price of the ordinary and preference shares has fallen to 12s. 6d., and the 7 per cent. preference came down to 18s. The nominal price of the two debenture stocks is still about 73. Doubtless the directors have acted with all discretion in passing the share-dividends in these difficult days, but it is not surprising that the matter should have aroused discussion.

There is no improvement in the market for Home Railway stocks. Prices continue to be dull, and so little interest is taken in any of the various departments that prices scarcely alter from day to day. When they do change, it is usual for small declines to be registered. Underground Incomes and *Metropolitans* are a point down, and Districts have given way to 16½. *London Electric Railway* shares are lower at 2½. Nor is there any particular support being rendered at the present time to the prior-charge stocks, most of which show a tendency to drop.

Electricity supply shares are firm. *County of London* at 9½ are another ½ up, though the preferred at 8 are equally easier. The latter now show a return of £7 10s. per cent. on the money. *Bournemouth* and *Poole* ordinary have risen to 5½. *Metropolitans* gave way to 4, but *Kensingtons* rose ½ to 4½, at which they pay the round 10 per cent. on the money, and *Westminsters*, which yield 8½ per cent., retain their rise at 5½. *St. James* hardened to 5½.

The manufacturing shares are somewhat irregular, though movements are narrow. General Electric ordinary went back a few pence to 18s. 6d. The 6½ per cent. preference shares, however, are better at 12s., and the 7½ per cent. preference stand at 18s. 9d. *English Electrics* receded to 10s., shares

changing hands the other day down to 9s. 10½d. *Metropolitan-Vickers* preference further hardened to 1½. The ordinary remain at 16s. *British Aluminium* are still flat at 15s. 9d., owing to the disappointment in connection with the cut in the interim dividend from 4 per cent. to 2½ per cent. *British Insulated* are steady on the dividend of 9d. *The Victoria Falls and Power Co.* has issued a report which received favourable attention. The preference have hardened to 17s. 3d., at which they may be reckoned a very fair speculative investment. There is a useful protection for the dividends in the 5 per cent. paid on the ordinary, and, although the gold-mining industry is under something of a cloud at present, it is reasonable to assume that the Transvaal will emerge from its present troubles as successfully as it has done from those of the past. The ordinary shares stand at 9s. 3d.

Marconis have gone back to 1 11/16, the wireless group being heavy and dispirited. Radio ordinary, however, rose to 11s. 6d., although the full rise was not held. The preferred are more sluggish at 9s. 6d. In the cable group, *West India* and *Panama* shares dropped to 5s., being a fall of 1s. 3d. One seller accepted 4s. 6d. Globe preference are ½ down at 9½. *Chili Telephones* equally lower at 5½, but the *Eastern* group is marking time. *Siemens* at 1½ have lost 1/32. *Telegraph Constructions* at 2½ hold their gain of last week.

Mexican Light & Power bonds are better, although those of the *Tramways Co.* have not moved. The foreign list is quiet as a whole. *Canadian General Electric* at 11½ and the preferred at 10½ are both a couple of points higher. The armament group is dull because of the misunderstanding, as to wages, which has arisen between the Board of Trade, Mines Department and South Wales coalowners. Rubber shares continue to give a better account of themselves than they have done lately, but there is not much activity in the share market.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.									
	Dividend		Price						
	1919.	1920.	Sept. 27,	Rise or fall.	Yield.				
			1921.		p.c.				
<i>Brompton Ordinary</i>	12	12	68	—	9 8 4				
<i>Charing Cross Ordinary</i>	7	8	44	—	9 8 4				
do. do. do. 4½ Pref.	4½	4½	34	—	7 4 4				
<i>Chelsea</i>	4	6	32	—	9 4 8				
<i>City of London</i>	13	14	126	—	10 2 0				
do. do. 6 per cent. Pref.	6	6	17	—	6 17 0				
<i>County of London</i>	8	8	94	—	8 15 4				
do. do. 6 per cent. Pref.	6	6	8	—	7 10 0				
<i>Kensington Ordinary</i>	7	9	43	—	10 0 0				
<i>London Electric</i>	3½	3½	21	—	7 10 0				
do. do. 6 per cent. Pref.	6	6	24	—	10 0 0				
<i>Metropolitan</i>	6	7	4	—	8 15 0				
do. 4½ per cent. Pref.	4½	4½	21	—	7 13 4				
<i>St. James' and Pall Mall</i>	12	12	68	—	9 1 4				
<i>South London</i>	6	7	24	—	10 12 2				
<i>West Metropolitan Pref.</i>	7	7	15	—	8 17 10				
<i>Westminster Ordinary</i>	10	10	54	—	8 10 2				
TELEGRAMS AND TELEPHONES.									
<i>Anglo-Am. Tel. Pref.</i>	6	6	87	—	6 18 0				
do. do. Def.	15	14	172	—	8 14 2				
<i>Chile Telephone</i>	7	8	58	—	8 14 8				
<i>Cuba Sub. Ord.</i>	7	7	7	—	9 6 8				
<i>Eastern Extension</i>	10	10	164	—	6 1 0				
<i>Eastern Tel. Ord.</i>	10	10	164	—	6 2 4				
<i>Globe Tel. and T. Ord.</i>	10	10	164	—	6 1 0				
do. do. Pref.	6	6	94	—	6 8 0				
<i>Great Northern Tel.</i>	22	24	243	—	9 14 0				
<i>Indo-European</i>	25	15	30	—	6 8 8				
<i>Marconi</i>	25	15	30	—	6 8 8				
<i>Oriental Telephone Ord.</i>	12	12	21	—	*6 16 8				
<i>United R. Plate Tel.</i>	8	8	64	—	*6 18 4				
<i>West India and Panama</i>	10	10	54	—	Nil				
<i>Western Telegraph</i>	10	10	164	—	*6 1 2				
HOME RAILWAYS.									
<i>Central London Ord. Assented</i>	4	4	48	—	8 5 0				
<i>Metropolitan</i>	12	14	23	—	8 10 6				
do. District	Nil	Nil	164	—	Nil				
<i>Underground Electric Ordinary</i>	Nil	Nil	9	—	Nil				
do. do. "A"	Nil	Nil	67	—	Nil				
do. do. Income	4	2	76	—	*3 10 5				
FOREIGN TRAMS, &C.									
<i>Anglo-Arg. Trams, First Pref.</i>	54	124	24	—	10 0 0				
do. do. 2nd Pref.	Nil	64	22	—	10 0 0				
do. do. 5% Deb.	5	6	834	—	7 17 0				
<i>Brazil Traction</i>	Nil	Nil	29	—	Nil				
<i>Brazil Columbia Elec. Ry. Pref.</i>	5	6	80	—	8 6 8				
do. do. Deferred	6	98	644	—	*8 2 2				
do. do. Deb.	44	44	644	—	*11 5 2				
<i>Mexico Trams 5 per cent. Bonds</i>	Nil	Nil	60	—	7 2 10				
do. do. 6 per cent. Bonds	Nil	Nil	90	—	Nil				
<i>Mexican Light Common</i>	Nil	Nil	9	—	Nil				
do. do. Pref.	Nil	Nil	19	—	Nil				
do. do. 1st Bonds	Nil	5	514	—	9 14 2				
MANUFACTURING COMPANIES.									
<i>Babcock & Wilcox</i>	16	16	27	—	6 11 2				
<i>British Aluminium Ord.</i>	10	10	159	—	9 12 0				
<i>British Insulated Ord.</i>	15	15	14	—	8 11 6				
<i>Calenders</i>	16	16	14	—	10 8 8				
do. 6½ Pref.	6½	6½	149	—	6 14 8				
<i>Crompton Ord.</i>	10	10	14	—	13 15 10				
<i>Edison-Swan</i>	10	10	176	—	7 7 1				
do. do. 5 per cent. Deb.	6	6	68	—	11 18 10				
<i>Electric Construction</i>	10	10	169	—	16 0 0				
<i>English Electric</i>	15	15	107	—	8 11 6				
do. do. Pref.	6	6	14	—	7 4 6				
<i>Gen. Elec. Pref.</i>	6½	6½	14	—	10 5 4				
do. do. Ord.	10	10	136	—	10 5 0				
<i>Hewley</i>	15	15	174	—	10 5 0				
do. 4½ Pref.	4½	4½	34	—	6 16 6				
<i>India-Rubber</i>	10	10	44	—	8 10 8				
<i>Mess. Vickers Pref.</i>	8	8	12	—	*17 10				
<i>Siemens Ord.</i>	15	15	14	—	*5 11 9				
<i>Telegraph Ord.</i>	20	20	214	—					

* Dividends paid free of Income Tax.

THE BRITISH ASSOCIATION.—IV.

The Negatron: A New Negative Resistance Device for use in Wireless Telegraphy.

By JOHN SCOTT-TAGGART. (Abstract.)

Section G.—Engineering.

THE idea of a negative resistance is by no means a recent one. Duddell first distinctly intimated how the arc produced oscillations, and it is to Duddell's important appreciation of the value of negative resistance effects that we owe many of our modern achievements in radio communication.

Negative resistance might be defined as the exact opposite of ordinary or positive resistance. A feature of an ordinary resistance is that if the voltage across it increases, the current through it increases. This seems quite what would be expected, but there are a few devices which obey an exactly opposite law. As the electromotive force across them increases, the current through them decreases and conversely. A negative resistance in series with a positive resistance circuit will partially, or completely, neutralise the ordinary resistance of the circuit. This property enables signals of all kinds

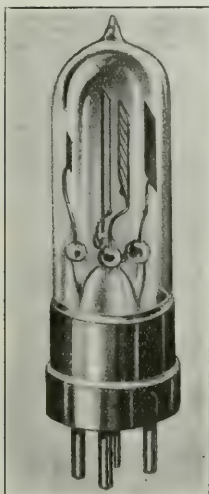


FIG. 1.—THE NEGATRON.

to be greatly amplified. For example, by the use of a negative resistance device, it is possible to cut down the resistance of long stretches of telegraph cable and save costs in this way. Wireless signals have also been amplified a thousand times by the use of a single negative resistance valve. The chief use of a negative resistance valve, however, is in the production of continuous oscillations for use in wireless transmission or reception by the beat method. Oscillations once set up in an oscillatory circuit will normally die out because of the

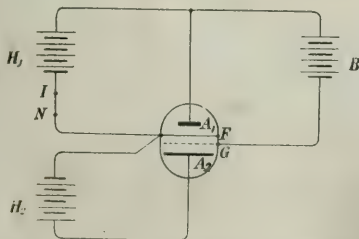


FIG. 2.—DIAGRAM OF CONNECTIONS OF NEGATRON.

resistance of the circuit which dissipates the energy. If, however, we can reduce the resistance of the oscillatory circuit to zero we enable the oscillations, once started, to persist.

The negatron valve was produced in September, 1919, and the author's patent for it (No. 166,260) has recently been

accepted. The principle on which it works is briefly as follows: A thermionic valve is arranged having two flat anodes one on each side of a filament. Each anode is connected through an anode battery to the filament so that the electrons emitted by the filament, when it is heated to incandescence, are distributed fairly equally between the two anodes. A control electrode, which may be a flat grid, is also arranged within the valve between the filament and one of the anodes. This latter anode will be called the "diversion anode," while the first anode will be called the "main anode." If we suitably arrange the relationship between the electron emission and the anode voltages, we may make the total of the anode currents approximately equal to the electron emission; in other words, a saturation effect is obtained. Under these conditions, if we make the grid more positive with respect to the filament we shall divert electrons from the main anode to the diversion anode, with a consequent reduction of the current flowing in the main anode circuit. In the negatron, as preferably used, the main anode is connected to the grid so that when the main anode voltage is increased the grid potential is increased, electrons are diverted from the main anode, and the main anode current decreases. Hence the negative resistance effect. Fig. 1 illustrates the negatron valve itself. The anode on the left is the main anode (usually small), while the anode on the right is the diversion anode. Between the filament and the diversion anode is a flat openwork grid. A tubular valve with four-pin cap is preferred, the connection to the main anode being taken to the metal portion of the valve cap. A metal spring on the holder presses against and makes electrical contact with this metal portion. The action of the negatron will be best understood if reference is made to fig. 2, which shows a negatron connected up in one way so as to possess negative resistance characteristics. Between the anode A_1 and the filament F is a battery H_1 , and two terminals I, N . Between these terminals a milli-ammeter may, for the time being, be connected. The anode is connected through a battery B to the grid G . This battery is merely connected in this position to keep the grid at a suitable potential which is preferably slightly negative. If G were connected directly to A_1 , G would have a high positive potential with respect to F . Between F and the diversion anode A_2 is a second battery H_2 . Both H_1 and H_2 are usually of about 60 volts, but their values are not very important provided that the current supplied to the filament F may be adjusted to produce the saturation effect. If we increase the voltage of H_1 , we should normally expect the current to A_1 to increase, but as the potential of A_1 increases so does that of the grid G . Since G becomes more positive, the current to A_2 will increase, and this increase could be measured by connecting a second milli-ammeter in the A_2 anode circuit. This method of varying (by altering the space charge) the current to A_2 is, of course, well known, as it has been used in ordinary valves since Lee de Forest first introduced the grid. The important fact to notice, however, is that, if the current to A_2 increases, the electrons which go to A_2 must come from those which would have gone to the anode A_1 . There is, therefore, a diversion of electrons. If the A_2 anode current increases, the A_1 anode current must decrease, and conversely. Similarly a decrease of the A_1 anode current would always be accompanied by an increase of the A_2 anode current, and conversely. This effect is conditional on the existence of saturation in the valve. Since by increasing the potential of the main anode A_1 , we have diverted electron current to the anode A_2 , the main anode current decreases. There are now two effects which govern the A_1 anode current. The increase in the A_1 anode potential tends to increase the A_1 anode current; the diversion effect, however, tends to decrease the A_1 anode current. The diversion effect greatly outweighs the other, and the result is a decrease in the main anode current consequent on an increase of the main anode potential; the converse also applies. A decrease of the main anode potential makes the grid G more negative and decreases the current to A_1 . The A_1 anode current consequently increases. In this way, the negatron acts as a negative resistance. The negatron, as described, works only when the saturation effect is obtained. For this reason, a filament current rheostat is desirable, and the current through the filament is adjusted until the negative resistance effect is obtained. If the filament be too bright, there will be no "robbing" action. There will always be a plentiful supply of electrons around the filament and an increase of grid potential would increase the A_1 anode current and the additional electrons would come from the source round the filament and not from amongst those which would have gone to the main anode A_1 . The A_1 anode current would, therefore, be unaffected and no negative resistance effect would be obtained. The above explanation is borne out by characteristic curves obtained with the negatron, three of which curves are included in the paper.

The main use of the negatron is as a generator of continuous oscillations for the transmission or reception of continuous waves. It may be used for receiving spark signals by reducing the effect of positive resistance. As a local oscillator it is exceedingly convenient as it will oscillate on all ranges from 600 m. to 20,000 m. (the usual commercial range) without any complicated switching arrangements.

The Biotron: A New Device Having Negative-resistance Characteristics.

By J. SCOTT-TAGGART.

Section G.—Engineering.

ANOTHER addition to the formerly very small list of devices having negative-resistance characteristics is shown in the accompanying diagram. The arrangement employs two three-electrode valves, one acting as a conductor of current and the other as a phase-reverser. The valve A (fig. 3) is the conductor of current from the battery H_1 . Let us imagine an ammeter included across the terminals I, N. If the e.m.f. of H_1 were increased we should expect the anode current to be increased. The opposite effect is obtained, however, by arranging that the increase in the anode voltage of P₁ increases the potential of the grid G₂ of the valve B. The normal potential of G₂ is kept near zero by a battery B₁. In the anode circuit of B is an anode battery H₂ and a resistance R. When G₂ becomes positive, the anode current through R increases, making the grid G₁ of the valve A more negative. The battery B₂ keeps the grid G₁ at a suitable normal potential near zero. By increasing H_1 we therefore have two effects: One is a tendency to produce an increase of anode current by increasing the anode potential; the other is a tendency to

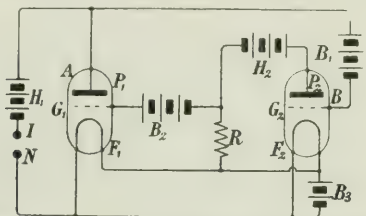


FIG. 3.—THE "BIOTRON" NEGATIVE-RESISTANCE DEVICE.

decrease the anode current by making the grid more negative. This latter effect greatly outweighs the former, so that the anode current decreases and a negative-resistance characteristic is obtained. If the voltage of H_1 be decreased the converse effect takes place. The circuit, the resistance of which is to be decreased, is normally connected across I, N. This static negative-resistance device can produce a very steep negative characteristic. The curve, moreover, is straight. This particular negative resistance bears, at first glance, a certain resemblance to other resistance coupled arrangements, but as far as operation is concerned this is not the case. The arrangement shown in the diagram is perfectly stable. There is no building-up or retro-active action, as in the devices using two anode resistances. In the diagram the negative-resistance current does not itself produce any further change in any of the grid potentials. This is not the case with the arrangements the author is thinking of wherein the negative-resistance current passes through a resistance and produces a building-up action. The arrangement is described more fully in the author's British patent 152,693 (July 25th, 1919).

The Linking-up of the Small Water Powers in Scotland.

By PROF. F. G. BAILY. (Abstract.)

Section G.—Engineering.

THE theoretical water power of Scotland runs into many millions of h.p. But for the most part the rivers have too gradual a fall, and the streams of the steeper ground too little water, to permit of any great concentration of water power at any one place. A scheme is proposed to utilise the small rapid streams and waterfalls of the high uplands, and the rivers of the long gently-sloping valleys, by numerous small hydro-electric stations, so that the rainfall will pass through a succession of turbines in its passage from the gathering ground to the sea, and yield up a fair proportion of its total energy. For this purpose, the stations must be small, generally from 50 h.p. to 300 h.p., in order to avoid the costly engineering work of large dams and long lades and pipe lines; they must operate automatically to reduce cost of superintendence, and they must be simple and robust. Each turbine will drive an induction generator, which is a three-phase squirrel-cage motor, driven at a speed slightly above that at which it runs as a motor. Without any control or adjustment this machine will supply electricity to the mains in proportion to the water power available. The starting up is simple, and may be controlled from a distant central point, and once started no further care is needed. The general arrangement consists of a set of electric mains running out from a large town with a steam-driven central supply station, following the course of the river and branching at its tributaries, until the distance and the smallness of the streams render further extension uneconomical. At all suitable points these small stations will be erected, merely huts with turbines and dynamos. The steeper parts will have short pipes to the turbines, but in the valleys, a succession of small dams will be built, and the turbine house will be a part of the dam, running with the head of water of the dam, unless the ground favours the

construction of a lade in addition. These dams will also serve to store water in times of drought, by the shutting down of the turbines from the main station during the hours of light load. As fluctuations of head make no difference to the dynamo beyond changing the amount of power it is able to deliver, considerable use can be made of these dams without any supervision. Superintendence may be reduced to periodic visits round the area to see that all is well, and to clear the strainers of the intake water. Wear and tear of turbine and dynamo are extremely small, as neither has any rubbing surfaces except the bearings of the main shaft. The central station will require some special provision, for it will supply the magnetising current for all the small dynamos. But even this may be provided by water-driven alternators set at some more central point. These would require an attendant, who would also be suitably placed for the control of the upland stations. In all waterpower schemes, the chief difficulty is the irregularity of the water, and usually this can only be avoided by making a huge reservoir, or by using only a fraction of the average power. By linking up with a large system, times of drought will make calls on the steam engines, but through the heavy winter load the water power will be at its best. Any other possible sources, such as the tidal force in estuaries, may be linked up as well, and the various fluctuations of these, and the changes of the load, will tend to average out to some extent, the balance being taken by the central station. The electric mains will not only form collectors of power, but they will be equally valuable as distributors. All the farms, villages and small towns in the area will link on to the system, and much of the power may be used before the town is reached, while the central station ensures regularity of supply. The district will be opened up, and many facilities for industry will be afforded.

The scheme may be developed gradually, for even a few stations in an area will be helpful, and successive additions will not disturb those in existence. Hence, while the complete plan will be of great magnitude, the financial commitment at the beginning will be small until success is assured.

The author is indebted to Mr. D. S. Munro, of Edinburgh, for the idea of collecting the water power of scattered streams and long rivers by small units of power, and to Dr. Steinmetz, of America, for the use of the induction generator as a feeder to a supply system.*

Large Electric Units.

By S. PARKER SMITH, D.Sc. (Abstract.)

Section G.—Engineering.

THE development of electric generators has been largely influenced by the development of prime movers, and transmission problems have given a great impetus to the growth of a.c. machines. Steam turbines have been developed until they now can meet practically all demands; units of from 25,000 to 35,000 kW are found most suitable for all-round economical working. The Ljungström turbine, by splitting the electric unit into two, has made large outputs possible with small generators. Internal-combustion engines have also developed, and on the Continent most iron and steel works feed their exhaust gases to engines. Valve gears have been improved, and greater reliability is a feature of the latest types of engines. The progress in design of water turbines has been even more marked owing to the development of water power as an alternative to dear coal. The greatest difficulty in the construction of alternators for this work is the need for safeguarding them against over-speeds, which vary from 80 to over 100 per cent., according to the type of turbine, &c. The construction of alternator rotors has improved as larger outputs have been required. Outputs of 20,000 kVA are now possible from 50-cycle machines running at 3,000 r.p.m. This entails a peripheral speed of sometimes more than 25,000 ft. per minute. Despite the difficulties attending the production of 20/25-ton forgings, solid rotors are generally preferred to the built-up types. The efficient ventilation of large machines is a serious problem. Water-cooled rotors are built, but there is a marked tendency to rely exclusively on surface cooling, safety being ensured by non-combustible insulation. For large four-pole rotors in which ventilation is difficult, and which weigh from 35 to 45 tons, some form of built-up construction appears essential. In stators ventilation problems are accentuated by the greater losses. Simple radial or axial ventilation is not sufficient; the two must be combined. Manufacturers' difficulties are often enhanced by their having to construct stators on site. Water cooling is being attempted for stators. In the Schneider water-cooled stator the water is first passed through the refrigerator used for cooling the circulating air. After absorbing heat from the air and from the machine, the water is used to heat the feed water. The design of end windings has been improved considerably, and turbo-alternators can be built to stand sudden short-circuit conditions, although, in low-frequency systems an external reactance coil is sometimes desirable as an additional safeguard. Automatic voltage regulation is now generally effected by adjustment of the exciting current. The principle difficulty in water-wheel alternator design arises from the runaway speed. Most

* See ELECTRICAL REVIEW, September 19th, 1919, p. 383.—Eds.

modern types are entirely enclosed to reduce windage loss and noise, and to protect the machine against leaks. A large flywheel effect is necessary, and it is preferable to embody this in the rotor rather than have a separate flywheel. Low-speed alternators have again become of importance (after their partial supersession by turbine sets) owing to the development of internal-combustion engines and the adoption of reduction gearing.

The direct-current turbo-generator may be regarded as dead; the extension of the life of the direct-driven d.c. generator is due to the improvement of internal-combustion engines. For large powers the combination of turbo-alternators with rotary converters is probably cheaper, but for smaller powers the geared low-speed generator appears to many to be the ideal arrangement. Gearing has now been brought to a high pitch of efficiency and reliability, and permits the turbine to be run at a speed consistent with low steam consumption, and of a generator which is economical both in cost and working. It remains to be seen what influence mercury-vapour rectifiers will have upon the production of d.c. energy.

The difficulties connected with the design of rotary converters for 50 and 60 cycles have been largely overcome, but with present limits it is difficult to build a rotary converter for more than 1,000 V. This matter is important where it is desired to obtain 1,500 V at 50 cycles. In this case it may become necessary to use either motor-generators, two rotary converters in series, motor-converters, or mercury-vapour rectifiers; but mention should be made of the fact that the Oerlikon Co. recently built a successful rotary for 1,500 V at 50 cycles. The motor-generator is useful, as pressures up to 11,000 V can be supplied direct to the stator winding of the induction machine, making a transformer unnecessary. Mercury-vapour rectifiers are now on the market in three sizes, viz.: 300, 600, and 1,000 A at pressures up to 1,500 V. Owing to the short time that this apparatus has been in use, it is too early to make a proper comparison with other converting apparatus. It appears to be, however, a very useful alternative method of converting a.c. to d.c.

The author illustrated his remarks with a large number of lantern slides, and expressed his indebtedness to a number of leading manufacturers of electrical machinery.

Self-supporting Industries: an Inquiry into the Principle of Regulating Wages and Provision against Unemployment in Accordance with Industrial Capacity.

By MRS. B. WOOTTON. (Abstract.)

Section F.—Economic Science.

SATISFACTORY regulation of wages according to what industry will bear is impeded by the absence of any consistent definition of an industry, inequalities in the strength of different industries, in respect of value of output per head, stability, &c. Since weak industries can only bear comparatively low wages, an ethical as well as a commercial element must be introduced into wage determinations. The effort to bear high wages may, however, cause unemployment. Industries that are self-supporting in respect of wages ought, therefore, to assume some responsibility for the unemployment which their wage policy may create. The possibility of this is illustrated by drafts of special schemes under the Unemployment Insurance Act, and proposals of the National Transport Workers' Federation and of the Building Industry.

The Principles by which Wages are Determined.

Presidential Address by MR. W. L. HICHENS. (Abstract.)

Section F.—Economic Science.

MANY industrial troubles to-day arise from the fact that people are so intent on the rights of labour or of capital that they overlook the fact that each is necessary to the other. It is clearly important, therefore, that both capital and labour should understand, and, what is more, sympathise with, each other's point of view.

The wage problem is in essentials simple to grasp; it is the problem of the division of the proceeds of industry between labour and capital. How are we to ensure that neither the capitalist nor the worker gets too large a share of the proceeds of industry? How are we to provide that one class of labour does not get too much in relation to another? How are we to secure that the consumer is not robbed by the exaction of too heavy a toll for services rendered?

In some Australian Acts reasonable wages are defined as "the average prices of payment paid by reputable employers to employes of average capacity." But there are industries in which a standard wage is paid by all employers so that in the event of a dispute there are either no reputable or else no disreputable employers. In the second place, even if there are certain employers in an industry who pay higher wages than others, it does not follow either that the employers who pay less are not reputable or that the higher-paid employes are of average capacity. Everyone, even the disreputable employer, will agree that wages must be fair and reasonable, but with this meaningless proposition our unanimity comes to an abrupt end, for we find the most divergent views as to what constitutes fairness or reasonableness. One school holds that a fair wage is determined by the law of supply and demand. But, important though the part played by the law of supply

and demand, there is another equally important principle which governs wages—namely, that all men must be paid a living wage. The former is easy to understand and works automatically, though not always satisfactorily. It is important to remember, however, that if the law of supply and demand works badly the fault lies not with political economy but with ourselves. The fact that wages postulate a willing buyer and a willing seller of labour does not justify the employer in driving the hardest bargain he can.

Mr. J. R. Clynes defines the living wage as one which should ensure to the human being a condition of life "equal to the expectations and tastes of a civilised population of this age." This is an ideal which should be readily accepted. But it is an ideal, and therefore it may not be capable of realisation in all times and in all places. If the principle is accepted, the question arises: What do we mean by "worker"? A single man, a childless married man, or a man with a family? Miss E. F. Rathbone advocates that wives and children should be provided for from a fund contributed equally by single and married men. The speaker was afraid that this would eventually lead to administration by the State. The third principle was that wages should be proportional to the services rendered—a good worker should be paid higher wages than a bad one. The best way of securing this was by a piecework or bonus system, but the leading trade unions were against this. The principle of equal pay for equal work leads to the consideration of women's wages. In the speaker's opinion, the entry of women into industry has led to a reclassification of work, and it is the exception that they do the same work as men. For a number of reasons it is inevitable that women's wages should be lower. Apart from these three main principles there are others, such as: The agreeableness or otherwise of the trade; the expense of learning a trade; constancy of employment; responsibility; and the risk of failure. It has also been suggested that the state of the industry should have some bearing on wages. Profit-sharing may, or may not, form a valuable adjunct to the wages system, but no form of co-partnership or of the co-operative movement can ever replace the wage system, for the simple reason that one cannot keep body and soul together on a minus quantity of food; there must always be some guaranteed minimum.

Another objection to profit-sharing is that, if it is to succeed, the capital employed must be high in relation to the wages paid, otherwise the profits to be shared will be insignificant.

Whilst it is improbable that profit sharing will ever solve the problem of the fair distribution of the proceeds of industry between labour and capital, it may prove of advantage in particular cases, and it is to be hoped that experiments will continue to be made. The real solution of the problem is a moral one. Arbitration offers no immediate solution of the difficulty, for to be effective it must be voluntarily accepted by the majority on both sides, and the principles by which arbitrators are to be guided must first be clearly expressed and accepted. But it is the goal at which civilisation must aim, and as a step in this direction public inquiries into all disputes between labour and capital should be encouraged after all attempts at mutual agreement have failed.

The Magnetic Storms of the Present Solar Cycle.

By REV. A. I. CORTIE, S.J., F.INST.P. (Abstract.)

Section A.—Mathematical and Physical Science.

THERE have been four outstanding magnetic storms of great violence during the present cycle: (a) 1917, August 9th, 10th, renewed on August 13th, 14th; (b) 1919, August 11th, 12th; (c) 1920, March 22nd, 23rd; (d) 1921, May 12th-21st. In the cases of (a), (c), and (d) the magnetic storms were coincident with the passage of very great sun-spots across the sun's disk. The most active period of sun-spots was 1917, August 6th-16th, and a big active group, lat. + 16 deg., maximum area 3,444 on August 9th, was near the central meridian when the series of magnetic disturbances began. In 1920 there was but one greatly disturbed area, mean latitude - 6 deg., which extended in longitude 36 deg., and which was active from 1919, December 27th, to 1920, May 16th. Its maximum area was 3,652 on March 23rd, when a series of synodical magnetic disturbances culminated in a violent storm. It was also near the central meridian, and in latitude - 5 deg. Similarly the protracted storm of 1921 coincided in its maximum phase with the central meridian passage of a very large sun-spot group, area 3,300, on May 14th. These cases support the view that the action of a sun-spot area, as the necessary condition of a magnetic storm, is by the projection of a set of divergent rays proceeding fan-wise from the area, and probably diffused into a cloud-belt. For some of the series of magnetic storms, accompanying the passage of the sun-spot area, occur when the sun-spot is far removed from the central meridian. But with regard to the violent magnetic storm of 1919, August 11th, 12th, the accompanying sun-spot, the largest group of the year, a triple equatorial group, extending 20 deg. in longitude, did not appear on the sun's E limb until August 14th. If it is supposed that violent magnetic storms are connected with disturbed sun-spot areas on the sun, a supposition which is supported by a great mass of evidence, this case is decisive against a radial discharge of electrical particles from the area. But it is not inconsistent with the hypothesis of a wide diffusion of electrical particles by mutual repulsion in the form of a belt of clouds round the sun.

Seismological Investigations.

(Extract from Report of Committee.)

Section A.—Mathematical and Physical Science.

Breaking Submarine Cables.—It was Professor Milne's opinion that submarine earthquakes were often responsible for breakages of cables, which occasionally occur without assignable cause. If so, we should have an important link between a scientific study and the business world. During the past year opportunities have arisen in several independent ways for testing this hypothesis. In some cases definite dates and places of cable breakages were supplied, with inquiries whether shocks fitting in with these data had been recorded. In no case could an affirmative answer be given after scrutiny of the records; while in some of them the trace seemed to be almost maliciously quiet for many hours near the date and time provided. After some experience of this kind other inquiries were initiated by the Chairman without better success. The cable companies concerned do not wish the details published, for business reasons; but the main facts are as stated. It would seem that if submarine shocks of the kind are responsible, then for some reason they do not affect the seismological records.

The Microchronograph.

By PROF. R. A. SAMPSON, F.R.S. (Abstract.)

Section A.—Mathematical and Physical Science.

The instrument described is in actual use at the Royal Observatory, Edinburgh, for registering clock times of any signal accurately to 0.001 sec., for the purpose of examining short-period changes in the relative rates of two clocks, or the lag of a controlled clock, or of one part of a piece of apparatus with respect to another. It has many other applications. The means employed are an adaptation of the oscillograph; this instrument can be so constructed as to be completely free from noxious or variable lag of its own. A detector is placed between the poles of a powerful electromagnet. This detector consists of a short loop of fine platinum wire, under tension, and spanned by a small plane mirror. The clock signal or other signal being given as an electric current of a few milliamperes

is recorded photographically on a moving film by the help of a minute rotation of the mirror. The rate of motion of the film cannot be trusted for fine measurement over an interval of one second; therefore the standard is taken from an interrupter which cuts off the light falling on the mirror at intervals of approximately 0.1 sec. This interrupter is a simple steel tongue, set in vibration and not maintained in any way, and carrying a wire which occurs a slit through which the light passes. The scale employed can be varied within wide limits. That used most frequently at present gives a motion of the film of about 3.3 cm. per second, with a lateral displacement of 0.13 mm. per millimetre, corresponding to a magnification of the movement of the wire loop of the detector by about 1,000. Exhaustive tests have shown that the instrument is completely reliable.

Modern High-speed Centrifugal Pumps.

By DR. S. F. BARCLAY. (Abstract.)

Section G.—Engineering.

THE fourteenth-century records of the French Academy contain a reference to a primitive form of centrifugal pump, and it is probable that the principle involved is quite an ancient discovery. The foundation of the modern form of turbine pump was laid in 1875, when Osborne Reynolds invented the stationary guide vanes. The present-day development is due mainly to the industrial evolution of the electric motor, with its demand for high angular speeds. The efficiency of the centrifugal pump attains a high value only when worked at the full rated output. The advantages, however, of the compactness, simplicity, and low first cost of pumps of this kind as compared with displacement pumps are so marked, that they are often employed for intermittent work with which high efficiency is not possible. Centrifugal pumps are suitable for use under a very wide range of conditions; they are used for lifting water against a head of only a few feet, or against a head of several thousand feet, and for small or large volumes. Centrifugal pumps are constructed that require only a fraction of a horse-power to drive them, and at the other extreme there are pumps that require several thousand horse-power.

SOUTH AFRICAN TRADE AND INDUSTRIAL POTENTIALITIES.**Methods of Marketing.**

H.M. Senior Trade Commissioner in South Africa, in his recent report, describes the persistent endeavour which is being made in the Union, aided by the Government, to start new industries. Amongst those in which great developments are or may be pending are iron and steel and cement production, and coal and oil shale distillation. Apart from experimental work in blast furnaces, the iron and steel industry is confined to working up scrap in electric and other furnaces. The work done has been highly creditable, but it is to be presumed that such ventures will be entirely eclipsed when the new large-scale blast furnace and steel converter plants are ready. In tin-plate and sheet-metal working, the tendency, owing to expense of transport, is for the industries to be confined to small factories serving their own locality.

Under the influences of the war, the iron and steel industry has developed very considerably. Light rails, reinforcing steel rods and bars, and lighter sections, are now being rolled in the Transvaal; steel shoes and dies for the gold mines are being cast locally, and several electric furnaces are being operated. But enormous developments in the production of pig iron and steel on a commercial scale from local ore are pending, no less than three undertakings of this nature being in various stages of preparation. Success in these ventures may create something in the nature of an industrial revolution, as with the raw material of good quality and lower price on the spot a host of subsidiary and dependent industries should spring up in their neighbourhood.

Greater progress in many industries would undoubtedly have been made before now, had it not been for the war and its after effects. Before the country generally realised what the war was going to entail, sources of supply of industrial machinery and plant were cut off and even raw materials were hard to obtain or prohibitive in price. Electric power stations producing up to maximum load could not cope with demands for current, and equally could not obtain additional plant.

Technical Equipment for University Education.

Very important developments, particularly in relation to University education, are in progress. Capetown is building a University on an ample scale. Johannesburg has converted its School of Mines and Technology into a University College, and is hoping for a charter to create an independent University. In both cases new buildings and new equipment are involved, and excellent opportunities are afforded to British

manufacturers of being first in the field with donations of apparatus, machinery and other equipment for laboratories, both scientific and engineering.

There is probably no form of advertisement—to put it on its lowest plane—so remunerative as making sure that the rising generation of chemists and engineers are taught as household words the names of the makers of plant and apparatus. Optical instruments, laboratory supplies, assay apparatus, testing machines and instruments, engines, machine tools of all kinds, all find a place in such educational institutions, and the makers of such who are fortunate enough to obtain a place for their makes in college laboratories have an obvious advantage over their rivals in all succeeding years. United States and German manufacturers are presenting certain apparatus free of charge.

Problems of Marketing.

In opening his discussion on methods of selling, Mr. Wickham recalls that the Department of Overseas Trade and its overseas representatives are sometimes accused, quite wrongly—he adds—of endeavouring to eliminate the merchant as an unnecessary middleman.

There is no doubt, he says, that years ago the British merchant was to an increasing extent acting as the channel for foreign manufactures to reach the Indian and Dominion markets. British manufacturers not having felt in the past the need for personal study of overseas markets while their goods were being satisfactorily pushed by merchants, found the pressure of competition increasing, and became alive to the necessity for studying overseas requirements and foreign competition first hand. They found that many merchants had become cosmopolitan in their business, and that enormous inroads had been made into Dominion markets by American and German manufacturers in particular.

American goods, designed for a home market very much akin in its tastes and particularly in its needs to those of the Dominions, were declared to be eminently well suited to Colonial markets. The idea that they were specially designed for the Dominions was fostered and very generally believed. Germany, on the other hand, by a systematic policy of copying on a cheaper scale and by readiness to adapt goods to demand, similarly established a firm hold.

In the Trade Commissioner's opinion, manufacturers, however, have not realised generally the essential facts of the case. They have fallen into the error, which may equally be found in labour circles and among farmers' co-operative societies, of claiming that their own work was the only work. The

manual labourer considers, as does the farmer, that production ends when his work is finished, and that all the brain work and clerical work involved in distribution is a mere nothing for which almost any pay at all is overpayment. The manufacturer is quite ready to defend the salaries of managing directors and export managers as money well laid out, but it is evident that to an enormous number of manufacturers the real facts are no more clear than they are to their manual workers when they clamour for the whole value of their product as wages.

The fact is that a product is not complete when boxed at a factory door, but only when it has been so manipulated and moved as to be ready for the consumer. If the consuming public will not buy, then that product has no value at all. If the flavour is disliked, the design is not attractive, the package is inconvenient, then the result is exactly the same as if, through bad salesmanship or insufficient advertising, the public had never been offered the goods. The goods in either case have no value, and production, however efficient, has to stop.

The value of a product depends largely on distribution. A perfectly worthless article, such as some patent medicine, finds a market through scientific distribution. An utterly inefficient system of distribution may equally ensure the failure to sell a product which would be of great value, just as a brilliant invention, may fail through capital being reluctant to put it on the market.

If manufacturers had been more generally ready to study the work and methods of merchants before they decided to dispense with their services, they would, continues the report, have realised that all middle men are not parasites and that many are not only an economy, but essential to efficiency.

Appointment of Agents.

As suggested above, very many manufacturers adopted the system of appointing travelling representatives or agents in the Dominions. Frequently from the fact that they stress the statement that they are trading direct with their market it is evident that they have failed to realise that they have merely substituted one type of middleman for another.

From evidence collected month by month, it is apparent that very many manufacturers have no great appreciation of the importance of their representative and of his functions. Agents are often regarded as almost mechanical displayers of samples, walking sample-room counters. No allowance is made for, or importance attached to, the personality of the agent.

Goods do not sell themselves, though they may continue to sell on an established reputation for a time. Orders do not follow automatically from shipping samples out to an agent, any more than they would if the samples were kept in London. If manufacturers would be more ready to appreciate the influence of a good agent in the sale of goods, and the value of the goodwill attaching to his position in the market, they would possibly modify their attitude to the question. Many manufacturers, of course, have learnt at least by experience, how important a factor their representative is in finding a market and keeping it. A very large number, including many old-established, successful and powerful firms, in the Trade Commissioner's opinion, quite clearly have no appreciation of the fact.

Some firms regard it as wholly unnecessary to be represented. They think it should be quite sufficient that they should offer their goods through catalogues (frequently badly got up and seldom self-explanatory) or mere price lists to importers in South Africa. They expect all the Union Government Departments and the mines to come and ask for their tenders in London.

Others, again, appear to think that any kind of individual who happens to be going out to South Africa, and to whom they wish well, is fittest to take their agency. In the last two years there have been many cases of men entirely ignorant of South African conditions, and either entirely lacking in knowledge of business and salesmanship, or at least disqualified in other ways, entrusted with valuable agencies for well-established and old British firms.

Men have been sent out to organise distribution and appoint agents having little knowledge and no discretion—men who, having no knowledge of their own limitations, are not prepared to learn from local experts in the business any more than from the Trade Commissioner's office.

Factors in Distribution.

Distribution in distant markets involves two factors which are not present, at least to the same extent, in the home market. The much longer time required for realising the cash value of goods necessitates financial strength, and catering for the needs of foreign countries involves close study and exact knowledge of the local idiosyncrasies, customs, climate, prejudices and so on. Advertising has to be adapted to different localities. Economies have to be studied in relation to packing, shipping and exchange. Credit, while not necessarily involving greater risk, must be specially studied in relation to the trade customs of different countries.

All these matters were in the past made subjects of special study by merchants, and, unfortunately for such manufac-

turers who desire to dispense with their services, the knowledge acquired has never been dealt with in text books. Apart from small sub-sections of the science, there is no literature of overseas distribution. The many British manufacturers who have successfully built up their own system of overseas distribution have had to learn by experience as merchants did before them. They have learnt that scientific distribution involves much study, judgment, and hard work; that while possibly the system of relying entirely on merchants for export markets was unsatisfactory, that while distribution through independent middlemen was not economical or did not secure the maximum amount of enthusiastic pushing of their goods, and did not provide an adequate supply of information as to foreign competition and local needs, nevertheless to undertake distribution and eliminate the merchant involved more rather than less work than the merchant had hitherto done.

It is probable that from the point of view of the consumer, the efficient merchant can always distribute as cheaply as, if not more cheaply than, the manufacturer, and in addition to the work done the manufacturer needs, in his own interests, a constant supply of information as to competitive makes and changes of local taste. It is therefore obvious, adds the Trade Commissioner, that for effective competition with the merchant, a manufacturer needs more efficiency and closer study of the economies of distribution than his rivals.

It will be of interest to compare the foregoing views expressed by the British Trade Commissioner, with the following advice contained in a report by the United States Trade Commissioner at Johannesburg.

American Experience.

The latter explains that it would not be feasible or practicable to market machinery, including agricultural, mining and industrial, automobiles, typewriters, adding machines or kindred lines, where service is a fundamental factor or where the cost of maintaining large stocks of goods and spare parts is high, except through merchant agents. Certain new specialties for which a market must be developed, such as washing machines and vacuum cleaners, also come within this category. High-grade lines of trade-marked or branded goods may be placed in the above classification. With such lines it is essential that the principal centres, Johannesburg, Cape Town and Durban, should be covered by agency holders, with sub-agents in the tributary territory, these to be approved by the manufacturer.

For general merchandise such as a policy tends to restrict sales and is, as a general rule, inadvisable. It is not advisable to grant a sole agency to a retailer, because wholesalers or other retailers will not buy of him, nor will they, as a rule, buy of a competing wholesaler. As a result, the new lines are brought to the attention only of the regular customers of that particular merchant.

For such goods two methods are presented. The more popular is the export commission house with adequate branches or field representatives. Probably 75 to 85 per cent. of the American goods in South Africa have been introduced in this way. Care should be taken in the selection of a commission house that there should be no doubt as to its ability to develop business, that the firm has the proper standing and reputation among South African importers, and that the house has an extensive, established following.

The second method is through the use of manufacturers' agents. Of these there are perhaps only a few types worthy of serious consideration. One class consists of firms or individuals having substantial sales organisations reaching all desirable customers by means of branch houses, travelling salesmen or local sub-agents. A small class of agents, for the most part specially trained men, accept only such lines as may relate to a particular trade or class of goods. A third type that should appeal to the American manufacturer, goes in for intensive selling of a restricted number of lines, and endeavours to work each one fully.

If a satisfactory firm can be secured to cover the entire country, this is more desirable, but it is far better to have a separate agency in the chief city of each province, than to have one general agent who will place sub-agents in important centres. Only in rare instances may it be advisable to permit the firm having the South African agency to attempt to cover Portuguese East Africa, Rhodesia or other adjacent territories.

When an agent has given satisfactory evidence of his ability, the Trade Commissioner explains, he should be given a definite, clean-cut contract, which should be lived up to in letter and in spirit. Provision should be made in the contract that no competing lines of any country can be carried by the agent. Frequent change of agents does not tend to produce a favourable attitude towards the goods represented, and this gives an additional reason for a proper first selection.

German Steel Industry.—The number of unemployed in the Solingen steel industry is steadily diminishing. The number of unemployed is given as 100, as against 2,000 in July. There is a great lack of steel-workers, and the industry is reported as being swamped with export orders on account of the low value of the German mark.—*The Times*.

THE SOUTH-EAST LANCASHIRE ELECTRICITY DISTRICT.

THE MANCHESTER SCHEME.

THE South-east Lancashire Electricity Committee formed in July of last year has approved unanimously a comprehensive plan of power organisation suitable for Manchester and the district contained roughly between Wigan, Rochdale, Glossop, and Knutsford (see *ELEC. REV.*, June 25th, 1920; p.815). This area will be the biggest electrical unit in the provinces, and the interests contained therein will be equal to those of Greater London, says the *Manchester Guardian*, from which the following details are abstracted.

The scheme, which was drafted by a sub-committee, will involve the closing of some stations and the extension of others, but no immediate joint action is anticipated, except the formation of an Advisory Board, to give expert advice on any proposals by electricity undertakings within the district. The Board will have no power either to order or to authorise the outlay of capital; it will not be able to order the closing of any undertaking; but the Electricity Commissioners will entrust to it the organisation of power supply in the district and the duty of deciding any proposal which may be made locally. The Board will have neither funds nor borrowing powers. The finance of expansion and extension will, therefore, devolve on the local authority which proposes such expansion, and will depend on the consent of the Electricity Commissioners.

Should general opinion in the district desire it, however, the Board could, by an amending order in Parliament, be changed for a Joint Electricity Authority, which would have borrowing powers, being responsible only to its members and to the Electricity Commissioners. Either of these bodies would be composed of experts from the individual undertakings under the scheme, but the constitution of the Joint Authority would differ from that of the Board. The Board, for instance, will have 48 members, of whom five only will represent Manchester, though the output of Manchester generating stations is 42 per cent. of that of the whole district. The formation of a joint control will, many experts think, be a necessity in the future.

The scheme of the South-east Lancashire Committee has yet to be considered by the municipal electricity committees concerned, by city councils, or local authorities; and a conference is to be held on October 18th. The local inquiry by the Electricity Commissioners will probably take place in November; at present there is no opposition to the scheme.

Each undertaking will pay a fee—according to capacity—for administrative purposes, and it is expected that within five years the scheme will effect a saving of £175,000 and that within ten years the saving will be close on £250,000. This is to be accomplished by using and extending the stations which generate most efficiently, by diverting surplus energy to places which are short of it, and by manipulating to the fullest extent load and diversity factors.

The factors of efficiency which obtain in the district now vary tremendously. One of the smaller stations, for instance, takes 22 lb. of coal to produce one power unit, and only the biggest take less than 3 lb. The difference is one of the things the scheme is intended to rectify. The construction of many new power mains, direct and intercommunicating, is outlined in the scheme, even though 80 per cent. of the stations are already linked up, and details of necessary station extensions are given. As the report has been in preparation during the greater part of 18 months, it appears at a time when a good deal of money has already been spent on work which is in accordance with the general design of the scheme. The Barton station, built by the Manchester Corporation, is, for example, half finished, and will take its place in the new organisation. Manchester, indeed, is pledged to spend more than £3,000,000 on this and other plans.

The comparative figures printed in the Committee's report are for the next five years:—

Capital outlay:—	
Under individual development	£8,178,000
Under the scheme	£6,801,880
A saving of	£1,376,120
Interest at 10 per cent. per annum.	£137,612

Similarly a great saving of coal should result. The following figures are for the same period of time as above:—

Coal consumption:—	
Under individual development	1,468,750 tons
Under the scheme	988,159 tons
A saving of 19,831 tons annually, i.e.,	£34,704 per annum.

A further saving would be effected during the next five years, 1926-31, and should amount, roughly, to the following:—

Capital outlay:—	
Under individual development	£9,787,500
Under the scheme	£6,280,100
A saving of	£4,507,400
Interest at 10 per cent. per annum	£450,840

Coal consumption:—	
Under individual development	1,468,750 tons
Under the scheme	1,432,912 tons
A saving of 35,838 tons annually, i.e.,	£62,716 per annum.

The Committee has shut out certain generating stations from the scheme as not suitable—namely, those at Bury (Rochdale Road), Eccles, Glossop (Urban Electric Supply Co., Ltd.), Heywood, Manchester (Dickinson Street), Radcliffe, Sale, and Stretford (Longford Bridge). "At these stations," says the report, "no extensions should be made, and they should be shut down as generating stations when other arrangements can be made for furnishing supplies on a commercial basis for the area at present served by these stations." Haydock and Lymm have been left out of the scheme on account of locality. Stalybridge for the same reason, and also because the plant differs from the normal, may eventually secede.

The stations to be extended are at Stockport, Ashton-under-Lyne, Bury, Bolton, Outwood, Wigan, Altrincham, and Alderley. New stations are either being built or are planned at Stockport, Oldham, Kearsley, Wigan, Agecroft, Barton, and Carrington. The construction of additional mains will be carried out between stations and also for distribution. The electrification of railway lines has been discussed, and the report finds that it is possible that the Lancashire and Yorkshire Co.'s line from Manchester to Oldham may be electrified within the next ten years. The company's station at Kearsley will, however, be capable of supplying the whole of the potential demand on this account.

It should be noted in conclusion that the scheme has been designed by members of municipal bodies, and by the experts of undertakings. The South-east Lancashire Committee, led by Alderman W. T. Dagnall, who has presided over its sessions during the whole period, approved the scheme unanimously. Mr. A. H. Banks, deputy town clerk of Manchester, has been secretary throughout the discussions, and as soon as the scheme is accepted by local authorities will be able to sell copies of it to any of the general public who are interested.

ELECTRICITY IN WORKING-CLASS DWELLINGS.

An important report on the use of electricity in working-class dwellings has just come to hand from the British Electrical Development Association, Inc. (E.D.A. No. 167, price 10s.); it was prepared by the E.D.A. Domestic Committee with the assistance of Messrs. G. Blair Imrie and T. G. Angell, architects, and shows in detail how the cost of a complete electrical installation can be met by the saving of the fabric which is effected by omitting such chimneys and fire-places as are rendered superfluous by the adoption of electrical methods of lighting, cooking, and heating. That such is the fact has often been stated, but this is the first occasion, so far as we are aware, on which chapter and verse has been given for the assertion.

In a brief preface, Mr. J. W. Beauchamp, director and secretary, points out the pressing need for reform and improvement in the domestic régime, and the importance of the rôle that electricity can play in effecting such changes—already established as the ideal means of artificial lighting, "its fuller use for heat and power now promises to do as much for home life as it has accomplished for industry."

Where electricity is employed for cooking, and for the provision of heat in all positions where that method can be economically used, it is found that the cost of an "all-electric" house, including equipment, is the same as that of a house designed for cooking and heating with coal, but without any provision for artificial lighting; and the cost is £34 less than that of an "all-gas" house. Yet the "all-electric" house is wired on high-class lines, and fully equipped with lighting and cooking apparatus, short-hour room heating, and clothes boiling, as well as with controllable ventilators.

To substantiate these statements we refer the reader to Mr. G. Blair Imrie's report and plans, which show precisely how each class of house is constructed and equipped. The plans and quantities are based upon an approved design for a working-class house suitable for urban areas (No. 178 of the Ministry of Health). In each case at least one coal fire is provided, of the open combination type, for heating, cooking, and heating water in the winter time; a coal, gas, or electric cooker is provided as an alternative for use when the principal fire is not in use; and similarly an alternative water heater is installed. In the "all-coal" house the alternative cooker and water heater takes the form of a small portable coal range in the scullery. The "coal and gas" house is provided with built-in gas fires in the bedrooms and parlour, and ventilation is effected by outlet flues. In the "coal and electric" house there is one coal stove, an electric cooking range, an electrical geyser, circulator, or heat storage tank, and plug points in the parlour and bedrooms, for two portable electric fires. Controlled ventilators are also provided. Mr. Imrie comments on the freedom in design arising from the use of electric cookers, fires, &c.,

which enables the architect to make the best arrangement with regard to the site, natural lighting, ease of access, and working; one chimney stack takes the place of three, the interior of the rooms is unobstructed by fire-places, &c., and the "social centre" of an apartment (that is, the source of heat) can be placed anywhere without regard to flue facilities. Again, electric pendant lamps need not be lower than nine inches from the ceiling; gas fittings and hanging oil lamps must be placed at a lower elevation, with a correspondingly lower efficiency.

Bills of quantities of all work in connection with the heating, cooking, lighting, and hot-water supply of the designs are given, specifying the items, and signed by Mr. W. Gordon Allen. The prices are based on current London rates, and have been verified by Messrs. F. & H. F. Higgs, Ltd., while the electrical quantities have been prepared and priced by Mr. Alan Kirk, A.M.I.E.E. Assuming that the cost of the cottage is £660 exclusive of all work in connection with fires, hot-water service, &c., the comparative values are as follows:—

Scheme.	Heating, cooking and lighting equipment.	Total.
Coal (no lighting)	£182 11 7	£842 11 7
Gas	£216 12 2	£876 12 2
Electricity	£182 8 11	£842 8 11

The electric lighting embraces nine points, with efficient shades, and ten switches (two 2-way); the lamps are 30-watt (one 20-watt). For electric heating two 1½-kW radiators are provided, with plug-sockets and switches at five points; one water heater, and one wash copper. The electric cooker is loaded to a maximum of 4 kW. The wiring is in enamelled heavy-gauge screwed welded conduit, with v.r. cables of C.M.A. quality, all fittings and accessories of British make and standard quality, and all work in accordance with the I.E.E. rules. Materials and labour are priced at the rates now current in London. As all the details are tabulated in full, any reader is in a position to verify the costs in every particular. The plans show in full the three arrangements, and a fourth plan details the electric circuits.

The complete report, which must have involved a considerable amount of labour, reflects credit upon its authors, and the Association is to be congratulated on the enterprise which it has shown in embarking upon this costly investigation, and carrying it through with a thoroughness which leaves little room for criticism.

LEGAL.

WESTERN ELECTRIC LAMP CO. v. PEARCE.

In the Shoreditch County Court, on September 20th, before Judge Cluer, the plaintiffs, of Sun Street, Finsbury, sued Mr. F. W. Pearce, of Market House, Maidstone, ironmonger and electrical sundries dealer, to recover 38s. for goods supplied. The plaintiffs said they did not think the defendant would deny the order, or having received the goods, but he declared that he had paid the traveller, who was not authorised to receive it. An invoice was sent at the time the goods were supplied, and on that it said "no traveller to be paid." They had had no dealings before. The plaintiffs agreed that the signature on the statement for the receipt of the money was that of the traveller. Judge CLUER: Have you prosecuted him? PLAINTIFFS: No. Judge CLUER: Then you must do your public duty first. PLAINTIFFS: He cannot be prosecuted, as it happens, as he is not a traveller on a weekly salary. On the statement it says "an official receipt by the company will only be recognised." Judge CLUER: But he was entitled to think that he was paying the proper person, and that the official receipt would follow. You will have to do your public duty first. As to the invoice, you have given no notice to produce it, so I have not got it before me. There will have to be a verdict for the defendant. DEFENDANT: Can I have my costs, your Honour, I have only been defending this case on principle? Judge CLUER: Oh, certainly. I quite understand why you have defended the case.

Judgment was then entered for the defendant, with costs.

IMPORTANT VALUATION DECISION FOR ELECTRICITY USERS.

In an appeal by Lanarkshire steelmakers against the valuations proposed by the County Assessor for the current year, the Valuation Court has issued an important decision affecting electricity users.

With regard to motive power, the Court, in its findings, states that a turbine is assessable, but the generator is not. In the case of a motor generator, the motor is assessable and the generator not.

With regard to a rotary converter, it was decided that it could not be split, and it was therefore assessable. Lighting sets as such were assessable, but in connection with light taken from a power plant, the Court decided the quantity that was used for lighting was so infinitesimal that it could not be split, and it was not assessable.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published & considered of sufficient interest.

A New Circuit Breaker.

Our illustration, fig. 1, shows a new pattern of automatic circuit breaker recently put on the market by Messrs. J. G. STATTER & Co., of Queen Anne's Chambers, Westminster, which is giving every satisfaction to its users. The design is a reproduction, with improvements, of a breaker designed by Mr. Statter jointly with Mr. James Sugden, now of Rugby, in 1908. The breaker then designed was much appreciated by those to whom it was supplied, but certain features were found to be somewhat expensive in manufacture, and for manufacturing reasons, it was not put forward in quotations after 1910. Its advantages from the user's point of view kept the design alive, and it was recently re-designed in all sizes from 100 to 3,000 amps., and both these sizes, together with a full series of intermediate sizes, have now been made and supplied.

One salient feature may be mentioned. The breaker in the open-circuit position, just as it would be found after it had tripped automatically, or had been tripped by hand, has its handle hanging downwards. In order to re-establish the circuit, the operator first raises the handle to the position shown in figure 1. This operation brings the main brush and auxiliary breaking tips nearer to their closed position, and is a definite position which no amount of pushing at the handle in the upward direction can alter. The makers call this the "Half Cock" position in which the parts will remain pending the moment at which the operator desires to close

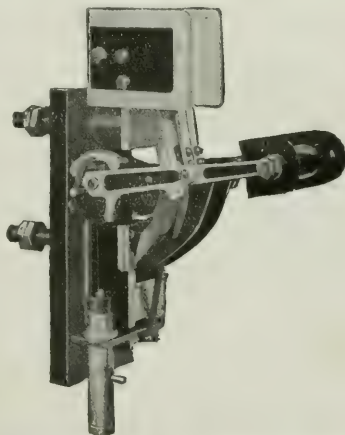


FIG. 1.—CIRCUIT STILL OPEN, BUT BREAKER IN POSITION FOR INSTANT CLOSING.
("Half-Cock position.")

the circuit, when a downward pull on the handle gives a quick closing action. This feature is useful when paralleling. The illustration shows the breaker in its simplest form, viz: single-pole d.c. overload type; but it is also made in d.p. or t.p. form, and with carbon breaks in lieu of a magnetic blow-out, when it is suitable for use on a.c. circuits.

In all cases the handle is of the "free" type—that is to say, manual power never over-rides the automatic features. The breakers are also supplied with no-volt, minimum and reverse-current trips, and time lags are added to the overload trip-coils where necessary. The design also lends itself to enclosure in c.i. cases, and the breaker is supplied in this form. For cleaning of the brush or contacts (a necessary process for all open type breakers exposed to oxidising influences), a brush may be completely detached in a few seconds, leaving the contacts fully exposed. Similarly, in all large sizes the pressure of brush on contact may be increased, to allow for wear, in a few seconds also.

Added to the special advantages briefly outlined above, the breaker is machine-made with interchangeable parts; it is finished in black and nickel, and the standard sizes are suitable for d.c. voltages up to 750 and a.c. voltages up to 1,000.

Empson's Alkal-Acid Indicator.

This automatic device, which is supplied by Mr. A. W. EMPSON, A.M.I.E.E., of 39, Victoria Street, London, S.W.1, is an electrical instrument specially designed for the continuous testing of water, thus obviating the necessity for making frequent chemical tests. Applied to surface condensers, it will automatically indicate a very small leakage

of circulating water into the steam space, thus protecting boilers against the effects of impure feed water and avoiding the risk of overloading the air-pumps. In designing this instrument advantage has been taken of the fact that the electrical conductivity of water is increased by the presence of acids, alkalis, or salts in solution, and the difficulties introduced by reason of the rise and fall of conductivity with temperature, and variation in the quality of steam supplied by the boilers, have been successfully overcome.

The testing device consists of two cells, one of which is supplied with condensed steam at the rate of a few drops per minute direct from the main steam pipe, and the other with water discharged by the air-pumps. The indicator, which may be placed on the switchboard, or in the office of the engineer-in-charge, is electrically balanced across the electrodes of the testing device, and thus a continuous comparison is made between the steam as it leaves the boilers and the condensate delivered by the air-pumps. Any leakage of circulating water will, therefore, destroy the electrical balance and cause the pointer to be deflected.

A modified form of this instrument is supplied for checking the working of water softeners, and indicating any shortage or excess of reagents. In this instrument the electrodes are enclosed in perforated cases, one pair being immersed in the inlet and the other in the outlet compartments of the softening apparatus. The reagent supply having been correctly adjusted and checked by a chemical test, the instrument is switched on and the pointer set to zero, further chemical tests being unnecessary until an irregularity is denoted by the deflection of the pointer towards the "excess" or "shortage" positions of the scale.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DRILL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

- 24,062. "Portable electric heating apparatus." Knaulmann & Co. September 9th. (Switzerland, December 13th, 1920.)
- 24,063. "Electric bicycle bell." L. Dalsgaard-Anderson. September 9th.
- 24,064. "Electric clock and signal installation." Schveizerische Magneta Akt-Ges. September 9th. (Switzerland, September 11th, 1920.)
- 24,071. "Electrode for electricity meters in which gases are electrolytically dissolved and eliminated." Schott & Gen. September 9th. (Germany, September 17th, 1920.)
- 24,076. "Trolley heads for tramscars, &c." C. P. Ellis. September 10th.
- 24,094. "Bulb and battery tester." H. T. Morgan. September 10th.
- 24,098. "Incandescent electric lamp holder." A. Hippisley and F. A. Milham. September 10th.
- 24,099. "Shade retainer for electric lamp holders." A. Hippisley and F. A. Milham. September 10th.
- 24,136. "Switches or switchboards for controlling electric circuits." A. H. Midgley. September 10th.
- 24,140. "Electric motors." M. W. Woods. September 10th.
- 24,143. "Enclosed cartridge fuses for use in electric circuits." E. J. Pierce. September 10th.
- 24,146. "Electric generators for road vehicles." H. Hepworth. September 10th.
- 24,179. "Electro-magnetic step-by-step mechanism." Western Electric Co., Ltd. (Western Electric Co., Inc.). September 12th.
- 24,180. "Signalling systems." Radio Communication Co., Ltd., and J. Scott-Taggart. September 12th.
- 24,194. "Electric water heaters." A. Fisher and J. Rosenkrantz. September 12th.
- 24,202. "Electric circuit breakers." M. Paul. September 12th. (Germany, September 10th, 1920.)
- 24,206. "Clamping of electric trolley conductors." Metropolitan Vickers Electrical Co., Ltd. September 12th. (United States, October 29th, 1920.)
- 24,207. "Photo-electric devices and methods of manufacturing same." British Thomson-Houston Co., Ltd. (General Electric Co.). September 12th.
- 24,227. "Electric indicator for wireless waves for telegraphy and telephony, &c." C. E. S. Phillips and Watson & Sons (Electro Medical), Ltd. September 12th.
- 24,240. "Electric furnaces." L. J. Hancock and T. R. Hancock. September 12th.
- 24,241. "Mining toy switchgear." F. G. Warburton. September 12th.
- 24,247. "Spark plug valves." J. & C. G. Rotundus Melandsky Verkesta Aktiebolag. September 12th. (Sweden, September 20th, 1920.)
- 24,250. "Manufacture of depolarisers for galvanic elements." R. Porsche. September 12th.
- 24,251. "Manufacture of electrolytes for galvanic elements." R. Porsche. September 12th.
- 24,266. "Electrical or mechanical hand or chain control." J. E. Smith. September 12th.
- 24,295. "Telephone exchange systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). September 19th.
- 24,303. "Adaptors or wall plugs for electrical connections." D. Lyon. September 13th.
- 24,331. "Unidirection electric generator set." H. H. Ellison. September 13th.
- 24,332. "Electric traction systems." R. Brooks, A. J. Hall, and Metropolitan Vickers Electrical Co., Ltd. September 13th.
- 24,333. "Sealing of electrical conductors in glass, &c." H. G. Cameron (Metropolitan Vickers Electrical Co., Ltd.). September 13th.
- 24,340. "Electrically-operated automatic valve regulators." A. J. Haddon (London and Glasgow Co.). September 13th.
- 24,345. "Control indicator for wireless waves for telegraphy and telephony, &c." J. H. Whitaker Swinton. September 13th.
- 24,349. "Electric etching machines." G. F. Johnston and E. G. Schwachow. September 13th.
- 24,352. "Electric lifting gear." E. C. R. Marks (Siemens Schuckertwerke). September 13th.
- 24,356. "Electrical circuit controlling devices." J. B. Bignamy. September 13th.
- 24,388. "Apparatus for testing line or line groups, particularly in automatic and semi-automatic telephone plants." Relay Automatic Telephone Co., Ltd. (G. A. Betulander and N. G. Palmgren). July 2nd, 1920. (168,474.)
- 24,413. "Combination electric lamp horn and switch board." Quenby Bros., Ltd. (Quenby Electric Co.). September 14th.
- 24,441. "Submersible electrical apparatus." H. T. Harrison, F. Pooley, and W. L. Wreford. September 14th.
- 24,442. "Portable electrically-driven combination tools." F. C. Austin, F. Pooley, and W. L. Wreford. September 14th.
- 24,448. "Portable electrically-driven apparatus." F. Pooley and W. L. Wreford. September 14th.

- 24,465. "Electro plating, &c., apparatus." W. Canning & Co., Ltd., and G. A. Pope. September 14th.
- 24,468. "System of rheostatic converter, and its application to speed regulation of induction motors, &c." M. de Conninck. September 14th. (France, September 30th, 1920.)
- 24,479. "Arc lamps." P. K. Jackson (Sperry Gyroscope Co.). September 14th.
- 24,501. "Time switch." V. A. J. Conlin. September 15th. (Denmark, January 13th.)
- 24,502. "Trolleys for overhead conductor electric tramways." W. Lawrence. September 15th.
- 24,528. "Electric switches." I. C. Green, J. Jamieson, and B. J. Wilson. September 15th.
- 24,562. "Method of protecting polyphase supply circuits on earth connection." Akt.-Ges. Brown, Boveri & Cie. September 15th. (Switzerland, September 15th, 1920.)
- 24,564. "Governor for electric motor, &c., operating a pump to supply pressure in a hydraulic system." J. Stone & Co., Ltd., and W. P. Watkins. September 15th.
- 24,578. "Wireless receiving apparatus." C. K. Chandler. September 15th.
- 24,579. "Electric signalling and telegraphic devices, &c." E. O. Symonds. September 15th.
- 24,593. "Wind-driven dynamos." F. A. Wilkinson. September 16th.
- 24,597. "Electric terminals." J. Eaton and Elandem Co., Ltd. September 16th.
- 24,598. "Electric hand lanterns." J. Eaton and Elandem Co., Ltd. September 16th.
- 24,607. "Electric lighting sets for motor vehicles, &c." W. J. Nicholas and P. J. W. Roberts. September 16th.
- 24,622. "Electric storage battery." E. E. Dutt and J. T. Godfrey. September 16th.
- 24,635. "Electric water heaters." O. Granthal and F. H. Zschauer Metallwarenfabrik. September 16th.
- 24,636. "Clock operated electric switches." J. L. Rodger. September 16th.
- 24,641. "Electric packet lamps." B. Rogge. September 16th. (Germany, September 22nd, 1920.)
- 24,650. "Electric switches." A. S. Cubitt. September 16th.
- 24,652. "Wireless telegraph devices." T. D. Parkin. September 16th.
- 24,654. "Electric contact breakers." British Lighting & Ignition Co., Ltd., and E. B. Tuppen. September 16th.
- 24,655. "Suspension insulator." M. Carolus. September 16th.
- 24,681. "Electric clock time switch." C. B. Pinkerton. September 17th.
- 24,692. "Dynamo electric machines." Lancashire Dynamo & Motor Co., Ltd., and H. B. Whitmore. September 17th.
- 24,693. "Thermostatic switch." Aktiebolaget Birka Regulator. September 17th. (Sweden, September 30th, 1920.)
- 24,726. "Sparkling plugs, &c." G. W. Clark and G. H. Ward. September 17th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

- 5,989. "Dynamo-electric machines and magnetos." K. F. Ries. February 27th, 1920. (168,396.)
- 6,139. "Party line telephone systems." R. C. M. Hastings. March 1st, 1920. (168,337.)
- 6,139. "Party line telephone systems." R. C. M. Hastings. March 1st, 1920. (168,338.)
- 6,492. "Alternating current electrical instruments." G. F. Shoter and E. W. Hill. March 3rd, 1920. (168,339.)
- 8,711. "Automatic control mechanism for electric furnaces." Scovill Manufacturing Co. June 26th, 1918. (146,789.)
- 9,812. "Electric distributing device for the ignition systems of internal combustion engines." A. W. Fellows and W. A. Gardner. June 5th, 1920. (168,350.)
- 11,963. "Containers for electric batteries and other electrical apparatus." Ajax, & Co. A. Cooper, and D. F. Sell. April 29th, 1920. (169,560.)
- 12,773. "Electric contacts." J. B. Tucker and J. H. Tucker & Co., Ltd. May 20th, 1920. (168,363.)
- 14,680. "Vacuum tube relay devices and the like especially for use in wireless signalling systems." J. Scott-Taggart and Radio Communication Co., Ltd. May 29th, 1920. (168,409.)
- 14,907. "Supports for filaments for thermionic valves." A. K. Macrorie, H. Morris Airey, and G. Shearing. May 31st, 1920. (168,407.)
- 14,970. "Construction of combined electric switch and plug coupling." C. May. June 1st, 1920. (168,408.)
- 15,253. "Electric fuse carriers or connecting and disconnecting devices." F. Honnor and British Insulated & Helsby Cables, Ltd. June 5th, 1920. (168,425.)
- 15,393. "Tramcar fenders." O. G. Jones. June 12th, 1920. (168,441.)
- 15,986. "Systems of electric ship propulsion." British Thomson-Houston Co., Ltd., and D. E. Jewitt. June 12th, 1920. (168,448.)
- 17,346. "High-tension electric transformers." Siemens & Halske Akt.-Ges. June 30th, 1919. (145,675.)
- 18,193. "Arrangements for testing lines or line groups, particularly in automatic and semi-automatic telephone plants." Relay Automatic Telephone Co., Ltd. (G. A. Betulander and N. G. Palmgren). July 2nd, 1920. (168,474.)
- 18,764. "Electric starting and lighting systems for automobiles." L. K. Smith. December 2nd, 1919. (146,873.)
- 18,849. "Portable electric welding apparatus." Siemens Schuckertwerke. May 3rd, 1919. (146,914.)
- 18,912. "Telegraphic ciphering and deciphering mechanisms." Western Electric Co., Ltd. December 4th, 1918. (Addition to 146,530.) (146,990.)
- 19,169. "Process and apparatus for electrostatic separation of finely divided discrete material." G. R. Brown. July 7th, 1920. (168,479.)
- 19,637. "Electric generating systems." Kohler Co. March 2nd, 1916. (117,964.)
- 19,964. "Wireless telegraph transmitters." Ges. fur Drahtlose Telegraphie December 32nd, 1917. (147,850.)
- 19,942. "Primary batteries." C. Eay. December 1st, 1914. (147,890.)
- 20,000. "Sound transmitting arrangement." Signal Ges. August 12th, 1919. (147,845.)
- 21,914. "Electric wireless receiving apparatus." Metropolitan-Vickers Electrical Co., Ltd. August 5th, 1919. (148,349.)
- 22,164. "Junction boxes and the like for electricity distributing systems." H. E. Walker. July 24th, 1920. (168,499.)
- 23,864. "Apparatus for measuring the maximum demand demanded from the electricity supply." O. Howarth. August 13th, 1920. (168,514.)
- 24,464. "Means for holding in close contact a movable truck and stationary cable of an electric switchboard or other relatively movable members." Johnson & Phillips, Ltd. and A. H. Hockley. October 7th, 1920. (168,537.)
- 28,921. "Thermo-metrical indicating apparatus." H. Joire. June 20th, 1920. (165,762.)

1921.

- 3,919. "Electric liquid heaters." Festa Akt.-Ges. February 11th, 1920. (158,842.)
- 3,919. "Party line telephone systems." R. C. M. Hastings. March 1st, 1920. (Divided application on 169,397.) (169,568.)

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ELECTRICAL REVIEW.

MUNICIPAL TRAMWAYS AT BAY.

Vol. LXXXIX. CONTENTS: October 7th, 1921.

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The annual conference of the Municipal Tramways Association (Incorporated), which was held at Salford last week, was favoured with splendid weather, such as is not usually associated with that neighbourhood; some 180 delegates were present, and the arrangements for the Conference were admirably planned and carried out, so that the meeting proved thoroughly enjoyable. The leading feature of the meeting was the question of unfair competition with the tramways by road vehicles, which has long been a thorn in the side of the former, but has recently assumed dimensions and acquired an intensity far beyond all previous experience; the Conference was like a nest of hornets stirred up with a pole, and fairly buzzed with excitement and indignation. The upshot was that a strong resolution was unanimously passed, vigorously protesting against the operation of the Roads Act, 1920, and calling upon the Minister of Transport to take action in the matter.

The reason why this outburst of wrath has suddenly occurred is simply this: That on August 31st the war officially ended, and an emergency Act, which until then had provided some restraint over the competition of private concerns, no longer held sway. Consequently, a flood of motor omnibuses and charabancs was let loose, and immediately the tramways in many districts found themselves exposed to competition in its severest form.

We have often pointed out that electric tramways, subject as they are to the out-of-date provisions of the Tramway Act of 1870, which were based upon the conditions appertaining to animal haulage, are heavily handicapped by having to pave and maintain the road surface, although electric tramcars are the only class of vehicle that makes no use of the paving, whilst all others do. In many cases, too, the tramway undertaking has had to bear the cost of road widening, and other improvements for the benefit of the public and, incidentally, of its commercial rivals. Its operation is subject to onerous statutory requirements with regard to maximum fares, workmen's fares, regular running, &c., and it has to pay rates on its street works. It cannot stop running. On the other hand, its competitors are at liberty to run or not as they please, to charge what fares they think fit, to run on the paving paid for by the tramways, to ply only at the rush hours, and to leave the unremunerative periods to the tramcars; they make practically no contribution to the cost of construction or to the upkeep of the roads, and they are not subject (with certain exceptions) to examination as to their fitness for public transport traffic. Where they are in competition with the tramways they lower their fares to a cut rate—elsewhere, of course, they extort much higher rates, and if the tramways ceased to exist, there is no doubt that they would increase the fares on the routes where competition was removed. As they run regularly over the same roads they soon destroy the surface, and the community has to bear the cost of renewing it—thus, in fact, defraying part of the establishment charges of the rival concern.

Now, Parliament, in imposing conditions, and severe conditions, too, upon the tramway undertakings, municipal and other of necessity granted them implicitly if not explicitly a monopoly of the class of public service concerned, just as it did in the cases of water, gas, and electricity supply. Yet, under the provisions of the Roads Act, 1920, any person or company is entitled to obtain a licence to ply motor vehicles for hire anywhere unless the licence is withheld for certain reasons with which we are not concerned; the only appeal

is to the Minister of Transport, whose fiat is final and cannot be reviewed by the Courts or any power save Parliament itself!—and the Ministry of Transport has up to the present shown a tendency to favour the competing road vehicles at the expense of the tramways, over which, one would imagine, it would be its plain duty to extend a protecting shield.

For confirmation of these statements we refer our readers to the report of the discussions at the Tramway Conference, given elsewhere in this issue; that the members had most substantial grounds for dissatisfaction will at once be evident. Already hard hit by the depression of the national industries (only five municipal undertakings avoided making a loss last year), they are now assailed by a fierce and irresponsible competition. We entirely sympathise with the members, whose grievance, moreover, is shared by the private undertakings, and we trust that the maximum pressure will be exerted in and out of Parliament to right their undoubted wrongs.

GERMAN GOODS MASKED AS FOREIGN MANUFACTURES.

ATTENTION was recently directed in this journal to the fact that German firms have begun to form shareholding companies in Switzerland for various purposes, including the intention to escape the taxes placed by the Allies on German exports by sending abroad goods "naturalised" in Switzerland. The question of the passing off of German merchandise as the manufactures of other countries has also arisen in Canada, where, it is stated, attempts are being made to evade the Customs Act by German exporters forwarding goods to Holland, Switzerland, and other high-exchange countries, and then re-exporting them as the particular products of these countries. The Canadian Reconstruction Association, dealing specially with this subject, asserts that evidence is accumulating of efforts to ship German goods into Canada at illegally low valuations in violation of the Customs Act. It is also reported that offices are being opened in Holland for the definite purpose of handling German merchandise intended for Canada and for invoicing the goods in Dutch currency and as of Dutch origin.

Naturally, we are not aware what evidence is in the possession of the Canadian Reconstruction Association, but there is not the slightest doubt that the Germans are endeavouring to use other countries as the intermediaries for the disposal of German products as the manufactures of the countries utilised for this purpose, and of Holland in particular. Yet there is nothing really new in this German procedure. During the years of war many Dutch firms, it is regrettable to note, were the willing tools of the Germans in the attempted continuation under Dutch auspices of the former German trade, although the many devices which were resorted to for the purpose of deception were almost invariably discovered in England and were successfully frustrated. After the armistice, when the Germans began to understand the actual situation which they had created for themselves in the matter of world trade, they consoled themselves for a time with the reflection that they would always be able to find foreign merchants and others who would be willing to attend to the recovery of the former trade of Germany. In fact, they frequently boasted about this availability of foreigners for the express purpose of carrying on the trade, and the reports now received from Canada tend to confirm that the work of the intermediaries, or of the Germans in Holland, is already in full swing under the influence of the new situation created by the low costs of production in Germany due mainly to very low wages, combined with the effects on sale prices of the heavy depreciation of the mark, which latter was not foreseen when the resolve to make

use of the services of intermediaries was originally announced after the armistice.

As bearing on the question, reference may be made to statements which were published in a Berlin newspaper—*Der Tag*—in July, when discussing the matter of trade with Holland. The writer states that numerous German firms established themselves in Holland directly after the armistice and found the conditions very favourable; they eventually, as is said, saturated the country with German goods. As to the future of these firms, the newspaper remarks that Holland is not the best site for "German export firms"—export firms, be it noted—so long as the florin preserves a value which is considerably higher than the mark. But all the time it is conceivable that these firms with a Dutch domicile have been elaborating their schemes to get the better, if possible, of the world by the camouflage of their manufactures as Dutch products.

Of course, there is another side to the question which indicates that the German commercial invasion of Holland is not only a serious matter to that country, but also that its risks are fully appreciated in some responsible quarters. Thus, for instance, a prominent Dutch banker, about a month ago, raised a strong warning against the German economic conquest of Holland. He drew attention to the various banking interests established by the Germans in Holland without any corresponding action on the part of the Dutch banks in relation to Germany, and to the great danger that in the course of time Dutch trade would in this way be diverted to the German banks in Holland; and as a further instance of the German invasion, he mentioned that the country was inundated with German travellers. The banker deprecated the idea of inviting English banks to extend their connections in Holland as a counterbalance to the German encroachment on the Dutch economic life, but the only remedy he was able to suggest was that the Dutch banks in their turn should establish banks in the large towns in Germany, England, France, and other countries.

We observe that the Canadian Reconstruction Association states that many industries in the United States have already suffered seriously from increasing exchange-aided importations of German merchandise, and figures are given in this connection of the large growth in German exports to the United States in the year 1920-21 as compared with the fiscal year of 1918-19. The comparison, however, is scarcely appropriate, seeing that the latter year comprised the final five months of the war and the first seven months of the still unsettled state of trade after the armistice. Nevertheless, all we can say is that as far as the United States is concerned, there will be precious little direct dumping of German goods into America after the United States Consuls get properly to work again in Germany, because the latter are specially qualified to assess at their real value the prices cited in the German invoices presented for the certification of merchandise destined for America. The certification of invoices by United States Consular officials is not a mere formality, as all who have had transactions with them know full well. It certainly takes a smart man—a very smart man indeed—successfully to deceive American Consuls as to the sale prices of German goods, or of those of any other country for that matter; and attempts to undervalue goods are almost invariably detected. If every allied country had a staff of men as Consular officials equally as qualified as are the Americans, and with the same duties to perform, and were also to insist upon certificates of origin—issued by the local Chambers of Commerce in the districts of production—it is probable that German schemes to deceive other nations would be, if not entirely frustrated, at all events reduced to a minimum; and under such circumstances it would also be extremely difficult for Dutch firms or firms of any other nationality to succeed in getting Consular certification for goods which, as a brief inquiry would very probably soon be able to prove, were not produced by any firm in the so-called country of origin but were "made in Germany."

Criticism of Japanese Methods.

WE have heard a good deal at different times about the methods adopted by some Japanese traders. It is to be regretted that their good qualities and their general business alertness do not form the complete story. There are some things that we would rather not believe, and we are far from desiring to rush into print with any and every grievance that the Britisher home from abroad lays before us. Perhaps we are still more disinclined to say anything that might disturb our good relations with Japanese electrical and other business men. We feel, however, that silence would prevent the better type of Japanese trader from understanding how deep is the resentment in some British hearts concerning grossly unfair practices which they in the Far East will wish to prevent as far as their influence will permit. We are not referring to the marking of Japanese manufactures with British distinctive letters and labels, nor any of those other artifices which were complained of during the war years that were so full of difficulties for British exporters. We allude now exclusively to the opening of registered letters to British agents in Japan before they have been delivered to the addressees. An isolated case is not sufficient basis upon which to offer a Press criticism, and so long as it was isolated, though it was electrical, we said nothing about it in print. Now, however, the charge comes from another quarter, for a member of the Bradford Chamber of Commerce has brought forward his own experience. The facts are in agreement with those of our electrical complainant, and therefore confirmatory. Letters have been withheld from delivery for a time, and the information contained in them has been extracted and circulated to Japanese firms! The opening of letters before delivery to an addressee is itself in contravention of international postal regulations—but to give away the private information so obtained, to the detriment of the addressee and to the advantage of Japanese traders, is an execrable practice, sly and cunning, and deserving of the fullest possible exposure, whether it be the mean action of postal servants in the pay of traders or whether it be regarded with a blind eye by more important people. Sometimes the extractor or purchaser of information has been indiscreetly eager to make use of it, and has so given the game away to the aggrieved addressee as to make himself a laughing stock and a fool in British eyes as he has retired in confusion—but that is another story, and need not be told here. Where is the sense of fair play in men who will descend to such methods of competition? Such practices are even lower than those of the German banks in some foreign markets which before the war gave away to German competitors the prices being quoted by American manufacturers so as to allow the Germans to go one better and under-cut their rivals.

As the Swedish State Railway Administration has applied to the Government for permission to purchase three motor coaches from the German State

Works at Kiel at a price of 60,000 kr. each, three Swedish companies have lodged a united protest against the proposal. These are the Allmänna Svenska, the Atlas-Diesel, and the Diesel Electric Wagon Co. At the same time the companies have asked the Government to institute a comparative inquiry concerning the Diesel electric rail motor coaches and the German benzine motor coaches. It is pointed out that the Swedish firms have carried out pioneer work in the direction of Diesel electric rail motor coaches, and that 12 of this type have been in service on seven Swedish private railways for the past eight years, possessing the advantages of reliability and low working expenses. It is contended that the Swedish type would become discredited both at home and abroad if the German coaches were sanctioned, and that the working costs with the latter, using benzine or benzol, are from five to six times greater than the cost with the Swedish coaches.

According to a correspondent of the *Manchester Guardian Commercial*, at least one British railway com-

pany is considering the adoption of a portable gas producer, gas engine, dynamo, and motors for the propulsion of trains. Probably, Capt. W. P. Durnall is at the back of the proposal, as he has advocated the use of internal-combustion engines and electrical transmission on ships, locomotives, and omnibuses for many years, and a Tyneside firm is building such locomotives under his patents.

The progress of the Engineers' Club (London) during the first month of its career has been, we understand, all that could be desired. The membership is

over 3,300, as was anticipated by the Committee, and the average income from subscriptions is much higher than had been allowed for in the preliminary estimates, indicating that the proportion of town members to country and overseas members has been well maintained. So far as we are aware, the arrangements made by the Committee have met with the approval of the members, and there is no doubt that the Club is already fulfilling its purpose in becoming the recognised rendezvous for engineers whenever they are in London; one cannot enter the premises without meeting a number of professional acquaintances. We understand that developments are in progress with a view to providing for the comfort and convenience of members who have little time to spare for the midday meal and require "quick lunch" facilities; and attention may again be drawn to the advantages offered by the Club for dinner parties, reunion dinners, and similar social functions on a moderate scale, of which so many are held in the course of a twelvemonth.

The Club is still a young institution, and some time must necessarily elapse before it is working at the highest efficiency and load factor, but it has already done so well that, with the hearty co-operation and goodwill of the members, it may be counted upon as a permanent institution, which fills the want that has been so keenly felt for many years, and which will probably develop eventually into a vastly bigger and more important concern than is generally imagined. Perhaps it is the nucleus of an Engineering Union rivaling in importance and utility the famous establishment in New York, and bringing together the great British Engineering Institutions in one powerful organisation.

ALTHOUGH the utilisation of water Electric Power power by private enterprise for hydro- in Norway. electric works in Norway has been hampered for many years past by legislative

restrictions in the matter of concessions and the high taxes imposed on the undertakings, it has yet been possible to establish certain privately-owned works in addition to those which have been constructed for the account of and working by the State. If these works had been in existence ten years ago the supply of power would have assisted in the development of existing, and the creation of new, industries, but this possibility is out of the question now under the industrial depression prevailing in Norway, and the difficulty experienced in raising capital for private enterprise. Under the circumstances, it is not surprising to hear that considerable quantities of energy available at existing hydro-electric works are finding no profitable use. This state of affairs is said to apply not only to the large works at Tyssedal, but also, to a greater or lesser extent, to all the hydro-electric works in Norway. Even the State works at Glomfjord, which has 50,000 h.p. at disposal, and can be extended to 75,000 h.p. or 100,000 h.p., is awaiting big customers for the power, which is declared to be too dear at from 30 kr. to 50 kr. per horse-power-year. The power available at the Glomfjord works has also been offered to the German Hugo Stinnes, but the offer is said to have been declined. Hydro-electric works established in war time and at the prices then prevailing, and also for some time after the conclusion of hostilities, are not entertaining propositions from the standpoint of supply charges to consumers: hence the large amount of energy for which no users can be found at the present time.

ENGINEERS AND THE CAMERA.

By J. WALKER.

Nowadays everyone knows how popular the "travel" and "things of interest" pictures are in our kinemas, and it is because of this that the following lines have been put together to show how engineers can make use of the camera to make their own pictures of "travel" and "interest." The camera should become part of the engineer's kit. Why not? The engineer from the first day he enters his apprenticeship is taught how to read a blue print which, after all, is a photograph.

The author always made it a point when going on to a repair job or the laying-down of a new installation first of all to make certain that his camera and slides were packed safely with the tools, papers, &c., to be used on the job. When a repair was to be carried out on a machine at some distant colliery, 20 to 30 miles away from headquarters, the camera was found very useful for taking pictures of the actual parts broken and for explaining the state of affairs to the chief, when he found it impossible to be personally present at the breakdown. Many a time spare parts have been looked out and temporary patches made up there and then with the aid of photographs.

Tradesmen who may have been sent out to a job, and who have had to go back to the shop for some spare part, will know the difficulty they have experienced in

supporting the floor, which was laid after all work was completed.

This same picture is to-day in the hands of the chief who finds it very convenient for going over the job (in his own chair) with his foreman, when new cables are to be run or any alteration is to be carried out.

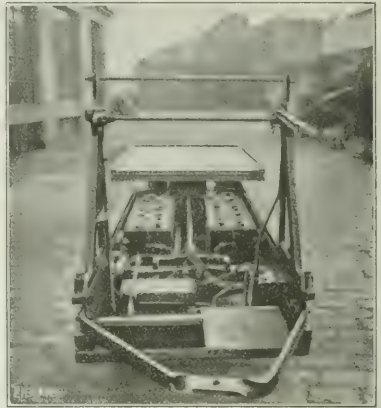


FIG. 2.

This picture brings out a point to which special attention should be drawn. Chief engineers and their staffs are well acquainted with the fact that when a job crops up a good deal of planning and discussion takes place in the office even before a man has been put on the actual work. It will be granted that much pencil and paper, as well as time in explaining things, would be saved by the use of photographs. Take fig. 2, for instance. This shows the working parts of an electric trolley used in a factory. This picture was very often

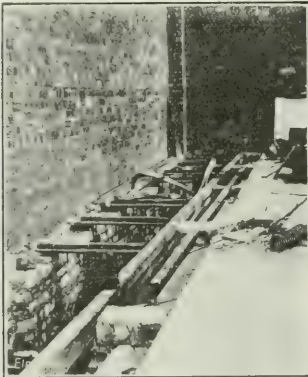


FIG. 1.

getting other people to understand what they actually wanted. By the use of even the crudest of pictures the "explaining" can be very easily done.

Some may say: "It's all right, but you can't take pictures of every little thing, and what would the boss say, any way, about wasting time?" There is certainly no need to take every little thing, but, of course, one would be able to form his own opinion as to what he should take. It may be worthy of mention that as regards "little" things the author has numerous photos of bent bolts and nuts, sheared cotter pins; and pins just being sheared, but which were caught in time before actual damage was done. As regards what the boss would say: well, nowadays chiefs have, or should have, more gumption than to say it would be a waste of time taking pictures of any pieces of plant or general surroundings in which they themselves were personally interested. The author knows some chiefs who were very grateful for pictures which enabled reports to be drawn up and the situation grasped even although they themselves were not actually on the ground.

Fig. 1 shows a power station floor cut up for the running of cables in the duct. The channel and angle irons across the gap serve the double purpose of supporting the rack insulators for the cables and also for

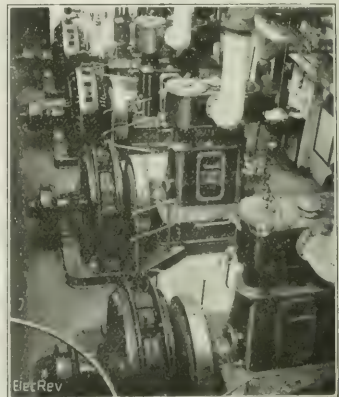


FIG. 3.

used by the chief when any instructions were to be given as regards the charging of the accumulators, or when special attention was to be given to other parts. One can see that a lot of running about can be done away with, and the same result can be got by going over the photograph as by going down to the actual job.

Fig. 3 is a bird's-eye view of the power station on the erection of which part of the author's apprenticeship was served. This picture serves the double purpose of being of interest as well as reviving pleasant memories. How many to-day would like to have an old photograph of their "ain wee corner" of the workshop in which they served their apprenticeship.

Fig. 4 shows a small lighting plant installed in the Highlands of Scotland many miles distant from the headquarters of the young engineer who laid it down, and

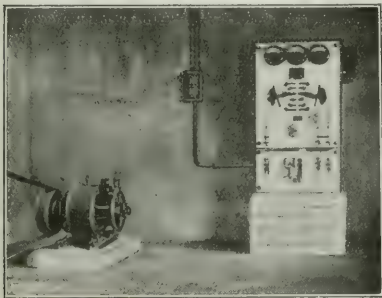


FIG. 4.

who made use of his camera when the job was completed. One can quite understand how proud he was to come home to his chief and say: "That's it. What do you think of it, sir?"

Many a time engineers on reading a book come across a drawing or a photograph of something of special interest, and often wish they could have a copy. Without a camera their only means would be to cut out the page, and thus destroy the book or, on the other hand, they would require to make a tracing. This in itself would perhaps put the idea out of their heads, but with the camera the actual page could be taken. Fig. 5 shows a drawing which was specially required without cutting it out.

Enough has been written to show how useful the camera can be to the engineer, but in addition to the

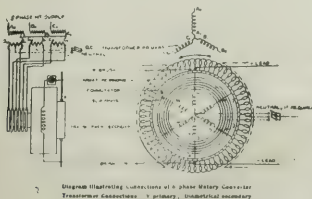


FIG. 5.

uses already mentioned, there is one to which more attention should now be paid, namely, to make use of the camera in the interests of our apprentices.

Photographs play a very important part in the training of our young engineers, be they electrical, mechanical, mining, or marine. The pages of our journals and text books are more easily understood when photographs are used to illustrate various points.

Young engineers should be encouraged to take pictures of machinery in their works, and be allowed to make use of them for lantern slides, which in turn would be shown and described before local engineering societies. By so doing the young men would be educating themselves as well as others.

The author knows of no better means of "drawing out" our apprentices than the getting up of a paper for discussion at the engineering clubs, which paper would be illustrated and adorned by means of lantern slides. Of course it is no new idea for apprentices to

give a paper on "Apprentices' Night," but very few papers (perhaps for want of pluck to ask the chief's permission to take them) are ever illustrated by pictures.

The engineering clubs and societies should certainly take up the matter, and give the necessary encouragement for the presentation of illustrated papers, especially in these days, when everyone "wears" a camera.

As regards apparatus—perhaps the works "official" photographer knocks all the stuffing out of the young fellows in the workshops when they see him coming down with his assistant carrying a large camera and a heavy stand, but there is no necessity for special apparatus. It is necessary, of course, for the works manager to have the very best pictures for his catalogues, but for the young engineer's purposes a much smaller and cheaper outfit is sufficient.

Then again, the pictures of machinery and breakdowns do not require to be "works of art." So long as they serve their purpose, that is all that is wanted.

A quarter-plate folding type plate camera with a focusing screen answers the requirements very well.

"TURNING" versus "GRINDING" OF COMMUTATORS.

By JOSEPH T. TOWLSON.

AN esteemed contributor (Mr. Owen Linley), writing on "The Grinding of Commutators" (ELECTRICAL REVIEW, September 2nd, page 303), while making a case for the advantages of grinding, and deprecating to the turning of commutators, put forward some most peculiar remarks.

I hope, in the following statements of facts and of personal experience, to throw a little light on the subject, and if I am compelled to give a gratuitous advertisement in respect of the qualities of motors and generators of a particular company's manufacture, I hope to be forgiven, my only object in so doing being that what I write shall ring true and indisputable. It is, moreover, open to investigation.

The India-Rubber, Gutta-Percha & Telegraph Works Co., of the island of Silvertown, has running in its factory about six hundred motors and generators ranging from 1 to 1,000 kW. The company has also the upkeep of many motors and generators working at various factories in the vicinity, and it has manufactured many hundreds of these machines for outside customers, which come under our observation at very long intervals, though, when repairs are necessary, the company has the work to do. Among all these innumerable machines, not one commutator has been ground. They are well prepared, rock hard, and substantial, the amount of copper in the sections being generous. They are turned, and buffed with glass-cloth or emery-cloth, the cloth being simply held in a block of wood cut to the curve of the particular commutator and extending about 20 deg. around its periphery. No special tools are used—just suitably-ground single-point tools—and the copper is turned at a speed of 200 ft. per minute, and buffed at about double that speed. No trouble is met with in respect of the true running of the armature shaft, the resources of the turning shop in respect of men and means being amply equal to making any shaft run true within "half a thou." in quick time. The writer has been in charge of such work for many years, and to his personal knowledge no difficulty has been met with as regards the operation of turning "cons." of any size, nor has he found any case where the turned commutator has failed.

There are motors running in that factory of various ratings, which have run all but day and night for 15 years, and have never been touched. Day after day and year after year they take up their respective loads, and the only attention they get is the weekly supply

of oil to their ring-oiled journals, and a puff or two with a blower, wherewith to disperse the carbon dust. No special men are deputed to turn the "coms.," and they are done, and well done, frequently by lads in their teens.

Large commutators from 100 to 1,000 kW are turned and buffed in their places quite easily, while the "coms." of lesser powers are taken out and turned and replaced in less than two hours.

It is a significant fact, and an absolute proof of the durability of the Silvertown turned commutators, that though there are six hundred to keep in repair, the men whose duty it is to attend to the repair work are frequently out of a job. The durability of a modern commutator designed as it should be, and turned and buffed, challenges most emphatically any statement made derogatory to turning; and fine colour is lent to such challenge by the fact of a Silvertown commutator running for over 15 years in a machine shop, exposed to all the dust and dampness which appertains to such shops, with the minimum of attention. Any who may hold a brief for the grinding way are welcome to their faith, though I am certain that, did they adopt the turning way as is done in Silvertown, they would be surprised and satisfied at the result.

THE IDEAL ELECTRIC KITCHEN.

By MARY GWYNNE HOWELL.

THERE is no doubt that the all-electric kitchen will be the highest mark of efficiency in the labour-saving house of the future.

Although conditions are not favourable at the moment, yet there is always the hope that "somehow" and "some time" electricity will be sufficiently cheap and plentiful to be adopted as the *universal household servant*, for heating, cooking, and driving appliances, as well as for lighting. With such future popularity in view, it may be as well to consider particulars which are likely to find favour with the housewife.

Looking at it from the point of view of *electricity taking the place of servants*, there are several things to be remembered:—

1. The ideal electrical equipment consists not of a multiplicity of electrical utensils, but of appliances capable of a multiplicity of tasks.

The busy housewife is not much better off for electrical appliances so numerous and intricate in design that they take more trouble to keep clean than the old-fashioned pots and pans. Electric toasters and grillers, coffee pots, immersion heaters, and hot plates, are perfectly delightful regarded singly, but a thorough collection of them will entail quite a lot of cleaning and polishing, and this "aftermath" is a point of considerable importance to the servantless housewife. On the other hand, what a treasure beyond price to such a woman is a general utility motor, with its "magic" attachments capable of cleaning the silver and brass, shredding the vegetables, chopping the meat, beating the cakes and batters, and suchlike tasks. These are time-taking and energy-expending jobs, and an appliance that will accomplish them swiftly and efficiently will find high favour in the eyes of the home worker.

2. Of all hated tasks *possibly washing up* will take first place. Why? Because it is "messy"; it takes up at least half an hour of precious time three or four times a day; it involves much muscle and step motion; and—the biggest grievance—it has no lasting results. It is not a "worth-while" job, and yet there is no escape from it. There is, then, a real need for electrical dish washers, and provided they are safe, efficient, and reasonable in price, such appliances will be hailed with delight in the servantless kitchen.

3. Practically all the major household machines should be considered as fixtures. Washing machines, clothes driers, ironers, ironing boards with their accessory

electric irons, dish washers, &c., all require convenient and adequate connections to gas, electricity, water supply, and drainage.

At the moment, perhaps, this need is not very apparent, since such appliances are in the experimental stage as far as the housewife is concerned, but once the all-electric kitchen becomes an everyday affair instead of a novelty, it will be essential to arrange the appliances logically, install them permanently, and utilise them intelligently. By such means household management will be placed on a business basis.

Apart from actual labour-saving appliances there are still matters in which the practical utilisation of electricity in the kitchen is possible. Of these the most important are ventilation and illumination.

In no place is efficient ventilation more necessary than in the kitchen, yet there is seldom any provision made beyond the door and windows.

Not only is it difficult to keep the kitchen at an equable temperature, but any attempt to keep it cool while cooking is progressing often means a draught, and a draught means a cold for the cook, and a cold for the cook means danger to the whole household.

The simplest method of overcoming this difficulty is by the installation of a motor-propelled fan in a panel in the upper sash of a window. The fan in motion will draw out all cooking odours as well as the hot air, and, moreover, will keep the air in motion, which is a desirable factor in all ventilation.

Since cooking odours in the house are closely connected with inefficient ventilation a hood over the cooking stove is a great asset, and when a blower operated by electricity is connected with the hood, it is possible to draw off all cooking odours directly, without giving them a chance of pervading the hall atmosphere.

And not only in the kitchen, but throughout the house is added ventilation by means of electrical appliances a point to be considered.

Electric lighting has reached a stage of efficiency beyond criticism, and it is probably the housewife's fault rather than the electrician's that her kitchen is not as a rule adequately lighted. At the same time, the installation of lamp sockets in such positions as to ensure a good light at the sink and the stove will make her realise how important are such details.

In conclusion, domestic difficulties invite mechanical help, and nothing but the cost of electricity deters its general adoption. Everything but the price is in its favour, and could this difficulty be eliminated electricity and electric appliances should reign supreme in every house in the land. What can be done about it?

Battery Locomotives on the Isle of Man.—Visitors to the Isle of Man this year will have had an opportunity of seeing what can be done by the storage battery to solve the problems of transportation from aesthetic and utilitarian standpoints. At Groulle Glen, near Douglas, one of the "show" places of the island, there is a miniature railway which previously had been operated by steam locomotives, but has now been converted to use storage battery locomotives. The two locomotives used were supplied by British Electric Vehicles, Ltd., and each is driven by 40 I.M.V. 10 Exide-Ironclad cells.

These neither obtrude themselves on the landscape nor obscure the view of passengers. Steam locomotives seem to have a special trick of emitting clouds of steam when passing through the more beautiful parts of the route. If the object of the passenger is merely to get from one point to another as quickly as possible he may not be worried by this screen between himself and the scenery, but when he has come expressly to see it, and the line has been built for this purpose, it is decidedly irritating to have the engine driver ring down the curtain so frequently.

Where the gradients do not rule it out, the storage battery locomotive has advantages also over the trolley locomotive in such work as that at Groulle Glen. The erection of the overhead equipment necessarily involves the cutting back of trees to prevent short circuiting and "earths"; and the railway becomes most conspicuous in those places where the natural surroundings demand that it should remain concealed.

The enterprise of the directors of the Howstrake Estate in developing the attractions of Groulle Glen through the substitution of the battery for the steam boiler could be studied with benefit by others interested in similar projects.—*Electric Vehicle*.

ELECTROCULTURE.

By "ANODE."

A FEW years ago, several large experiments in electro-culture were carried out in various districts; while the results obtained were very encouraging, we have not been favoured by the authors of these experiments with any data on the subject of late, and this must serve as my apology for putting forward the results obtained by me in a small garden with apparatus within the reach of all, and, moreover, entirely independent of a generating station, perfectly safe, and productive of a large amount of pleasure and interesting incursions into other branches of science.

The apparatus consisted of a trembler coil capable of giving a 2-in. spark with a 6-volt accumulator, several bobbin insulators, some heavy gauge copper wire, and 2 oz. 24 S.W.G. S.C.C. copper wire.

The plot of garden was 30 ft. by 18 ft., and the heavy copper wire was strung from end to end both sides of the plot, insulated at each end, while the light wire was suspended across the plot from the heavy wire on bobbin insulators, at a height of about 4 ft.

This enabled me to move the overhead equipment up to one end for convenience in cultivation, digging, weeding, &c.

As the voltage was extremely high it was necessary to affix danger notices, and I soon found that a great deal of interest was taken in the experiment by all and sundry, but after a time the novelty wore off, and callers were few and far between; as I did not want any accidents, I did my best to discourage visitors.

A peculiar effect I noticed was that if you held the end of a dry walking stick near the high-pressure wire, a blue glow was seen round the ferrule, and, in fact, this constituted a very good way of finding out whether the conductor was continuous, as owing to the exposed situation of the garden, breakages were frequent.

One night I landed home with a friend, to whom I was anxious to show the equipment; on the way up I mentioned the corona effect, and proceeded, on our arrival, to demonstrate it, but forgot for the moment that I was doing so with an umbrella with a steel stem. I was forcibly reminded of it by the ensuing shock which afforded my friend considerable amusement.

The next sufferer was the dustman, whom I had warned of the great danger of getting too near the line, and really he had no right to say what he did, for he distinctly said: "That's all right, guv'nor, leave it to me, I know all abaht it." He did, and the cause of his enlightenment was that, after taking the dustbin out, he returned with it on his shoulder and turned round to dump it in its accustomed place; he proceeded to lower it very carefully, and placed it on the live wire.

He kept on for at least five minutes, and never repeated himself. I never thought the English language was so rich in invective, and on my suggestion that he should enter for the Billingsgate championship, he went off again at synchronous speed till at last the fuses blew.

My wife was distinctly of the opinion that the largesse paid to this horny-handed son of toil should not be charged to the garden account; but women have no sense of perspective. Personally, I thought it cheap at the price.

Incidentally, the dustbin on reaching terra-firma flattened out a seed bed of onions, and carried away a portion of the overhead equipment, which dropped on to a promising row of peas and electrocuted them.

Sultan, a poodle of uncertain origin belonging to my neighbour, began to take a great deal of interest in the garden, and evidently arrived at the conclusion that it was just the place to hoard his treasures, so one day I suspended a nice meaty bone from the wire just about a foot from the ground, and stationed myself at the switch inside the house and awaited developments.

His lordship appeared, I switched off, he got the bone nicely in his jaws, and I switched on. Sultan was im-

mediately taken with a combined attack of lockjaw, locomotor ataxy, general paralysis, hemiplegia, and strychnine poisoning, and struck dumb into the bargain. The physiological effects were remarkable, and variegated displays were easily obtained by quickly switching off and on.

As he appeared to be suffering somewhat, I switched off, and he seemed to imagine that he was a series-wound motor running on no load; in his revolutions and evolutions round the garden, he shipwrecked everything that the dustman had missed.

His owner witnessed this interesting experiment, quite unknown to me, and was of the opinion that it savoured of vivisection with a dash of Bolshevism thrown in, but this I strenuously deny, and for my own part I consider that Claude Bernard was a back number in scientific researches of this nature.

It took me about a month to get things all square again, when we had a visitor, a young lady from the country, who was greatly interested in this latest method of food production. She was of the opinion that I greatly overestimated the danger of touching the line, and one day carried out the experiment on her own account.

As she had been brought up in a refined home, and carefully shielded from all worldly taint, she was at a loss what to say, but the Athanasian creed and extracts from the Psalms supplied the deficiency. She then entered into a searching and critical analysis of my past, and finished up with a lurid description of my future destination.

And there was silence for half an hour . . . when my wife discovered that the accumulator was leaking, and had burnt a hole in the dining-room carpet.

On my return home next evening I found the whole outfit scrapped; but though my experiments did not lead to any new facts being discovered in the horticultural line, I have every confidence in recommending an electro-culture outfit to those in search of cheap and refined amusement.

IMPORT TRADE OF CHINA.

THE following table shows the value (and where possible the weight) of China's imports in 1920 of material of interest to the electrical and allied trades, indicating the principal countries of origin. The figures for 1919 are given in comparison, and notes of increases or decreases are added. The advance in Chinese purchases is striking, and it is noteworthy also that Great Britain is regaining its share rapidly. It is probable that the trade credited to Hong Kong was to a fair extent transacted with the United Kingdom.

The Chinese picul=133½ lb. average, and the Haikwan tael=6s. 4d. in 1919 and 6s. 9½d. in 1920.

Country whence imported.	1919.	1920.	Inc. or dec.
<i>Aluminium, manufactured.—</i>			
Total piculs	1,760	1,040	— 720
taels	287,000	70,000	— 217,000
Japan piculs	1,330	613	— 717
taels	275,000	45,000	— 230,000
United States piculs	160	265	+ 105
taels	10,000	15,000	+ 5,000
<i>Brass and yellow metal; bars, sheets, wire, &c.—</i>			
Total piculs	27,000	44,500	+ 17,500
taels	860,000	1,224,000	+ 364,000
Hong Kong piculs	8,600	10,900	+ 2,300
taels	247,000	318,000	+ 71,000
Great Britain piculs	1,630	15,470	+ 13,840
taels	56,000	238,000	+ 182,000
Japan piculs	15,000	16,500	+ 1,500
taels	468,000	505,000	+ 37,000
Canada piculs	1,330	14	— 1,316
taels	54,000	1,000	— 53,000
United States piculs	542	1,380	+ 1,438
taels	32,000	81,000	+ 49,000

Country whence imported.	1919.	1920.	Inc. or dec
<i>Copper, bars, rods, sheets, plates,</i>			
Total	piculs 40,000	60,000	+ 20,000
	taels 1,371,000	1,900,000	+ 529,000
Hong Kong	piculs 430	810	+ 380
	taels 15,000	26,000	+ 11,000
Great Britain	piculs 988	3,000	+ 2,012
	taels 25,000	94,000	+ 71,000
Canada	piculs 36,000	55,000	+ 19,000
	taels 1,209,000	1,768,000	+ 559,000
United States	piculs 917	122	- 795
	taels 24,000	3,000	- 21,000
	piculs 1,460	6,000	+ 4,540
	taels 50,000	22,000	- 28,000

Machine belting.—

Total	taels 768,000	1,540,000	+ 772,000
Hong Kong	taels 58,000	78,000	+ 20,000
Great Britain	taels 296,000	645,000	+ 349,000
Japan	taels 230,000	264,000	+ 34,000
United States	taels 170,000	521,000	+ 351,000

Electrical materials and fittings.—

Total	taels 5,170,000	6,515,000	+ 1,345,000
Hong Kong	taels 398,000	319,000	- 79,000
Great Britain	taels 285,000	354,000	+ 69,000
Italy	taels 288,000	381,000	+ 93,000
Japan	taels 2,303,000	2,624,000	+ 321,000
Canada	taels 227,000	304,000	+ 77,000
United States	taels 1,622,000	2,012,000	+ 1,390,000

Machine tools.—

Total	taels 500,000	761,000	+ 261,000
Great Britain	taels 50,000	111,000	+ 61,000
Denmark	taels 21,000	1,500	- 19,500
Japan	taels 222,000	317,000	+ 95,000
Canada	taels 28,000	22,000	- 6,000
United States	taels 169,000	284,000	+ 115,000

Propelling machinery—as boilers, turbines.—

Total	taels 1,640,000	2,376,000	+ 736,000
Great Britain	taels 292,000	1,018,000	+ 726,000
Japan	taels 162,000	202,000	+ 41,000
Canada	taels 108,000	140,000	+ 32,000
United States	taels 799,000	655,000	- 144,000

Machinery, other, not textile, brewing, refining, &c.—

Total	taels 8,417,000	12,444,000	+ 4,027,000
Hong Kong	taels 658,000	426,000	- 232,000
Great Britain	taels 918,000	2,172,000	+ 1,254,000
Japan	taels 2,320,000	2,122,000	- 198,000
Canada	taels 740,000	399,000	- 341,000
United States	taels 2,618,000	6,774,000	+ 4,156,000

Telegraph and telephone material.—

Total	taels 940,000	1,889,000	+ 949,000
Hong Kong	taels 60,000	25,000	- 35,000
Great Britain	taels 67,000	365,000	+ 298,000
Japan	taels 406,000	1,150,000	+ 744,000
Canada	taels 103,000	73,000	- 30,000
United States	taels 151,000	292,000	+ 141,000

THE PROVINCIAL ELECTRIC SUPPLY COMMITTEE OF THE UNITED KINGDOM.

THE annual meeting of the Provincial Electric Supply Committee of the United Kingdom was held on Tuesday, September 27th, Sir Harry Renwick, K.B.E., the chairman, presiding.

In the course of a general review of the work of the past year, the chairman said with regard to the Joint Electricity Schemes that, generally speaking, there was one point on which he thought all agreed, namely, that the chief concern of most of the provincial companies was whether they would be able to get a cheap bulk supply without having any rights infringed by competition or otherwise. If many of the smaller companies, whether in London or in the provinces, could safely get bulk supply at a low price it would be the best thing that could possibly happen to them, and in many cases it would prove their salvation. With regard to labour, he said that at present there was a period of quietness so far as the electricity supply industry was immediately concerned, all questions regarding workmen being settled by the Industrial Councils, and the adjustment of salaries of technical staffs coming under a continuing agreement made by the National Joint Board.

He explained the reconstruction of the National Council, and said that the Committee felt it was the view of the majority of its member-companies that it should fall in with the new proposals. Broadly speaking, it was possible that a more satisfactory position might be forthcoming, although there was always the difficulty of getting suitable representatives who could and would give up the necessary time to what everyone agreed was a very thankless task. The Committee had assisted the Ministry of Labour scheme for providing suitable employment for disabled soldiers.

The Committee had carefully watched all legislation introduced during the past year, and acted in the companies' interests with regard to any measures that required attention. It had been in negotiation with the Ministry of Transport with a view to an Increase of Charges Bill being introduced to cover the cases where an increase of maximum price was necessary, but did not come within the scope of the present Electric Lighting Acts, but in view of the Electricity Supply Bill having been brought forward, wherein a special revision clause had been inserted, this had to be dropped.

The assistance which the Committee had been able to give to individual companies in matters of a domestic character had been very much appreciated; it had acted in concert with various other associations, Committees of the I.E.E., E.D.A., and so forth, and had been able to meet all the expenses out of the annual subscriptions.

On the motion of Mr. W. A. Scott, supported by Mr. A. A. Campbell Swinton, the Executive Committee was re-elected *en bloc* for the ensuing year. A vote of thanks was accorded to the chairman, the Executive Committee, and the Secretary for their services during the past year. A general discussion on various matters took place, and a resolution was passed that the Unemployment Committee should be asked to receive a deputation from the Provincial Committee with a view to obtaining financial support for the smaller electricity supply companies for the purpose of extending their supply, and thus finding work for the unemployed.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Accumulator Froth.

Truly the reply of the Ediswan Accumulator Department's Manager amply substantiates the suggestion in my letter that the makers are not taking a reasonable attitude with regard to the question of frothing of cells.

Mr Coates says that the painting of the inside of the boxes would eliminate the transparency. I fear his knowledge of the number of transparent paints available must be very limited; but what is the use of making suggestions when the manager of a reputed firm in his last paragraph says: "They have to cater for the demand, not dictate to the public?"

This can only be interpreted in one of two ways: either that accumulator makers are willing to sacrifice their reputation and supply an article which they know is bad in use; or that there is a demand for accumulators that froth. I think that this deplorable sentence must have been written hastily. Surely, since the general consensus of opinion indicates clearly that in a large number of cases celluloid containers or separators cause frothing, the chemistry of this frothing should be properly investigated, and if by mechanical means it cannot be prevented, then an alternative to celluloid should be substituted.

The writer is personally of opinion that there is a multiplicity of ways for overcoming the evil, and it should not be beyond the chemical knowledge of accumulator makers to deal effectively with the situation.

Imagine someone buying a Rolls-Royce car and fitting it with self-starting apparatus (the batteries being in celluloid cases). After a small interval it is found that these cells froth and an acid slime attacks all the metal work in the vicinity. I ask Mr. Coates, would he knowingly sell an accumulator for such, even if the demand were there, without notifying them that frothing would probably result in a short time? His letter suggests that he would. Mr. Coates has much to learn about celluloid. If he will examine outside the cases where the froth oozes out he will find that even the polish on the celluloid becomes so greasy that, in certain cases, the decomposed face of the celluloid can be wiped off.

Thos. Hesketh,
Mining Engineer,
Folkestone Electricity Supply Co., Ltd.

Folkestone.
October 3rd, 1921.

A Spare Armature Incident.

The other day I was called to a motor which, I was told, sparked badly. It was a shunt-wound interpole machine, 460 V, 10 h.p., of the ball-bearing type. On examination I found the armature tight, and suspected a broken cage in the pulley end bearing. Eventually the pulley was removed (I said eventually, because the key was nicely cut off flush with the shaft, and needed a specially shaped drift to drive it out—even then it was an awkward job). I cannot understand why makers will persist in cutting shanks off keys after fitting, it is much easier to get a pulley off if the key can be drawn easily). On examination of the bearing it was found that the cage and balls were smashed to bits; this of course had

let the armature rub and destroyed the bands. As the machine was urgently needed we decided to put the armature of another identical machine of the same make and type, 460 V, 10 h.p., in place of the damaged one. On starting, the motor ran in the opposite direction, and of course sparked. I reversed the field current to change the direction of rotation, but then before getting the starter right over we had a brilliant display of fireworks; this occurred at all brush positions. I should be obliged if someone could explain why this occurred. From the above experience it seems to me that it is necessary to keep a spare armature for each machine, even if all the machines are of the same make, type, size, and voltage, whereas one ought to be sufficient. The damaged armature after repairs ran O.K. in its own carcass, proving that the field system was all right.

F. W. G.

September 29th, 1921.

[Probably the relation between the armature, the interpoles, and the main field was incorrect. The subject was fully dealt with in our issue of August 2nd, 1918.—EDS. ELEC. REV.]

Support for French Industries.

I have often noticed how active Swiss, German, Dutch, Swedish, Norwegian, and even Austrian firms have been with their publicity and their representatives in this country, and how seldom we hear from the French.

The war proved that none of the others had all the brains. How seldom we hear of French motors, transformers, or even lamps being supplied to us, as compared with machinery, &c., from the other European countries mentioned.

I think we should, and would, offer a warmer welcome to the engineers and products of our very gallant Allies in the late war.

C. T. Allan,

Assistant Manager,
South Wales Electrical Power
Distribution Co.

Cardiff.

October 1st, 1921.

The E.P.E.A. and the E.T.U.

My attention has been drawn to the paragraph headed "The E.P.E.A. and the E.T.U.," and I have to point out that no working agreement will be arranged between the two organisations unless agreement can be reached on demarcation of membership. To show the feeling that has arisen between the unions, parties to the No. 10 Area Council, I am enclosing a copy of a letter that I was instructed to write as secretary of the Trade Union side of the said Council. No reply has yet been received.

W. J. Webb,

London. London District Sec. E.T.U.,
October 4th, 1921. Sec. T.U. Side, No. 10 Area Council.

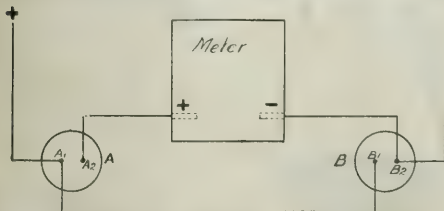
[The letter referred to, addressed to the Secretary of the E.P.E.A. and dated September 27th, stated that the full Trade Union side of No. 10 District Council had resolved that unless the Electrical Power Engineers' Association confined its organisation in the area to the grades covered by the Stoker award, transferred back to the Unions concerned men admitted to membership outside that category, and undertook that no further encroachment should take place, the Trade Union side would break off all negotiations with the E.P.E.A.—EDS. ELEC. REV.]

A Sensitive Meter.

The accompanying diagram is an arrangement for cutting out of circuit a 20-amp. Chamberlain & Hookham meter in series with a 400-volt (d.c.) 10-h.p. booster.

Of course, as the diagram shows, with switch A closed and B open, the meter will revolve, and with B closed and A open the meter will remain stationary.

Some time last week I closed both switches and started the



booster; imagine my surprise when I found the meter revolving slowly, but quite fast enough to be immediately detected.

The length of cable between points A, B₁, and A₂ and B₂ is only a matter of about 2 ft., so the drop across the terminals of the meter is practically negligible.

This is surely a fine testimonial to Messrs. C. & H. for a small starting torque.

Surprised.

October 3rd, 1921.

The Glasgow Hiring Scheme.

In your issue of September 23rd, page 468, in an article dealing with the Ideal Homes Exhibition, Glasgow, the statement is made that "importance is attached to an American 'Universal' cooking range, which, we understand, the Corporation intends to put out for hire shortly."

I do not know where your correspondent got his information, but it is not quite accurate. It is true the Corporation is about to hire out electric cookers, but the cookers will be of British, not of American, manufacture. It is well known that American cookers cost three times as much as the British article, but apart altogether from price, the present is not the time to go past the home manufacturer for apparatus of this kind.

Electricity Department,
Glasgow, September 29th, 1921.

R. B. Mitchell.

Organ Blowers.

I have been interested in perusing the replies of your correspondents to the inquiry which appeared in your issue of September 16th, signed by "Organ Blower."

Generally speaking, my experience, which has extended over a period of nearly 30 years, goes to show that in the application of electric motors to organ blowers no difficulties are presented when a new installation is in contemplation.

Many organ builders still prefer the old-fashioned three-feeder system of supplying wind to the main reservoir of an organ, and where direct current is available this can be arranged for in a very simple and direct manner, the motor being either connected to the 3-throw crankshaft by means of a silent chain drive, or in smaller installations by belt drive. In these cases the crankshaft is usually designed to run at a maximum speed not exceeding 40 r.p.m., the motor running at a maximum speed not exceeding 240 r.p.m. Absolute control of the speed can be obtained by a regulating resistance placed in the armature circuit of the motor, which reduces the speed of the motor to zero when the bellows is full. The regulator can be provided with starting steps as well as with regulating steps, so that when the current is cut off the bellows gradually empties itself and the controller is brought round automatically on to the starting position, with the result that the starting resistance is introduced ready for the next start up. Organ-blowing motors provided with this form of controller (which was the subject of one of my old patents now lapsed) can be started or stopped by closing an ordinary single pole or double pole switch placed in a convenient position near the keyboard. Alternatively, the controller can be provided with an electrically-operated switch controlled by a pilot circuit connected to a switch or push button at the keyboard; this arrangement has the advantage of saving heavy-current wiring having to be carried to the keyboard.

Generally speaking, I would recommend, where alternating current is available, the installation of a rotary blower, the motor being either direct coupled to the blower or coupled by endless belt drive.

There are many excellent blowers now manufactured to select from, in all of which confidence may be placed, and they can be run for many years without attention of any kind. The advantage of using a rotary blower is, of course, that it can be placed in a small chamber, vestry or basement near the organ, where the slight humming noise inseparable from a.c. motors is sufficiently isolated to prevent any objectionable noise being heard in the church.

The difficulties in connection with the driving of organs commence where existing arrangements, either hand blowing, hydraulic blowing, or direct driving by continuous current motors, have to be converted due to alteration in the supply or for some other reason. Such cases have to be considered individually on their merits, and a wide experience in the application of alternating-current motors to these installations proves that the difficulties can frequently be satisfactorily solved by the direct application of a single-phase or 3-phase motor, which can be easily started from the keyboard.

One of your correspondents has referred to the possibility of applying a single-phase constant-speed motor to an existing 3-throw crankshaft blower through the medium of a counter-shaft fitted with fast and loose pulleys, the fork controlling the belt being controlled by the rise and fall of the main reservoir, and in many cases with which I have been acquainted, this arrangement has proved entirely satisfactory, but there is another method in connection with this form of drive which calls for special mention, and that is an arrangement of valves in the reservoir by which the wind supply is controlled irrespective of the speed of the crankshaft, which runs at a constant speed and does away with the necessity for the fork striking gear and fast and loose pulleys.

The most satisfactory form of a.c. motor for driving these various forms of equipment is the "Century" single-phase repulsion induction motor, which has the capacity of starting up any load it will run by merely closing an ordinary d.p. or single pole switch, which can be placed in a convenient position near the console; apart from this important feature, by its construction it is probably the most silent of all alternating-current motors at present available.

R. A. Marples.

London, September 27th, 1921.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Lowa" Dimming Switch.

While the "Lowa" switch has been before the public for some time, it has recently been so far remodelled as to be practically a new design. As shown in fig. 1, the interior of type A, it contains two packs of small carbon plates, insulated with mica, and firmly held in a brass frame; tappings are taken off by interleaved brass plates to a row of contact studs on the base, over which a contact arm is moved by a dolly similar in appearance to that of a tumbler switch, but without the spring action of the latter. Thus five steps are obtained between full off and full on. The cover is of brass perforated for ventilation as shown in fig. 2. The new

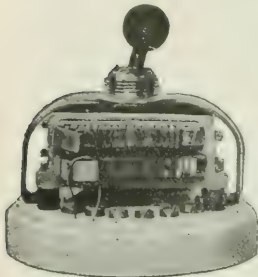


FIG. 1.—INTERIOR OF "LOWA" SWITCH.



FIG. 2.—THE "LOWA" SWITCH, TYPE A.

switch is small enough to fit on a $3\frac{1}{2}$ in. block, and is suitable for controlling lamps, fans, small motors, &c., up to 100 watts at any standard voltage. Tested at the National Physical Laboratory, it withstood a pressure of 1,000 volts between the case and the terminals, and varied the current flowing to a lamp from 0.18 to 0.11 ampere at 200 volts; with all the resistance in circuit, the temperature of the cover

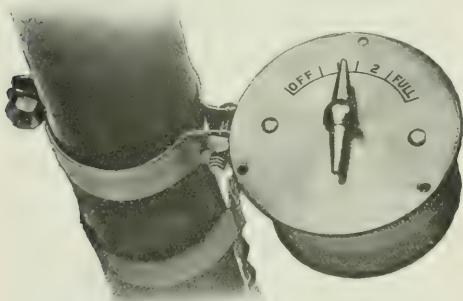


FIG. 3.—"LOWA" CAR SWITCH, TYPE CCI.

after half-an-hour's run was 30 deg. C. above that of the air. Similar results were obtained at Faraday House.

Other patterns include straight-line sliding types, giving gradations up to 25 steps, and suitable for theatres, kinemas, &c., and a motorcar switch which can be fixed on the dash or, as in fig. 3, mounted on the steering pillar. The last named is useful for dimming the headlights when approaching other vehicles, and for saving current when a car is standing at the kerb; it also serves to protect the lamps from over-running when they are energised from the magneto.

The sole selling agents are THE BRITISH & AIREDALE ELECTRICAL AGENCY, LTD., 13, Charterhouse Street, London, E.C.1.

The "Airedale" Oil Circuit-breaker.

An automatic oil-break circuit-breaker, suitable for a.c. or d.c. circuits up to 30 amperes at 600 volts, has been introduced and produced by the AIREDALE ELECTRICAL AND MANUFACTURING CO., LTD., of 151, Rydal Street, Bowdley, Bradford. The principles of the mechanism and the development generally have been very carefully thought out by Mr. L. E. WOOD, A.M.I.E.E.; the total weight of the device is only about 28 lb., so that it is easy to handle and can be mounted on any wall or other structure without difficulty. The design is said to embody several novel features, the trip mechanism being very simple and free from the dis-

advantages of the toggle-joint principle; wear of the moving parts will not impair the positive action of the tripping gear, and the moving contacts are at maximum speed at the moment of leaving the stationary contacts. The no-volt coil and trip are positive in action and unaffected by vibration, and the parts are interchangeable. The switchcase is of cast iron, and the tank of pressed steel, with interlocking gear. The loose handle principle is adopted, and an inverse time element

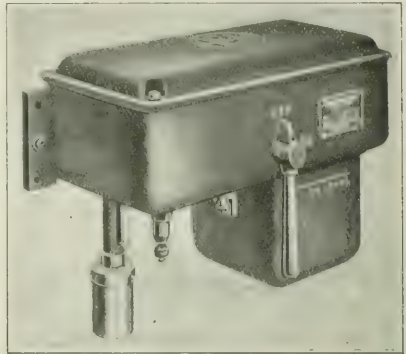


FIG. 4.—"AIREDALE" AUTOMATIC OIL CIRCUIT-BREAKER.

device is supplied if required. Adjustments are provided for the overload trip and inverse time element device, and an ammeter can be fitted. Fig. 4 shows the external appearance of the breaker.

The "Pride" Patent Bowl, Ring, and Silk Shade Fitting.

The usual practice in connection with indirect lighting by bowl fittings has been to suspend the ring or the bowl itself from a ceiling plate by three chains, and to drop the flexible cord conductors from the centre of the plate, through an insulator or a cord grip, the cord either hanging vertically to the lamp holder or being twisted round one of the chains. A neat device has been invented, and provisionally protected, by Mr. F. H. PRIDE for concealing and protecting the flexible

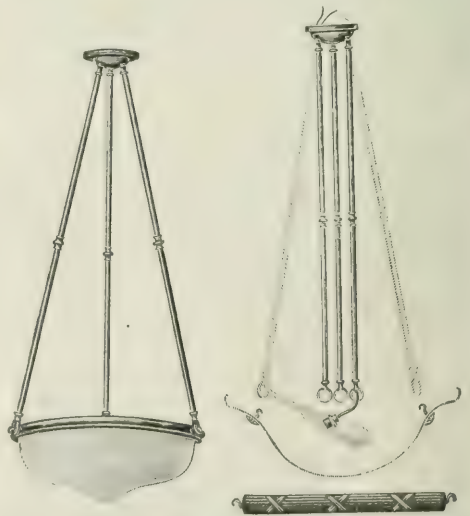


FIG. 5.

THE "PRIDE" BOWL, &c., FITTING.

FIG. 6.

THE "PRIDE" RING, &c., FITTING.

by means of brass tubes, whilst allowing the fitting to retain full freedom to swing, so that no strain is imposed on the tubes when the bowl is cleaned or when the lamps are being fixed in the holders. As shown in figs. 5 and 6, the ring is suspended by three small tubes, with eyes at the lower ends, which engage with the hooks on the ring or bowl; the tubes

are held to the ceiling plate by half-round ball screws, which allow the tubes to swing freely in any direction, and also enable them to be folded together for packing as shown in fig. 6. At the lower end of one of the tubes a lamp-holder is attached, and the flexible is carried from this through the tube to a connector lodged in the ceiling plate, ready for coupling to the leads. Thus the flexible is completely hidden and protected not only from mechanical damage, but also from damp and dust. The lamp-holder can be adjusted to focus the lamp in the bowl, after which it remains permanently in the correct position; the fitting is suitable for ordinary metallic-filament or gas-filled lamps, and the holder can be fixed at any desired angle. The fitting is independent of the ring or shade, so that an existing stock of these can be used up, or they can be supplied with the fitting; and it is stocked in various lengths, colours, and finishes. Mr. G. BOORMAN, of 413, Oxford Street, London, W.1, is the sole agent for the device, and we understand that large orders have been placed for it to be installed in the bathrooms of several of the most noted London hotels.

The Grubb Non-Dazzle Motor-car Headlamp.

On the stand of the **ENGINEERING & LIGHTING EQUIPMENT Co., Ltd.**, of Sphere Works, St. Albans, Herts., at the Shipping, Engineering, and Machinery Exhibition was shown the



FIG. 7.—THE GRUBB NON-DAZZLE LAMP.



FIG. 8.—THE GRUBB LAMP TUBE AND DIAPHRAGM.

latest pattern of the Grubb non-dazzle headlamp, made by Sir Howard Grubb & Sons, Ltd., St. Albans. This lamp is illustrated herewith in figs. 7 and 8; it consists of a slightly conical tube fitted with two semi-circular lenses at the smaller end, and with a 50-c.p. electric lamp and reflector of the usual type at the larger end. The tube is divided into

two compartments, upper and lower, by a horizontal sheet metal partition extending from end to end, and, as shown in fig. 8, part of the reflector is screened off by brass plates of special shape. The tube is carried on trunnions near its centre of gravity (a lighter type for small cars is carried on a pivot).

We are informed that this lamp, while perfectly "non-dazzle" over the desired boundary line (fixed by the French authorities at one metre from the ground), gives practically the same driving light as is attained by the best lamps of the usual dazzle form when using a bulb of the same candle power.

It is a focus lamp, i.e., it is so constructed as to form an image on a distant object of apertures in a diaphragm placed immediately in front of the illuminated area, and therefore the outline of the illuminated area can be sharply defined even at the longest distance. The non-dazzle effect is not produced as in other forms by stopping off any portion of the light collected by the reflector, but by using an optical arrangement that utilises practically the whole of the light.

This result is obtained by making the projecting lens in halves, the optical centres of which are separated by a quantity just sufficient to enable the two images to overlap exactly on the distant object. The upper lens forms an inverted image of the space A, fig. 9, and the lower lens an inverted image of the space B overlapped on A, the upper edges exactly coinciding.

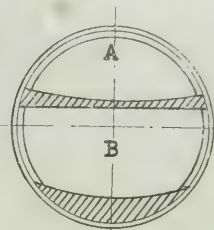


FIG. 9.—ARRANGEMENT OF DIAPHRAGM.

The only part of the light not utilised is that represented by the hatched portion, a very small percentage of the whole.

The edges of the diaphragm which form the upper edges of the inverted images are made with a slight curve, which gives a similar curve to the upper edge of the projected beam, to coincide with the general camber of the road.

BUSINESS NOTES.

Bankruptcy Proceedings.—G. W. ENDALL (Endall & Co.), electrical, mechanical, and automobile engineer, Canal Motor Works, Canal Bridge, Church Street, St. Helens.—Receiving order made September 27th on debtor's own petition.

E. KERFOOT, electrical engineer, 103, Cobden Street, Mosley Lane, Blackley, Manchester.—Receiving order made September 26th on creditors' petition.

A. MASKILL, electrician, 43, South Avenue, Halfpenny Lane, Pontefract.—Receiving order made September 24th on debtor's own petition. First meeting October 7th at the Official Receiver's office, Wakefield. Public examination November 10th at the Court House, Wakefield.

J. HARRISON (Harrison & Son), 93, Princes Street, London Road, Southend-on-Sea.—Last day for proofs for dividend October 15th. Trustee: Mr. T. Gourlay, 29, Russell Square, W.C.1.

MATTHEW WATKINSON, HAROLD WATKINSON, and ARTHUR WATKINSON, trading as Watt & Co., 22 and 24, Palmer Road, Sheffield, electrical and mechanical engineers. Trustee: Mr. T. C. Parkin, Jr., 36, Bank Street, Sheffield. The following are creditors herein:—

	£		£
British Insulated & Helsby Cables, Ltd.	61	Watkinson, Elizabeth	150
Jack, R. & T.	26	Watkinson, Lillian May	66
Northern Rubber Co.	44	Watkinson, Walter	11
Rowlands, W., Ltd.	410	Watkinson, Annie Ada	80

F. O. NICHOLS, electrical and mechanical engineer, 19, South Street, Scarborough.—First meeting, October 14th, at the Official Receiver's office, Scarborough; public examination, October 25th, at the Court House, Scarborough.

H. E. CARR, electrical contractor, Reedness, near Goole.—Last day for proofs for dividend November 2nd. Trustee: Mr. C. R. Townend, Carlisle Chambers, Goole, Yorks.

J. SKINNER (Foster, Skinner & Co.), electrical fittings dealer, 6, South Castle Street, Liverpool.—Trustee (Mr. E. D. Symond, 11, Dale Street, Liverpool) released August 29th, 1921.

J. C. THOMSON, electrician, lately electrical engineer and contractor, Station Street, Mansfield, Notts.—Trustee (Mr. E. W. Humphreys, 4, Castle Place, Nottingham) released August 28th.

W. DRYSDALE, electrician, Paxton Street, Barrow-in-Furness.—Last day for proofs for dividend October 14th. Trustee: Mr. H. Mossop, 4, Ramsden Square, Barrow-in-Furness.

J. V. BELL, electrical engineer, 21, North Bar Within, Beverley, Yorks.—Last day for proofs for dividend October 19th. Trustee: Mr. E. P. Dutton, Victoria Chambers, Bowl-Alley Lane, Hull.

Company Liquidations.—SPENSERS, LTD., Conduit Place, Paddington, London, W.—In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of the creditors was held on September 30th, at the Cannon Street Hotel, E.C.4, having been called by Mr. F. A. Caddick, of 7a, Laurence Pountney Hill, London, E.C.4, who had been appointed liquidator. According to the statement of affairs the unsecured liabilities amounted to £20,759, of which £8,646 was due to the trade, and £10,708 was owing to cash creditors. The balance of £1,405 represented the deficiency as regarded the second debenture holders. The assets were estimated to

realise £27,580, from which had to be deducted £1,306 for preferential claims and £11,152 for the first debenture holders. This left assets of £15,121 to meet the claims of the second debenture holders which were £16,526. There were consequently not sufficient assets to fully discharge the claims of the second debenture holders. The assets comprised cash in hand, £697; plant and machinery at book value, £3,000; furniture, fittings and fixtures at book value, £519; stock in trade, loose tools and work in progress estimated on the basis of a 25% profit, £16,000; and book debts expected to produce £7,352. No value was placed for the moment on the patent rights. It was pointed out that as the assets were insufficient to fully discharge the claims of the debenture holders there was nothing available for the ordinary unsecured creditors. The issued share capital of the company was £30,000, there having been issued 60,000 ordinary shares of 10s. each which were fully paid. The deficiency as regarded the shareholders was £50,759. The company had been in existence for a number of years, and the shareholders had found substantial sums in cash for the business. In 1919 the shareholders found over £19,000, for which they received shares, and in addition they contributed about £10,000 by way of a gift in order to write off certain leases. Debentures had been issued by instalments since 1912. The last issue was in April, 1920, and amounted to £11,000 for cash. The creditors decided to confirm the voluntary liquidation of the company with Mr. Caddick as the liquidator.

RENEW LAMP CO. (EASTERN), LTD.—Winding up voluntarily. Liquidator: Capt. H. D. Carey, 3-4, Great Winchester Street, E.C. A meeting of creditors was called for October 3rd. Particulars of claims should be sent to the liquidator by November 2nd.

Trade Announcements.—THE SPEARING BOILER CO., LTD., has removed to larger offices, and its address is now 20, Kingsway, London, W.C.2. Telephone Nos.: Holborn 5740 and 5741. Telegraphic Address: "Arcturus, Strand, London."

THE J. L. ELECTRIC CO., 30, Church Street, Birmingham, informs us that it is now manufacturing its universal wiring clips of aluminium instead of tinned brass. This has rendered possible a considerable reduction in price.

MESSRS. HAYNES BROS., LTD., have removed their electrical business from 18, Gabriel's Hill, to King Street, Maidstone.

MR. A. WALKINGTON, district representative of the Electrical Engineering & Equipment Co., Ltd., of London, has opened a provincial office at Temple Buildings, Pepper Street, Nottingham. Telephone No.: 5295.

Catalogues and Lists.—MESSRS. G. S. PECKHAM & CO., of 4 and 5, New Compton Street, Charing Cross Road, London, W.C.2, have issued a well-bound desk reminder with weekly sheets, each having seven daily spaces for entering engagements or memoranda from now until September, 1922. Readers requiring copies should make application to the firm.

THE REES ROTURBO MANUFACTURING CO., LTD., Wolverhampton.—Pamphlet R.191 describing the construction of the Rees Roturbo pump, with many illustrations.

MESSRS. E. P. ALLAM & CO., 107-109, Gray's Inn Road, London, W.O.1.—Monthly stock list, No. 12, of electric motors.

THE B.E. CO. (OF LONDON AND BIRMINGHAM), LTD., Hendon House, 57, Upper Thames Street, E.C.4.—Price list of electrical accessories for use with larger catalogue.

MESSRS. HIGGS BROS., Sand Pits, Birmingham.—"Monthly Magazine," October, 1921, containing priced stock lists of d.c. motors and dynamos and a.c. motors, &c.

MESSRS. S. G. LEACH & CO., LTD., 26-30, Artillery Lane, E.C.—A number of booklets and pamphlets illustrating and describing various types of "Arrow" switches and other electrical accessories.

THE THOR ELECTRIC SAFETY LAMP CO., LTD., Thor Works, Rea Street South, Birmingham.—Leaflet M 9/21, dealing with the "Thor" shaft and roadway lamp for mines.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Leaflet O.S. 2520, illustrating and describing the "Huntalite" "candle" lamp. Priced. Leaflet H. 2599, giving prices and illustrations of "Magnet" electric pipe lighters. Also leaflet O.S. 2619, giving an illustration and particulars of the "Ooram" window display for the use of retailers of these lamps.

MESSRS. DRAKE & GORHAM WHOLESALE, LTD., 67, Long Acre, W.C.2.—Pamphlet No. 316, a comprehensive illustrated price list of electric fires and domestic electrical apparatus; also pamphlet No. 317, dealing with lamps and industrial fittings—illustrated and priced.

MESSRS. EDWARD LE BAS & CO., Dock House, Billiter Street, London, E.C.3.—An illustrated and priced catalogue of a large variety of G.F. malleable tube fittings.

MESSRS. UNDERWOOD (MANCHESTER), LTD., 53, Brown Street, Manchester.—An illustrated and priced catalogue of "Moonstone" scientific illumination glassware.

MEASUREMENT, LTD., 34-38, Provost Street, City Road, London, N.1.—List A, single-phase 2- and 3-wire electricity meters.

MESSRS. DONOVAN & CO., 47, Cornwall Street, Birmingham.—A reprinted catalogue of "Safine" and "Dunlok" switch and fuse gear. Illustrated and priced.

THE EFANDEM CO., LTD., 22, Newman Street, Oxford Street, W.1.—A priced and profusely illustrated catalogue of electrical goods, including dry cells, pocket lamps, electric torches, bells, sirens, &c.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—Two leaflets dealing very fully with storage battery renewals. Dimensions and weights of a number of different types of plates are given.

Catalogues for China.—The Commercial Counsellor at Shanghai, Mr. H. H. Fox, C.M.G., has notified the Department of Overseas Trade that the majority of United Kingdom manufacturers who communicate with him direct asking for the names of suitable firms to act as agents for the sale of their products in China, do not send with their inquiries catalogues, price lists or illustration of their goods, and even when these are sent the number is usually limited to one or at the most two copies. The Commercial Counsellor points out that considerable delay is frequently incurred on this account, as he has to send a copy of the inquiry with the catalogue round to one firm at a time with a request that, if the business does not interest them, they will return the catalogues. It may also occur that a catalogue gets mislaid when going the rounds in this way. Mr. Fox, therefore suggests that United Kingdom manufacturers, when forwarding him inquiries for agencies, more particularly in the case of engineering specialities, should send at least six copies of their catalogue or illustrations for distribution amongst local firms in China. Attention has recently been drawn by the Commercial Counsellor to the desirability of quoting prices in such publications even if they are only approximate. While United Kingdom manufacturers and traders may, if they wish, communicate directly with His Majesty's Commercial Diplomatic and Consular Officers abroad with regard to any particular item of commercial intelligence upon which they may require information, it is desirable that such inquiries should in the first instance be directed to the Department of Overseas Trade in order to avoid delay in cases in which the Department is already in possession of the required information.

Book Notices.—Circular No. 13 of the U.S. Bureau of Standards, "Standard Specifications for Large Incandescent Electric Lamps (Lungsten and Carbon)." (9th edition.) Washington: Government Printing Office. Price 5 cents.—In addition to the specifications full details are given of the tests to which lamps must be subjected.

"The Faraday House Journal," Vol. IX., No. 4, Michaelmas Term, 1921. Among a great amount of information of interest to students and old students appears a biographical note of the career of Mr. H. W. Swann, A.M.I.E.E., who has recently been appointed an Inspector of Factories. The Principal, Dr. Alexander Russell, contributes an article on "The Capacity between Spherical Conductors."

"Electric Lighting in Factories and Workshops." Pp. 37, 19 figs. London: Sir I. Pitman & Sons. Price 6d. net.

"Diagnosing of Troubles in Electrical Machines." By Miles Walker. Pp. xii+450; 332 figs. London: Longmans, Green and Co. Price 32s. net.

"Book of the Ford Electric Equipment." By R. T. Nicholson. Pp. 149; 84 figs. London: Temple Press, Ltd. Price 3s. net.

"The Induction Motor and other Alternating Current Motors." By B. A. Behrend. Second edition, revised and enlarged. Pp. xxiii+272; 204 figs. London: McGraw Hill Publishing Co., Ltd. Price 24s.

"The Thirtieth Annual Report of the Hydro-Electric Power Commission of Ontario—Year ending October 31st, 1920." Vol. I. (326 pp.). Toronto: Clarkson W. James.

"The M. & C. Apprentices' Magazine." Vol. V. No. 19, Autumn, 1921.—A great deal of useful and interesting matter is included in this issue. Among the special articles are one on thermionic valves and an illustrated description of the firm's new iron foundry.

Electric Welding Demonstration.—The Equipment and Engineering Co., of 2 and 3, Norfolk Street, Strand, W.C.2, is holding a demonstration of electric arc welding on Monday, Tuesday, and Wednesday, next week (October 10th, 11th, and 12th), at the Huddersfield Corporation Tramways Depot (Great Northern Street), by permission of the general manager and engineer, Mr. A. A. Blackburn. The demonstration will include the use of the new E.L. type machine upon the magnetic system which has been specially designed for the rough-and-ready conditions of electric tramway work. Any of our readers who are interested in the matter and wish to attend the demonstration will be welcomed, and they should communicate with the company as above.

Italian Wireless Concessions.—According to the Italian daily Press, the Italian Government intends, in February, 1922, to invite from private firms tenders for concessions for commercial wireless installations between Italy and foreign countries. The competing firms will have to show their technical and financial standing and ability to secure the use of the corresponding station abroad. Italian companies, with capital preponderantly Italian will be preferred, especially those using Italian-made material and employing Italian labour. The concessions may, however, be given to foreign companies where they prove the possession of superior qualifications.

To Reduce the Cost of Living.—The Daily Chronicle reports that Messrs. Dick, Kerr, of Preston, are buying large quantities of American bacon, ham, and tinned goods, and selling these at almost cost price to their workpeople.

Australian Manufactures.—Official reports from Melbourne state that 75 British manufacturing firms have already established solid interests in industrial works and factories throughout Australia, and many more are preparing similar enterprises, notably in Tasmania and Western Australia. This, says the Director of the Federal Bureau of Commerce and Industry, shows that in the opinion of some of the most progressive British manufacturers it pays them to take their plant and their skilled workers to Australia's raw material. The new Australian tariff, he adds, opens up excellent prospects to enterprising firms and affords very real protection.

Chinese Notes.—An electric light plant was imported during 1920 for Linanfu, and a similar plant was expected early in 1921 for Amichow.

Mr. Wang Yu-wen has organised the Lau Ho Kow Electric Light Co. at Lou Ho Kow, Kwangchow.

The Tuchun of Chekiang has recently acquired from the Ministry of War, four sets of wireless apparatus to be installed in Hangchow for military use.

The Tientsin Telephone Administration has announced that two branch services have been installed at Yanghiutsing and Hengshuiku.

The Self-Government Association of Tungchow has organised a factory to manufacture electric goods.

The Fengtien authorities are reported to have concluded an agreement with the Japanese South-Manchuria Railway Co. for the supply of electricity between Hushun and Mukden.

See Shou-tseung, the Director of the Kansu-Haichow Railway, has started a company for the manufacture of electrical machinery in Tientsin. A Belgian has been appointed chief engineer. Official approval has been granted.

During 1920 there were some very heavy importations of machinery. A new plant arrived for the Canton Arsenal in October, and another consignment was for the Kwangtung Electric Supply Co.

The lead ore mine, opened at Siangshui in 1917, failed during the course of 1920. The Chinese company which promoted this enterprise and did all it could to make the mine a success lost, it is said, one-half of the capital invested in the undertaking.

The Provincial Government of Hunan has appointed the Vice-Comptroller of the Mint and the Director of River Likin Posts as members of a commission which plans to establish a copper mining company in Hunan to supply the provincial Mint. All the copper mines in the district of Sinhua have been allotted to the company for operation.—Chinese Government Bureau of Economic Information.

British Syndicate to Take Over Norwegian Works.—The *Oekonomisk Review* understands that Mr. Ragnvald Blakstad, managing director of the A/S Tyssesfaldene (The Tysses Falls Share Co.), has transferred his interests in the company to an English syndicate. The company owns a big power station at Odda, Hardanger, which supplies the power for important factories also owned by it.—*Reuter* (Christiania).

"Osram" Window Display.—The GENERAL ELECTRIC CO., LTD., has introduced a striking shop-window display for the use of agents for "Osram" lamps. This is composed of a street of miniature houses in accurate perspective, the windows of which are illuminated by means of three "Osram" lamps secreted behind the scenery. The houses are chiefly of the Tudor period, and the colouring is such as to suggest the depth of winter. The "properties" are loaned to agents free of charge and carriage paid for a period of two weeks subject to compliance with certain reasonable requirements. This is an effective device which should meet with a large demand.

E.D.A. Activities.—Among the publications of the BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION referred to in our last issue is a simple but effective poster which bears a representation of a clock dial, a segment of which is shaded. This illustrates an exhortation to use electric light, pointing out that five of every twenty-four hours are spent under artificial light. "Scenes in Suburbia" are discussions between an up-to-date "electrical" housewife and a lady of retarded views upon the superiority of the electrical way of cleaning carpets, resulting, of course, in the conversion of the "non-electrical" housewife. "The Power behind the Worker" is the title of an illustrated booklet describing the electrification of various industrial establishments. A list of the Association's publications, with details of prices, may be obtained from the headquarters: Hampden House, 84, Kingsway, W.C.2.

Italian Railways Electrification: German Plant to be Asked For?—According to a report issued by an Italian news agency, Signor Crova, director-general of the Italian State Railways, has urged the Government to demand electrical plant from Germany on account of reparations in order to expedite the work of electrifying the railways. The agency further states that the schemes of electrification are already prepared for the Venezia Giulia, the Bologna-Verona-Brennero, Pisa-Leghorn, and Naples-Rome lines, while the projects for certain other lines are being studied at present. An interchange of views is now taking place between the Treasury and the General Direction of the State Railways as to the provision of the funds for the construction of the electrical installations and the acquisition of the electric locomotives.

German Prices.—As a result of the growth in the costs of production it is stated that the rebates hitherto granted to merchants on the basis prices of galvanic batteries have been discontinued, and the Foreign Trade Department for Electrical Engineering will only issue export permits in future with the basis prices as the minimum. Makers of pocket lamps have raised the war time addition, which has stood at 250 per cent. until now, to 350 per cent., and the extra percentage on other low-voltage lamps has been advanced from 250 to 300 per cent.

German Export Permits.—For the purpose of providing foreign exchange (bills) for the Reich, the Committee of the Foreign Trade Department for Electrical Engineering has decided that export permits shall only be granted in the future to applicants on condition that they agree to communicate the export figures to the Reichsbank so that the latter may control them, and that the deliveries made are intimated to the latter monthly. A certain percentage of the exchange relating to each foreign transaction is to be handed over, while percentage is to be fixed by the end of October.

The Swedish Telephone Manufacturing Industry.—As reports have been circulated in Swedish newspapers to the effect that the Ericsson General Telephone Co. had discharged a number of workmen, Mr. Hemming Johansson, director of the works, has been interviewed on the question. He is reported to have stated that the work available in the different departments varied considerably. Taken as a whole, no reduction in the personnel had taken place, but only in certain departments. Thus that for the production of large and small exchange installations was fully occupied, but the demand for telephone apparatus was somewhat less at present than in the corresponding period of last year. One manufacture, the production of which had considerably declined, was that of electric meters. Large quantities had been placed in the home market, but sales had now greatly fallen off owing to German competition. On the other hand, there was practically no German rivalry in Sweden in the case of telephone apparatus and exchange installations, whereas American competition was perceptible in certain foreign markets. The number of workmen employed at the Stockholm works, which was 1,285 on June 1st, 1920, amounted to 1,319 on September 16th, 1921. Between the beginning of January and August 1st the total value of the home and foreign sales reached 11,600,000 kr., of which the preponderating part was for export.

At present, Mr. Johansson proceeded to state, the largest amount of business was transacted in Holland and the Dutch Indies, South Africa, Spain and Australia. The great economic development in the Dutch East Indies had resulted in large extensions of the network, the establishment of new telephone exchanges, and the addition of numerous subscribers. Great activity in the telephone system also prevailed in Holland, and the company had received considerable orders for exchange installations and for telephone apparatus, while development was also proceeding in Spain and Egypt, for which large orders were being executed by the Swedish industry. Of the European branches, that at Vienna in particular had a lot of work, and large orders were being carried out there for Czechoslovakia, and the works at Budapest was also in full operation, with a good stock of orders. The English branch, with works at Beeston, attended to the English market and the English colonies, including India. In the opinion of the director, the Indian market was expected to be one of the greatest importance in the near future on account of the economic activity. Already the demand for telephone apparatus, switchboards, &c., was constantly growing. In conclusion, Mr. Johansson expressed the opinion that the prospects for the industry were favourable, having regard to the large demand arising from different sources.

Concessions for Electrical Displays.—The E.D.A. recently made an inquiry with the object of ascertaining the general practice of undertakings with regard to the rates charged for electricity used in electrical displays and showrooms in the hope that it might be found possible in course of time to secure some uniform standard method of treating retail displays of electrical apparatus. There has always been difference of opinion as to whether it pays electricity supply undertakings to offer contractors low rates for supply in order to encourage them to make better displays of electrical apparatus in their windows and showrooms. In some cases such concessions have been abused, but broadly the principle is sound, and it is suggested that all undertakings should consider giving some substantial and uniform discount off their standard rates for all electricity used by contractors and retailers in displaying and demonstrating the use of electrical appliances suitable for connection to the local supply. As a protection, and as a method of preventing other traders from complaining of unfair treatment, it is suggested that it would be possible to assess contractors' display windows and showrooms on the basis of lighting or other uses normal to shops or rooms of like size and character, such assessed normal consumption to be charged for at the rates standard or current for similar businesses, and all excess use over such normal consumption to be charged for at a very low rate. The result of this method would be that the contractor would have the strongest possible encouragement to additional use of the supply in order to make a good display of electrical apparatus and to show it in operation. Out of 145 undertakings replying, 51 notified the existence of such concessions. Of these, 32 reported satisfactory results, while 17 considered justification of concessions doubtful.

Applications for British Trade-marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions associated with the electrical trades and industries.

Pinex (lettering and design). No. 417,001. Class 8. Electrical accumulators (not for medical purposes). Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester. 16/7/21.

Aerozon. No. 41,356. Class 11. Electrical fumigating apparatus for hygienic purposes. Aerozonfabrik G. & B. Sternberg, 75, Ritterstrasse, Berlin, Germany. March 18th, 1921.

Aerozonoin. No. 413,562. Class 11. Electrical fumigating apparatus for hygienic purposes. Aerozonfabrik G. & B. Sternberg, 75, Ritterstrasse, Berlin, Germany. March 18th, 1921.

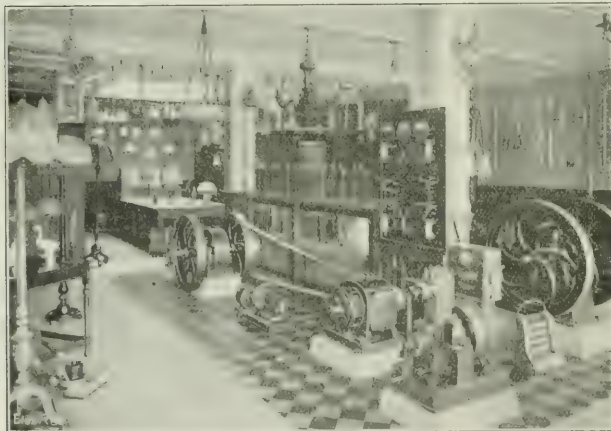
Channel. No. 416,917. Class 13. Sparking plugs. Far-riding Propeller & Engineering Co., Ltd., Eclipse Works, Glenthams Road, Barnes, S.W. July 13th, 1921.

Wog. No. 414,417,145. Class 8. Electric accumulators and batteries, not medical. Wm. O. Garbutt, 30, Russell Street, Gloucester. July 21st, 1921.

Bellite. No. 411,234. Class 8. Electric lamps. British Electric Lamps, Ltd., Spencer Hill Road, Wimbledon, London, S.W. January 5th, 1921.

A Recently-opened Showroom.—We reproduce herewith a photograph of the showroom opened a short time ago by Messrs. Mann, Egerton & Co., Ltd., at 173-175, Cleveland Street, W. Here is to be seen a well-arranged comprehensive display of all kinds of electrical fittings and apparatus. In the foreground of the photograph is seen an "Electolite" power set made by Messrs. Boulton & Paul, Ltd., Norwich, for which the firm are sole English agents.

A wide range of lighting fittings appears in the showroom. These are made in a variety of "periods" and styles to conform with any scheme of decoration or furnishing. These fittings include wall brackets, chandeliers, bowl fittings, &c., all of high artistic finish. Other appliances on view in the



MESSRS. MANN, EGERTON & CO.'S SHOWROOM.

showroom are pumping sets and battery switchboards, as well as a variety of cables, conduits, lamps, and other electrical accessories.

The special purpose of this showroom is to enable contractors to bring their clients to inspect the various types of apparatus that are on view, with the full assurance that in any subsequent transactions their interests will be safeguarded, the firm preferring to deal with contractors rather than with the general public.

French Company to Reconstruct Northern Power Stations.—La Société de Reconstitution d'Usines Sinistrées, Groupement Energie Electrique du Nord de la France is the name of a new concern which has lately been formed in Paris (56, Rue du Faubourg St. Honoré), with a capital of 1,000,000 francs with the object of re-constructing the electric generating stations in Northern France damaged or destroyed during the war.

A Finnish Amalgamation.—The shareholders in the Aktiebolag Göttyr, Strombug and the Finska Elektro industri A.B. have resolved to amalgamate under the title of the Finska Elektriska A.B., Göttyr, Strombug, the share capital being 12,300,000 fr. marks. The production is to be concentrated at the works in Sornas and Sockenbacka, the Berghall works of the Elektroindustri Co. being closed.

South African Electrical Trade.—The general managers of the Standard Bank of South Africa in information circulated regarding trade conditions in the Union, report that electrical goods are in poor demand, and prices are easier owing to the arrival of shipments from Great Britain, the Continent, and America. German goods are undercutting British.

Hiring Out Domestic Electrical Apparatus.—The director and secretary of the E.D.A. writes: Although at the present time all supply undertakings possess powers to hire out electrical apparatus there are a great many who are not doing so. It is essential to provide hiring facilities for the more expensive pieces. It would appear that in many undertakings there is hesitation in setting up hiring systems under present circumstances, because the impression exists that it is necessary to commence with a more or less elaborate showroom, a special staff, &c. Supply engineers are asked therefore to consider the possibility of starting the hire of domestic apparatus with a minimum of preliminaries and elaboration, in other words, to get the work going gently. There is little fear that the inauguration of hiring systems will result in a flood of orders and in embarrassment to the supply undertakings; although hiring is essential, much spade work has to be done, and the suggestion is rather that undertakings which have not done any hiring at all should obtain from their authorities a grant or permission to spend a limited sum in the course of six months or a year on the purchase of apparatus for hiring out.

If the matter were approached in this way it might be easy to obtain the necessary permission or grant, whereas proposals for an extensive hiring system might be objected to.

Dowlais Steel Works Reopened.—A rolling mill and rail-bank at the Dowlais steelworks of Guest, Keen & Nettlefolds, Ltd., have been restarted. Several hundred workmen, long unemployed, resumed work, and according to *The Times*, they were to be increased to 2,000 early this week, in accordance with the proprietors' intention to provide as much work as possible for their workmen, who number altogether about 4,000.

Vagaries of Exchange.—In an interesting article *The Times Trade Supplement* gives the views of Sir Raymond Dennis on the export trade outlook as the result of a 20 months' tour of the world. We quote the following paragraph illustrating the impossible situation that has arisen from exchange conditions:—

"The agent of a well-known American motor car ordered 30 cars for delivery to Rio de Janeiro and settled for them when the exchange rate was 3½ milreis to the gold dollar. When the cars arrived at Rio the dollar was worth just over 5 milreis, and as the trade position rendered sales at 50 per cent. increase in price extremely remote the agent paid freight and insurance from New York, but left the consignment in the Customs, paying warehousing charges but no duty. The exchange continued to go against Brazil, and at length recognising the hopelessness of the position the agent, after several weeks, reshipped the 30 cars to New York, paid freight, insurance, and other necessary charges, and awaited a credit. When this was remitted exchange had fallen to 8½ milreis to the dollar, and the agent, after allowing for the freight and insurance both ways, warehousing, and other incidental charges, netted a clear profit of just under £10,000."

Elsewhere in the article Sir Raymond discusses the excessive cost of our productions as being largely the cause of the slump in the export trade which has brought about unemployment.

He mentions that in his experience British goods are wanted everywhere, but out prices are too high. Only a few days ago he heard of orders placed by the Federated Malay States in the United States for railway material to the value of £1,000,000, and on the Continent for electrical material to the value of £500,000 because the goods could not be obtained from Great Britain. Other countries were able to give guarantees that we could not give because of unstable wage and delivery conditions.

Lead.—Messrs. James Forster & Co., reporting on October 1st, stated: "Closing prices yesterday were £23 2s. 6d. for September and £22 17s. 6d. for December, against £22 15s. and £22 12s. 6d. respectively at the end of last week. There has been very little demand from home consumers, and export trade has again been very dull. Should consumption continue at the present level during the next few months, this should be reflected in lower prices for lead."

German Wages and Competition.—"Z." in a letter (dated September 25th) to *The Times*, gives the following figures as to German wages as being of interest when considering German competition. They are figures received from a German factory in the metal trade for the last two weeks: 273 men average 245.45 M. per week; 269 men average 284.05 M. per week. A certain number of lads and a few women are included. The latter figure works out at less than 15s.

Czecho-Slovak-Italian Trade.—Exports from Czecho-Slovakia to Italy in 1920 reached the value of 184,048,160 lire, while the value of imports from Italy amounted to 75,156,013 lire, the trade balance being thus very much in Czecho-Slovakia's favour.—*Reuter's Trade Service* (Prague).

Specification for Metallic Resistance Materials.—The British Engineering Standards Association has just issued Specification No. 115, 1921, for "Metallic Resistance Materials for Electrical Purposes." For the purpose of the Specification these materials have been divided into the following classes: A, for use when a low temperature coefficient is required at temperatures not exceeding 60 deg. C. (as in standard resistances and in sub-standard instruments); B, for use when the temperature coefficient may vary more than that permitted for class A, and at temperatures not exceeding 200 deg. C. (as in instruments other than sub-standard); C, for use when the temperature coefficient may vary over a wide range and at temperatures not exceeding 300 deg. C.; D, for use at high temperatures not exceeding 700 deg. C. (as in heating apparatus); and E, for use at high temperatures not exceeding 1,000 deg. C. (as in heating apparatus).

The Specification fixes limits for uniformity of resistance and dimension. A comprehensive list of standard sizes of wires, tapes, and sheets is included, and considerable advantage will result if all designers of apparatus in which resistance wire is used will employ one or other of the standard sizes wherever possible.

Copies of the Specification may be obtained from the secretary, British Engineering Standards Association, 28, Victoria Street, S.W. 1, price 1s. net; post free, 1s. 2d.

Inquiry.—Makers of "asbestos wood" are asked for.

The Commercial Motor Exhibition.—Organised by the Society of Motor Manufacturers and Traders, Ltd., the Commercial Motor Exhibition will be held at Olympia from October 14th to 22nd, and is expected to prove that Great Britain leads the world for the largest display of petrol, steam and electrical vehicles for goods and passenger transport and general utility purposes. The exhibits include such vehicles as road-sweepers, fire engines, ambulances, tipping wagons, &c.

For Sale.—**ASSETS AUCTIONS CO., LTD.**, will sell by auction on October 12th, at 119-121, Newington Causeway, S.E., the stocks of an electrical goods factor and a telephone works. By order of Nobel Industries, Ltd. (who are concentrating the cartridge-making business at the Waltham Works), Messrs. FULLER, HORSEY, SONS & CASSELL will offer by auction at the cartridge works of Eley Bros., Edmonton, on November 8th and following days, surplus plant and machinery, including generating sets, Mirrieles-Diesel oil engines, dynamos, motors, &c. (See our advertisement columns to-day.)

The Premier's Advisers.—Sir Alan Smith, M.P., chairman of the Managing Committee of the Engineering Employers' Federation, and Mr. W. L. Hichens, chairman of Cammell, Laird & Co., Ltd., and vice-chairman of the English Electric Co., Ltd., were among those who went to Gairloch last Friday night to confer with the Prime Minister on measures for reviving trade and industry and diminishing unemployment.

Sir John Dewrance, president of the Engineering and National Employers' Federation (and chairman of Babcock and Wilcox, Ltd.), is also assisting in the Government's deliberations.

New French Companies.—"Over All" Sparking Plug is the title of a company formed at Paris (Avenue du Main 130), for the manufacture and sale in France and Belgium and their colonies of the plug named. The capital is 60,000 fr.

L. Pelletier and L. Baqué have been constituted a company at Hermes (Département Oise), for the construction, installation and repair of electric lines, the working of sub-stations and power stations, and the supply of electric current. The capital is 100,000 fr.

Engineering Developments in Colombia.—The demand for machinery and plant in the Republic of Colombia is slow, but consistent. Improvements in the financial condition of the State, will enable the Government to proceed with a number of projects long contemplated but hitherto impossible owing to the lack of funds.

Engineering commissions have been appointed to report upon the advisability of certain schemes.

Plans have been completed for the erection of a new electric light plant suitable for the growing requirements of the city of Bogotá, while the Municipal Council invites proposals for a new telephone system, the cost of which, including buildings and plant with a capacity of 1,600 lines, should not exceed £15,000. The Government is contemplating the establishment of a long distance inter-urban telephone service to be operated in connection with the telegraph service, which is Government-owned. The principal telegraph offices will be provided with improved equipment, and the work is to be carried out under the supervision of the Director-General de Telegrafos, with whom interested firms can correspond direct. All correspondence should be in Spanish, and addressed to the Director-General, Bogotá (Columbia).—*Reuter's Trade Service* (Bogotá).

Belgian Trade Conditions.—The Antwerp correspondent of *The Times Trade Supplement* reports a widespread recovery in almost every trade. Glass works are reopening after months of idleness, and all departments of metal works are busy. Some steel makers are already so full of orders that they are obliged to quote deliveries extending over several months, but for girders and rails quicker deliveries can still be arranged. General engineering shops and electrical works are, however, fully booked for the whole of the winter. Even the automobile industry shows a marked recovery in activity.

LIGHTING AND POWER NOTES.

Accrington.—**LOAN.**—The Corporation has applied to the Electricity Commissioners for power to borrow the necessary money for carrying out the work of supplying Messrs. Steiner & Co., Ltd., with electricity.

Aldershot.—**YEAR'S WORKING.**—The report of the electrical engineer (Mr. F. Garside), on the past year's working of the electricity department shows a total revenue of £16,933 as compared with £14,818 in the previous year. Working expenses totalled £16,228, leaving a gross profit of £665. The net result was a deficit of £2,275. The number of units sold was 563,297.

Argentina.—**PROPOSED HYDRO-ELECTRIC PLANT.**—A French engineering company has solicited a concession from the Republics of Argentina and Uruguay for the construction of a hydro-electric station at the falls of the Uruguay river which separates Uruguay from Argentina. The proposed plant would furnish electric power to all the territory within a radius of 375 miles of Salto Grande, and would include the principal cities and about three-quarters of the population of Argentina.

Commerce Reports.

Ascot.—**INCREASED CHARGES.**—The Ascot District Gas and Electricity Co. has applied to the Ministry of Transport for authority to charge 1s. 1d. per unit, with a minimum payment of 16s. 3d. for each winter quarter, and 10s. 10d. for each summer quarter.

Australia.—**SYDNEY.**—Although in 1914 the average price per kWh of electricity in Sydney was higher than that of towns in this country of comparable size, in 1920, it compared very favourably with most, the price having fallen from 1.88d. to 1.76d., while in England charges rose. Now increased charges have been sanctioned, and it is calculated that the average revenue per kWh will be 2.05d. in 1922, an increase of only 9 per cent. upon the pre-war average.

Barnstable.—**LOAN.**—The Town Council has applied for a loan of £1,500, for capital expenditure at the electricity works.

Bath.—**LOAN SANCTIONED.**—The Electricity Commissioners have sanctioned the loan of £22,000 for mains and services on account of the £30,000 applied for, but require further particulars concerning the expenditure of the amount forming the balance.

Bo'ness.—**ELECTRICITY SUPPLY.**—The Scottish Central Electric Power Co. is seeking permission from the Grangemouth T.C., to lay a cable to Bo'ness in order to supply electricity from Bonnybridge.

Bristol.—**YEAR'S WORKING.**—The annual report on the working of the Corporation electricity department for the year ended March 31st, 1921 (engineer and manager, Mr. H. Faraday Proctor), shows that the revenue increased to £303,930 (£229,525) and the expenditure to £236,409 (£166,590), which left a net profit of £6,864 (£10,875). The number of consumers increased by 1,657, to 8,923; the total connections to the mains are equivalent to 1,263,485 30-watt lamps, an increase of 168,925 lamps as follows:—Power, heating, and cooking 130,114, private lighting 38,755, and public lighting 56 lamps. The number of kWh sold, increased by 4,489,737 to 33,529,417, but the load factor fell from 27.1 to 26.7 per cent. The number of cooking stoves in circuit increased from 84 to 100, the fuel per kWh sold from 3.986 to 4.177 lb., and the total cost from 1.357 to 1.683d.

Chester.—**EXTENSIONS.**—Subject to the consent of the Chester Rural District Council, the Electricity Committee intends to lay a distributing cable in Ermine Road, at an estimated cost of £500.

ELECTRICITY CHARGES.—The Electricity Committee has decided that the increased charge of 1½d. per unit made to meet the increased cost of coal during the coal strike be terminated. A new scale of charges is to be considered when the Queen's Ferry scheme is in operation.

Chesterfield.—**LOAN SANCTIONED.**—The Electricity Commissioners have sanctioned the borrowing of £4,000 for electricity mains and services.

China.—**NANKING.**—Owing to the inability of the existing electric plant at Nanking to furnish sufficient current to meet the needs of the city and its riverside suburb of Hsiakwan, a new plant has recently been added. The United States Consul reports that the plant complete, exclusive of the site, cost about £25,000. It was supplied from the United States.

Continental.—**WEST FINLAND.**—An electricity supply company has been formed under the title of Björneborgs-Hvitvitsboggiard Mellanneds Elektricitäts A.B., with a paid up capital of 600,000 Finnish marks. The directors have been authorised to enter into contracts with the Central-Andelslaget-Hankkija, A.B. Gottfrid Stromberg, Siemens-Schuckert, and the A.E.G. for electrical plant and the setting of the works in operation.

RUSSIA.—The Electrotechnical Congress in Moscow, the object of which is to extend greatly the use of electric power in Russia, was opened on October 1st.—*Reuter* (Reval).

Dublin.—**ELECTRICITY CHARGES.**—The Electricity Supply Committee has decided to reduce the electricity charges for heating, cooking, &c., by ½d. a unit. It does not propose to make any alterations in the rates of lighting.

Darwen.—**REVISED CHARGES.**—The electricity department has revised its minimum charges, fixing 6s. for the quarters ending June 30th and September 30th, and 10s. for the quarters ending December 31st and March 31st, 1922.

Edinburgh.—**AREA OF SUPPLY.**—The new Corporation electric station at Portobello is nearing completion, and the questions of the extent of the area to be supplied and the administering authority within the area are to be decided by the Electricity Commissioners. The first instalment of the scheme, which will soon be operating, is to cost £1,750,000. A report circulated by the town clerk suggests that the area should be in the Lothians within a radius of ten miles of the station, as it is likely that the demand for supplies of electricity which can be met by the Corporation will be within such limits, although under the Act bearing on the matter the radius may be as great as 30 miles. The town clerk further submits a strong case for the Corporation being the authority controlling the area for electricity purposes, the alternative of a joint authority, which will have no financial or executive powers, being regarded as likely to lead to friction and difficulties. The only existing authorised distributors within the area are a company at Musselburgh and one at Dalkeith. These will receive electricity in bulk from the Corporation and pass it to their consumers. The report, which also suggests that the application by the Musselburgh company to extend the area of its supply should be opposed as unnecessary, has been generally approved by the Corporation committee concerned.

Gourcock.—**STREET LIGHTING.**—The Town Council has entered into negotiations with the Greenock Electricity Committee for the electric lighting of Gourcock.

Greenock.—**STRIKE AVERTED.**—A threatened strike of the technical staff of the electricity undertaking was averted on Friday last when the Corporation electricity department considered a dispute over a proposed wages cut, and heard Mr. J. W. Thomas, assistant general secretary of the E.P.E.A., on behalf of the staff. It was intimated that the proposed reductions would not take effect in the meantime, and that the whole question would be reconsidered by the Corporation.

Guildford.—**ELECTRICITY WORKS BOUGHT.** The Urban District Council has taken over the electricity works from the Guildford Electricity Supply Co., Ltd., at a cost of £60,000.

Hessle.—**ELECTRICITY SUPPLY.**—A draft agreement made by the Urban District Council with regard to the supply of electricity to the town has been submitted to the Hull Corporation Electricity Committee.

Llandrindod Wells.—**PROPOSED INCREASED CHARGES.**—An inquiry was held by the Ministry of Transport last week relative to the application of the Electric Light & Power Co. for an order authorising it to increase the price of electricity to 1s. 4d. per unit. The Urban Council and a number of large consumers opposed the application.

London.—**ILFORD.**—The Ministry of Health has refused the request of the Urban Council for permission to install electric lighting in the new London County Council houses on the Dagenham estate, on the ground of the expense involved.

Luton.—**INCREASED CHARGES.**—The Town Council has increased the charge for electricity to 125 per cent. above the pre-war price in place of the 100 per cent. addition which has previously been charged.

Maidstone.—The Town Council has applied to the Commissioners and also to the Kent Electric Power Co. for permission to supply electricity to the mill of A. E. Reed & Co., Newhythe, which is outside the Corporation's area of supply. The Council has also applied for a further loan of £500 for the purchase of apparatus in connection with the hiring out of fires, irons, and cooking stoves.

Nottingham.—**MAINS EXTENSIONS.**—The Electricity Committee recommends the expenditure of £40,000 for general extension of mains, transformers, and switchgear in connection with the high-pressure mains already laid and for increasing the area of two feeders supplying certain districts of the city. The whole of the capital sum of £50,000 sanctioned by the Council in December last has been laid out upon underground mains and outside service connections. In the purchase of meters during the year ending March last £7,735 was also spent out of revenue, but the committee being of opinion that such meters should be purchased out of capital, intimates that for this purpose a sum of £10,000 is required. It has been recommended, therefore, that authority should be given to apply to the Electricity Commissioners for leave to borrow £50,000. Considerable satisfaction is being expressed in Nottingham with the substantial progress which is now being made in many departments of the committee's work, after periods of long delay.

Portstewart (Co. Londonderry).—**POWER STATION DEVELOPMENT.**—The Electric Lighting Co. has decided to ask consumers to guarantee additional capital for the development of the undertaking. Application has been made to the Northern Ireland Parliament for new powers.

Portslade.—**REDUCED CHARGES.**—Brighton Town Council has reduced the charge for electricity for private lighting at Portslade from 8d. to 7½d. per unit.

Rathmines and Pembroke (Co. Dublin).—**LINKING-UP.**—The electrical engineers of both towns have been instructed to submit a joint report on the linking-up of the two electricity supply systems, and proposals for a 1,000-kW set, and bulk supply from a neutral source.

Singapore.—**ELECTRICITY EXTENSIONS.**—The municipality is extending its supply of electricity to the European residential quarter of the town. Work is now in hand, and energy is expected to be available early in the spring. This has naturally affected the sale of self-contained lighting sets hitherto so popular there.—*Reuter's Trade Service* (Singapore).

Skipton.—**BULK SUPPLY.**—The Streets and Buildings Committee has under consideration a proposal for the supply of electricity in bulk from the Keighley undertaking, and has asked the electrical engineers of both Corporations to prepare details and submit them to the Committee in due course.

ELECTRIC LIGHTING ORDER.—The Electricity Commissioners have fixed the date for the operation of the Electric Lighting Order, 1915, for September 1st.

Warrington.—**LIGHTING ORDER.**—The Electricity Commissioners fixed last Saturday (October 1st) as the date for the commencement of the operation of the Lighting Extension Order of 1915.

Wye (Kent).—**ELECTRICITY SUPPLY.**—The Commissioners have made a special order authorising the Wye Lighting, Heating and Power Co., Ltd., to supply electricity for public or private purposes within the parish.

TRAMWAY AND RAILWAY NOTES.

Australia.—**VICTORIA.**—The present position regarding the scheme for the electrification of the Victorian railways is summarised in a report recently issued in Melbourne. It comprises a power house, high-pressure feeder cables, 16 substations, 145 miles of track with overhead wiring and rail bonding, the conversion of 702 carriages, replacement of a large portion of the existing signalling system, and construction of workshops. Up to the present the total value of the actual expenditure upon the several activities of the commission amounts to nearly £500,000.

Bradford.—**YEAR'S WORKING.**—The financial report, issued by Mr. R. H. Wilkinson, the general manager of the Corporation tramway undertaking, shows a loss of £4,000 on the parcel department for the past year. The gross revenue was £19,420. The number of parcels carried was 740,609, as against 713,073 in the previous year. The deficit is attributed largely to the wages bill for parcel messengers.

Continental.—**SWITZERLAND.**—According to *The Times*, £2,280,000 is to be spent on the electrification of the Swiss railways next year.

THE FRENCH SOUTHERN RAILWAY.—The report for 1920 of the Compagnie des Chemins de Fer du Midi states that the work of electrification of the network, the resumption of which was announced in the report for 1919, was actively continued during the year. The station in the Ossau valley, and the erection of the power transmission lines from the district of the Pyrenees to Bordeaux and Toulouse are in full course of execution; the equipment works of the lines from Toulouse to Puyoo and from Puyoo to Dax, which are the first to be converted, have been put in hand, and the electric locomotives for these lines have been ordered. If the contract periods are observed, as is reasonably hoped for, the inauguration of electrical working on the section between Toulouse and Dax will take place from 15 to 20 months hence.

Deane Valley.—**LIGHT RAILWAY.**—According to the *Financial Times*, preparations are being made for the construction of the Deane Valley Light Railway, the necessary powers having been conceded. Contracts are being prepared and various preliminary negotiations conducted, notably in connection with road widenings.

Halifax.—**DEPOT EXTENSIONS.**—The Tramways Committee has decided to recommend that the Skircoat Road depot be extended, at an estimated cost of £11,000, to furnish four times the present accommodation for repairing cars and an enlarged workshop.

Japan.—**ELECTRIFICATION OF RAILWAYS SCHEME.**—The Japanese railways are to be electrified according to a plan now being worked out by the Department of Railways, states the *Journal of the Yokohama Chamber of Commerce*. As soon as the Department draft plan is completed, it will be presented through the Cabinet to the Diet in its next session. To facilitate the service, automatic signals have been installed. As the first step, the entire Tokaido line from Tokio to Kobé as a part of the central line between Iidamachi station in Tokio and Kofu, in the rear of Mount Fuji, where many tunnels make transportation slow, will have electric power installed.—*Board of Trade Journal*.

Keighley.—**YEAR'S WORKING.**—The annual statement of accounts of the Corporation Tramways Department for the year ended March 31st, 1921, shows a loss of £3,400, and the rail-less car system, which has not yet recovered from the heavy setback received during the war, shows a loss of £5,320. It is understood that much of the heavy expense is attributed to the cost of rewinding armatures. In the previous year there was a surplus of £1,675.

London.—**UNDERGROUND RAILWAY IMPROVEMENTS.**—In order to meet the demand during rush hours, 153 additional cars have been brought into service on the Metropolitan and District Railways, and through Southend trains are to be reinstated.

There will be a more frequent service on the Tube lines. On the Bakerloo branch trains will run every 2 and 2½ minutes instead of 2½ and 3 minutes. Similar shortening of the train intervals will be made on the Hampstead, Central London, and City & South London lines.

REPORT ON COLLISION.—In a report upon the collision which took place on July 8th at Wapping, between a Great Eastern Railway goods train and a Metropolitan Railway passenger train, Col. J. W. Pringle states that the accident was caused by the breaking of a draw-bar hook on one of the goods wagons. This released five trucks which apparently ran back into the front of the passenger train. There was no evidence of any flaw in the metal of which the hook was made. In his recommendations Col. Pringle says that the number of unfitted trains should be limited as far as possible during the hours of passenger service, especially on a line having such gradients as the one in question. There is another point for consideration. The track circuit (A) on the up road through Wapping station is continued beyond the up starting signal for a distance of 166 yards to form an overlap. In advance of A there is a track circuit B, occupation of which places and holds at danger the starting signal. So long as the five runaway vehicles occupied the rails covered by track B, the starting signal at Wapping was held at danger. But as soon as they left track B and entered track A the starting signal would automatically clear. This accounts for the fact that the starting signal indicated safety, and the up electric train had consequently started when the runaway vehicles were approaching. This false clear indication can, of course, only be given in similar circumstances, i.e., by vehicles running backward, but the irregular position of the signal in such circumstances is a further reason for the provision of additional security against breakaways.

Madagascar.—**RAILWAY ELECTRIFICATION.**—The *Exportateur Français* says plans have been drafted at the instance of the Governor-General for the electrification of the Tananariva to Tamatava railway in Madagascar, a distance of 369 km. The reasons for the conversion are high wages and the cost of coal.

Oldham.—**YEAR'S WORKING.**—The annual report of the general manager and engineer, Mr. W. Chamberlain, on the year's operation of the Corporation tramways for the twelve months ended March 25th, 1921 (twentieth year of operation), shows that the total receipts amounted to £250,742, against £237,409 for the previous year; the working expenses were £202,235 (£168,648), leaving a net profit of £5,065, against a deficiency of £1,004 last year. The electricity used for all purposes amounted to 4,225,055 kWh (3,921,931) at 1½d. and 1½d. per kWh, plus 10 per cent., the average kWh per car mile being 1.918. The number of passengers carried was 32,071,037 (31,878,455); average per car mile 14.559; average fare 1.819d. Statistics of the parcel department show that the expenditure was £2,662 (£2,346), and the income was £2,402 (£2,341), the balance being a deficit of £260 (£25), although the rates were increased during the year.

Preston.—**YEAR'S WORKING.**—For the first time in the history of the undertaking the report and statement of accounts of the county borough's tramway department, for the year ended March 31st, 1921, disclose a deficit on the year's operations. The total revenue increased by 8.04 per cent. to £96,482, and the working expenses by 29.73 per cent. to £85,458, the deficiency being £6,806. Total reserves stand at £51,706, sinking fund at £89,709, and the old tramway debt at £20,701; contributions to the rates have amounted to £23,050. The number of passengers carried was 15,885,352 (15,738,087) at an average fare of 1.44d. (1.34d.) per passenger. Electricity generated amounted to 1,946,945 kWh (1,788,495), the power cost per kWh being 1.28d. (0.993d.). The working expenses per car mile were 16.95d. (13.62d.), and Mr. J. F. Simpson, engineer and manager, states that the fact that out of 71 municipal tramway undertakings there are only four with lower working expenses per car mile than Preston would apparently indicate that they cannot make much progress in that direction, and it has therefore been necessary to adopt the alternative and to increase the fares. This increase came into operation in November, 1920, and the results have so far been quite satisfactory; if the increase in total receipts is maintained at the same level for the remainder of the year he anticipates that they will at any rate cover the expenses.

Walthamstow.—**PROPOSED TRANSFER.**—According to *The Times*, as the tramway system has been a heavy debt and the increased fares have not helped the financial position, the London County Council is to be invited to take it over and work it.

Warrington.—**TRAMWAY EXTENSIONS.**—The Electricity and Tramways Committee has under consideration a scheme for laying a tramway track between Warrington power station and along Mersey, Napier, and Parr Streets.

York.—**TRAMWAYMEN'S BONUS.**—The Tramways Committee has approved the appointment of the drivers and conductors of the City tramways that they should be paid full bonus during the period they were working on short time owing to the coal strike.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—**EQUIPMENT FOR RADIO STATIONS.**—The Australian Navy Department has accepted a Melbourne tender for the supply of high-pressure apparatus, generator sets, and other equipment for the Commonwealth radio stations at Perth and Sydney. The price was £9,983 8s. 9d.—*Reuter's Trade Service* (Melbourne).

An Italian Marconi Co.—A new company has been formed at Leghorn under the title of the Italian Marconi Co., all the share capital being Italian. The object is to establish and work radio stations for public services in Italy, the Colonies, and countries under Italian influence.

Cables in the Dutch East Indies.—The laying of new cables in the East Indian Archipelago, which were supplied by a German company, as was mentioned in a recent issue, is reported to have been completed on September 7th. A length of 1,100 kilometres, it is stated, was laid at a depth of from 3,000 to 5,000 metres, and about 4,000 kilometres at a depth of from 300 to 1,000 metres. Apart from the work done by the cable steamer *Telegraf*, most of the laying was carried out by the German company by means of a steamer chartered in Norway and specially equipped for the work. [Probably the lengths stated in "kilometres" should read "metres."]

Canada.—According to *The Times*, during one of the worst storms experienced for many years at Ontario and Quebec, the electric and telephone systems were disorganised. In Ottawa alone 800 telephones were cut off.

China.—**SHANGHAI.**—According to the *Central News*, preliminary arrangements have been completed by the Federal Telegraph Co., of San Francisco, for the erection of the largest wireless station in the world, capable of sending and receiving messages to and from all over the world.

Continental.—**ITALY.**—Wireless communication between Rome and Tripoli was successfully inaugurated on September 6th.

At the instance of the Ministry of Posts, Telegraphs and Public Works, a Royal Commission of experts has been nominated to study the best means and most suitable scheme for crossing the Straits of Messina with telegraph and telephone lines and power mains. The problem is no ordinary one owing to the straits being within the volcanic earthquake area of this part of Italy.

G.P.O. Research.—The research work in connection with the engineering department of the General Post Office will in future be done at Dollis Hill, says the *Evening News*. Disused army huts have been erected on a site that was acquired before the war, and later a permanent building will be erected. Hitherto the staff has been scattered in various G.P.O. buildings; concentration at one place, thinks Sir W. Noble, the chief engineer, will make for economy and efficiency. The wireless branch of the department will remain at St. Martin's-le-Grand.

Imperial Wireless Chain.—H.M.S. "Raleigh" has arrived at St. Johns (N.F.). It is understood that the purpose of the visit is an inspection of the Admiralty wireless station with a view to its utilisation as a link in the Imperial wireless chain.—*Reuter's Trade Service* (St. Johns, N.F.).

India.—**BOMBAY TELEPHONE SYSTEM.**—The Bombay Telephone Co. proposes to install an automatic system within three years. The scheme provides for fifteen thousand lines, and the cost is estimated at £400,000, providing for the introduction of a full automatic plant. It appears that the Government of India is prepared to extend the licence of the telephone Co. for 20 years in the event of the company introducing an automatic or a modern central battery system.—*Reuter's Trade Service* (Bombay).

New Japan America Cable. In order to improve the connection between Japan and America, a new submarine cable is to be laid down. It was first intended that it should run from Yokohama via the Aleutian Isles to Vancouver and Seattle, but this scheme had to be abandoned owing to the ice risks. The route now suggested is from Japan to San Francisco via Bonin Islands, Ladrone Group, Guam, Midway

and Honolulu. It will be largely supported by cables already existing. This route may be shortened by laying a new cable from Bonin to Midway, a distance of 2,823 miles.—*Economic Review.*

New Spanish Cables.—A Royal order published in the official *Gaceta de Madrid* of September 27th authorises the grant of a supplementary credit of two million pesetas to be added to the present estimates for expenses incurred under the heading of "new cables." This additional sum will be applied to the expenses entailed in the laying of a new cable from Malaga to Melilla.—*Reuter.*

Sweden.—**STOCKHOLM.**—The laying of the large new telephone and telegraph cable between Sweden and Germany was accomplished on September 29th last. One cable steamer has arrived at Zarintzin, to the north of Stralsund.—*Daily Telegraph.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Ashford (Kent).—October 12th. East Ashford Board of Guardians. Electric lighting installation at the Workhouse.—Mr. J. Kingsford, clerk, 7, Bank Street, Ashford.

Argentina.—October 21st. State Railways. Twelve months' supply of electrical stores.*

November. State Railways. One year's supply of railway signal material, including telephone and telegraph materials, &c.*

Australia.—**MELBOURNE.**—Victorian Government Railways. October 26th. D.C. arc welding plant (Cont. No. 34,377). November 9th. Armature banding machine with electric motor and starting gear (Cont. 34,378).

November 2nd. Electric storage battery complete for automatic telephone exchange (Cont. 34,229).*

January 4th. Victorian Government Railways. 150 electric train stops operated by a single-phase induction motor. One set of electric pyrometer equipment for measuring temperatures of 350 to 2,000 degrees Fahrenheit.—*Reuter's Trade Service* (Melbourne).

Belgium.—October 17th. Municipal Authorities of Schaerbeek, Brussels. 8,000 metres of 3 by 70 by 50 armoured cable and 6,000 metres of the 3 by 50 by 35 ditto. Particulars from the Service de l'Electricité, Hôtel Communale. Tenders to the Administration Communale, Schaerbeek, Brussels.

NOTE.—These are apparently 3-core cables for a 3-wire system.

Colne.—October 11th. Electricity and Tramways Department. Natural draught cooling tower. (September 30th.)

Edinburgh.—October 10th. Corporation. Electric lighting installation at the city collector's offices, Waterloo Place. Engineer's office, Dewar Place.

October 10th. Tramways Department. Sixteen car bodies. Tramways manager, 2, St. James Square, Edinburgh.

October 18th. Electricity Supply Department. Four 10-15-ton hand-operated overhead travelling cranes, electric and steam-driven feed pumps. (See this issue.)

India.—**CALCUTTA.**—November 9th. Calcutta Electric Supply Corporation, Ltd. One 15,000-kW turbo-alternator and condensing plant. Two water-tube boilers with an evaporation of 60,000 lb. per hour. (See this issue.)

October 19th.—East Indian Railway Co. Insulated cables. (See this issue.)

Leeds.—October 11th. Health Committee. Electric lighting set, comprising 4 b.h.p. oil engine, 3-kW d.c. generator, and accumulators, complete with tanks, piping, switchboard, &c., at Sanatorium, Gateforth, near Selby. Specifications from R. E. Fox, town clerk, 26, Great George Street, Leeds.

London.—**L.C.C.**—October 24th. Electric goods lift (capacity 30 cwt.) at the Stamford Hill Stores Depot. (See this issue.)

Loughborough.—October 31st. Electricity Department. Steam-raising plant, h.p. and l.p. mains networks. (September 23rd.)

New Zealand.—**WELLINGTON.**—November 29th. Public Works Tender Board, Mangahao power scheme. Water wheels, generators, 3-unit exciters, transformers, 110,000-V insulators, lightning arresters, switchboard, switches, and accessories. (September 23rd.)

November 21st. Post and Telegraph Department. 750 red and 750 white switchboard cords, 3 conductor (spec. No. 87).*

Portrush.—October 8th. Urban District Council. Work in connection with the public electric lighting of the district. (September 30th.)

Salisbury.—October 10th. Town Council. Electric wiring and fitting for 20 houses.—City engineer.

St. Annes-on-Sea.—Electricity Department. Four miles (approx.) armoured cable. (September 30th.)

South Africa.—**JOHANNESBURG.**—November 7th. Rand Water Board. Two 35-kW steam-driven electrical generating sets, complete with switchboards and all accessories.*

HUMANSDORP, Cape Province. November 30th. Corporation. One water turbine and dynamo, switchboard with connections, battery of accumulators, and accessories, supply main and public lighting, aerial distributing lines, street lamps, fittings and accessories, section boxes, service cut-outs, meters, &c., ferro-concrete pipe line, reinforced concrete tank, buildings, and foundations. Forms, &c. (63s.) from the town clerk, Humansdorp, Cape Province.

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CLOSED.

Australia.—Victorian Electricity Commissioners.

Switchgear, &c., for Newport "B" power station, four 50 cycle and four 25 cycle leaders, £40,000.—English Electric Co., Ltd. Set-up unit and station transformer, £21,240.—Metropolitan-Vickers Electrical Co., Ltd. Seven squirrel cage induction motors, £730.—Gardner, Wharfedale & Co.

NEW SOUTH WALES.—Public Works Department.

Hydro-electric plant for Dorrigo Shire Council, £3,245.—Sir W. G. Armstrong, Whitworth & Co., Ltd.—Tenders.

Chester.—Electricity Committee. Accepted:—

Sub-station in Sealand Road.—Wm. Vernon & Sons, Ltd., £1,715.

Government Contracts.—The following contracts were placed during August:—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).

Aluminium.—British Aluminium Co., Ltd. Conduit tubing and accessories.—Barton & Sons, Ltd.; I. Birch & Sons, Ltd.; Brunerton, Edison Tubes & Conduits, Ltd.; Credenda Conduit Co., Ltd.; General Electric Co., Ltd.; Portcullis Seamless Steel Tube Conduit Co., Ltd.

Electric lighting scheme.—Brush Electrical Engineering Co., Ltd.; British Thomson-Houston Co., Ltd.

Electric fuses.—L. Weekes, Ltd. Electric lighting installation.—Macintosh Cable Co., Ltd. Motor-driven planing machine.—Swiven & Co., Ltd. 10-ton electric trolley.—Cowan Sheldon & Co.

One 3-ton and one 10-ton ditto.—Sir W. Arrol & Co., Ltd.

WAR OFFICE.

Electric cells.—Siemens Bros., Ltd.; General Electric Co., Ltd.

AIR MINISTRY.

Accumulators.—Chloride Electrical Storage Co., Ltd.

Battery booster.—Lancashire Dynamo Co., Ltd.

Electrical wiring.—F. G. Minter.

Extension to switchboard.—Ferguson, Pailin, Ltd.

Wireless valves.—General Electric Co., Ltd.

POST OFFICE.

Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; Peel-Comer Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.

Telegraph and telephone cable.—Enfield-Ediswan Cable Works, Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.

Joint box castings.—McDowall, Steven & Co., Ltd.

Secondary cells.—Pritchett & Gold & E.P.S. Co., Ltd. Ducts.—Albion Clay Co., Ltd.; Donington Sanitary Pipe & Fire Brick Co., Ltd.; Doulton & Co., Ltd.

Electric light fittings.—Engineering & Lighting Equipment Co., Ltd.

Tungsten lamps.—British Thomson-Houston Co., Ltd.; Edison Swan Electric Co., Ltd.; English Electric & Siemens Supplies, Ltd.; General Electric Co., Ltd.

Electric motors.—K. B. Electric Motors, Ltd.

W.I. pipes.—J. Spencer & Co.

Distribution cable plugs.—British Insulated & Helsby Cables, Ltd.

Enamelled and silk-covered copper wire.—Corrall's (Blackley), Ltd.

Copper wire (soft strand).—Enfield-Ediswan Cable Works, Ltd.; H. W. Smith & Sons, Ltd., Ltd.

Laying conduits.—Openshaw-Clayton; Whittaker Ellis, Ltd. Bristol (Central South); Whittaker Ellis, Ltd. Kennal Road; J. Mowlem & Co., Ltd. Stockbridge-Oughtbridge; Hodges Bros. (Contractors), Ltd. Birmingham (South); Hodges Bros. (Contractors), Ltd. Tiverton; G. Percy Trentham, Ltd. Hebburn and Jarrow; G. Percy Trentham, Ltd. Stanmore-Chesham (Section III); G. Percy Trentham, Ltd. Manchester High Street (Section II); W. Pollitt & Co., Ltd.

L.p. switchgear, cables, connections, &c.—P.O. Savings Bank Sub-station: General Electric Co., Ltd.

Manufacture, supply, drawing-in, and jointing cable.—Purley-New Oxted; W. T. Henley's Telegraph Works Co., Ltd. Portsmouth-Ryde; W. T. Henley's Telegraph Works Co., Ltd. Portsmouth-Shedfield; Gullender's Cable & Construction Co., Ltd. Manchester-Hyde-Glossop; W. T. Glover & Co., Ltd.

Motor generators.—Post Office Savings Bank Sub-station: British Thomson-Houston Co., Ltd.

Power plant.—Guildford telephonic repeater station: General Electric Co., Ltd.

Telephone exchange equipment.—Swansea: Siemens Bros. & Co., Ltd. Sub-contractors for batteries: Pritchett & Gold & E.P.S., Ltd.; for charging machines: English Electric Co., Ltd.; for ringing machines: Crompton & Co., Ltd. Sketty: Siemens Bros. & Co., Ltd. Sub-contractors for batteries: Pritchett & Gold & E.P.S., Ltd.; for charging machine: English Electric Co., Ltd.; for ringing dynamometers: Small Electric Motors Co., Ltd. Ilford: Peel-Comer Telephone Works, Ltd.

CROWN AGENTS FOR THE COLONIES.

Bridge meggers.—General Electric Co., Ltd.
Cable, &c.—W. T. Henley's Telegraph Works Co., Ltd.
Copper line wire.—Elliott's Metal Co., Ltd.
Electrical materials.—British Thomson-Houston Co., Ltd.
Electric meters.—Lands & Gyr, Ltd.
Electrically-driven transporters.—Sir W. Arrol & Co., Ltd.
Lifts.—General Electric Co., Ltd.
Telephone (spare parts).—Siemens Bros. & Co., Ltd.
Train lighting spares.—J. Stone & Co., Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.

HIGH COMMISSIONERS FOR INDIA.

Generator set.—Lancashire Dynamo & Motor Co., Ltd.
Insulator cups.—Taylor, Tunnick & Co., Ltd.
Receivers.—Elliott Bros. (London), Ltd.
Switches, &c.—R. White & Son.
Telegraph apparatus.—Marconi's Wireless Telegraph Co., Ltd.; Automatic Telegraph Manufacturing Co., Ltd.

H.M. OFFICE OF WORKS (JULY CONTRACTS).

Engineering services.—Electric lighting plant: R. A. Lister & Co., Ltd.
Kew Insurance Office, electric wiring: Tredegars, Ltd. Llantrissant housing schemes, electric wiring: Alpha Manufacturing Co., Ltd.
Rowley Regis housing scheme, electric wiring: T. R. Priest.
Public Works Department, Dublin.
Electrical work and supplies, Belfast.—A. Stevenson.

Manchester.—Tramways Committee.

Tramcar trucks.—Brush Electrical Engineering Co., Ltd.

Electricity Committee.

Cable.—Connolly's (Blackley), Ltd.
L.p. water, steam, drain and by-pass pipework, supports, &c., at Barton Power station.—Aiton & Co., Ltd.
L.p. valves for circulating water.—J. Blakeborough & Son.
One transformer oil tank.—St. George's Engineering, Ltd.

Salford.—Education Committee.

Installation of electric light at Wellington Street Council school, £112.—R. Over.

Tramways Committee.

Welding and retreading 500 joints on the tramway track. £675.—Rail Welding Co., Ltd.
Three months' supply of the following stores, &c.:—
Cables and lamps.—Power & Lighting Supplies Co., Ltd.
Cables and tapes.—L. Andrew & Co.
Armature coils.—Barratt & Thornton; Manchester Armature Repair Co., Ltd.
Field coils.—Metropolitan-Vickers Electrical Co., Ltd.; Armature Wind-ing Co.
P. and B. tape and lamps.—British Insulated & Helsby Cables, Ltd.
Insulating varnish.—Griffiths Bros. & Co. (London), Ltd.
Cable brushes.—J. Eades.
Dry coils.—English Electric & Siemens Supplies, Ltd.
Gear wheels.—British Hele-Shaw Patent Clutch Co., Ltd.

Electricity Committee.

Repair parts for the No. 2 turbo-alternator, £3,370.—Metropolitan-Vickers Electrical Co., Ltd.
Spare armature for the canal water pumping plant.—Mather & Platt, Ltd.
Switch tripping batteries for the Blackfriars and Trafford sub-station, £278.—Metropolitan-Vickers Electrical Co., Ltd.
250 yards 3-in. stoneware pipes and 500 yards 34-in. stoneware pipes, £211.—Doulton & Co., Ltd.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, October 7th, at the Caxton Hall, Westminster, S.W. At 8 p.m. Lecture on "Colour Vision and Colour Blindness," by Dr. E. Green.

Friday, October 14th, at Caxton Hall, Westminster. At 8 p.m. Paper on "Electricity," by Mr. C. H. Woodfield.

Association of Engineers in Charge.—Saturday, October 8th, at the Holborn Restaurant. At 6 p.m. Annual dinner.

Birmingham and District Electric Club.—Saturday, October 8th. At the Grand Hotel, Colmore Row, Birmingham. At 7 p.m. Paper on "Commercial Efficiency of the Telephone," by Mr. C. G. Findlay.

Institute of Transport.—Monday, October 10th. At the Hotel Cecil. At 7.30 p.m. Annual dinner.

Institution of Electrical Engineers.—EAST MIDLAND SUB-CENTRE.—Tuesday, October 11th. At the College, Loughborough. At 6.45 p.m. Address on "Modern Development in the Electric Supply Industry," by Mr. T. P. Wilmshurst, chairman.

Northampton Engineering College Engineering Society.—Wednesday, October 12th. At 5.30 p.m. Paper on the "Construction of the Curtis Turbo-Alternator," by Mr. A. L. M. Ayres (kinematograph).—At 6.30 p.m., Presidential address, by Dr. R. Mullineux Walsley.

Commercial Motor Exhibition.—Friday, October 14th, to Saturday, October 22nd. At Olympia, W.

Edinburgh Electrical Society.—Friday, October 14th. At the Philosophical Institute. At 8 p.m. Paper on "Electro-Chemistry," by Mr. R. W. J. Stark.

Electro-Harmonic Society.—Friday, October 14th. At the Grand Hall, Cannon Street Hotel, E.C. At 8 p.m. First smoking concert of the 1921-1922 season.

NOTES.

The Electro-Harmonic Society.—The first smoking concert of the 1921-22 season will be held in the Great Hall, Cannon Street Hotel, E.C., on Friday, October 14th, commencing at 8 p.m. The following is the list of artistes:—Miss Doris Vane, soprano; Mr. Walter Glynn, tenor; Mr. Charles Tree, bass; Mr. Middleton Woods, stories; Mr. Herbert Collings, magic; Mr. Norman Long, humour at piano; Mr. Bernard Flanders, A.R.A.M., solo pianist and accompanist.

Appointments Vacant.—Works superintendent (£390), for the Oldham Corporation Tramways; Engineering assistant (£564), for the Stoke-on-Trent Corporation Electricity Department. See our advt. pages today.

The Electrical Trades Benevolent Institution.—Sir Tom Callender, who is presiding at the annual festival (to be held on October 26th) has issued an appeal for support to the Institution, in which he points out that its primary object is to grant pensions to those of its members who may fall on evil days, the funds for this purpose being provided out of income from its investments. As this is only £650 per annum, it will be recognised that the amount available for distribution is very limited.

In addition to this, the Institution gives help to those in the electrical industry coming within the scope of its operations, who find themselves in temporary distress. The value of such prompt aid in the hour of need is incalculable, and much real assistance has been given in this manner.

"There is little doubt," says Sir Tom, "that the trying times we are likely to experience in all industries (including our own) during the next few years will mean more calls upon us than in the past, and I therefore make a special appeal to you for your support and liberal contributions."

We earnestly hope that the response to this request will be proportional to the urgency of the need. In such matters as this it is essential to take thought for the future, and to be prepared in good time for the coming demands upon the resources of the Institution. How far would £650 go towards providing adequate pensions for our casualties?

The Industrial League and Council.—The first of a series of lectures and discussions on industrial subjects arranged by this organisation was held on Wednesday evening at Caxton Hall. Mr. E. J. P. Benn was the speaker, and his subject was "The Capitalistic System." The meetings will take place every Wednesday from now on to December, at 7.30 p.m., and the subjects arranged for are as follows:—

October 12th.—Mr. C. Jesson, M.P., "The Importance to the Worker of Initiative and Enterprise."

October 19th.—Mr. E. W. Pether, "Economic Axioms of Industry."

October 26th.—Mr. E. W. Mundy, "Profit Sharing and the Coal Settlement."

November 2nd.—Mr. E. C. de Segundo, "Ability as a Factor in the Production of Wealth."

November 9th.—Mr. E. J. Garmeson, "Industry and its Relation to Finance."

November 16th.—Mr. F. S. Burton, "The Great Essential to Industry."

November 23rd.—Mr. H. E. Blain, "The Industrial Revolution in England."

November 30th.—Mr. H. B. Elvin, "Some Causes of Industrial Unrest, and a Remedy."

December 7th.—Mr. John Baker, "Some Problems of Unemployment."

December 14th.—Mr. H. G. Williams, "The Cost of Living and its Implications."

December 21st.—Mr. A. Dalgleish, "Trade Boards."

A New Electric Rolling Mill.—Messrs. Hadfields, Ltd., of Sheffield, are installing a 23-in. electrically driven rolling mill of the reversing type, comprising a set of cogging and finishing rolls, for rolling tramway rails. The operation of rolling in this mill will be continuous, the bloom passing automatically from the soaking pit to the rolls through and through until it becomes the finished product. The rolling of tramway rails is a new departure at Hadfields' works.—*Ironmonger.*

A New Wireless Valve.—From the point of view of operating and maintenance expenses it is desirable to reduce the number of valves in use to the lowest possible limit, but until recently any such reduction involved a disproportionate sacrifice of sensitiveness and receiving efficiency. A new valve with four electrodes, which has been brought out by Marconi's Wireless Telegraph Co., Ltd., for use in its marine receiver, performs the functions previously carried out by three separate valves, and thus provides the required degree of sensitiveness with a minimum of expense. In this valve the central straight filament is surrounded by three coaxial cylinders; the first, which is next to the filament, is an open spiral "grid," the second a close-meshed "grid," and the third and outer electrode a thin metal "plate." The three inner electrodes, the filament and the two grids, operate as an ordinary three-electrode valve, but by an ingenious arrangement of circuits two stages of amplification are provided—one high-frequency and one low-frequency stage. An intermediate stage, during which rectification occurs, is provided by the outer electrode or plate acting in conjunction with the filament. The amplifying detector comprising this valve and its associated circuits is installed in conjunction with a compact and simple tuner of novel design having a wave-length range of from 300 to 23,000 metres. A small local oscillator of similar range provides for c.w. reception when required.

Educational.—UNIVERSITY OF LONDON, KING'S COLLEGE.—Special Advanced Engineering Lectures.—The following lectures (a course of five in each subject) have been arranged for post graduate and other advanced students, on Liquid Fuel, by Mr. H. Moore, on alternate Mondays, commencing October 17th; on Liquid Fuel Engines, by Mr. W. R. Ormandy, on alternate Mondays, commencing October 24th; on Bridge Construction, by Mr. H. W. FitzSimons, on alternate Thursdays, commencing October 13th; and on Cascade Induction and Synchronous Motors and Generators, by Mr. L. J. Hunt, on October 18th. The lectures commence at 5.30 p.m. Full particulars can be obtained from the secretary at the College. (See our advertisement pages to-day.)

The Board of Education announces the following successes in the 1921 competition for Whitworth Scholarships and Exhibitions:—*Scholarship*.—W. R. Beach, electrical fitter apprentice, Portsmouth Dockyard. *Exhibitions*.—S. H. Boss, S. Andrew, C. T. Redmond, A. E. Creasey, and J. E. Carr, all electrical fitter apprentices in Portsmouth Dockyard.

Fatality. A tank, which was suspended above the ground at the electric sub-station at Whitley Bay, collapsed during repairing operations, and Arthur Graham, fitter, was killed. William Hardy, of Newcastle, who, with Graham, was working beneath the tank when it fell, was injured.

Wages in the Electrical Contracting Industry.—The following communications have come to hand, at the moment of going to press, from the National Federated Electrical Association:

Communication (1).—*Electrical Contracting Industry.*—Variation of wages in accordance with the National Wages Agreements entered into by the National Federated Electrical Association and Electrical Trades Union under dates August 7th, 1920, and September 22nd, 1921.

We, the undersigned, having been duly appointed by our respective societies in conformity with the later agreement as the sub-committee whose duty it is to give effect to the agreements by ascertaining and declaring at four-monthly intervals the variations due (if any) and the net rates of wages payable under the terms of the agreements to each Grade for the ensuing period of four months:

Hereby declare that under the agreements, the variation in cost of living justifies a 10 per cent. variation in wages, and that the net hourly rates of pay applicable to the respective Grades of the agreements, from the end of the first pay period in October, 1921, exclusive, to the end of the first pay period in February, 1922, inclusive, are as follows:—

Grade A, 2s. 3d. (This rate includes a travelling allowance. No further allowances to be paid except as provided by Rule 9 of the London Rules dated February, 1920); Grade B, 2s. 0½d.; Grade C, 1s. 10½d.; Grade D, 1s. 8½d.

Signed on behalf of the National { JOSEPH ORRIDGE,
Federated Electrical Association, { H. J. CASH.

Signed on behalf of the Electrical { J. ROWAN,
Trades Union, { J. KINNIBURGH,
H. P. BOLTON.

September 22nd, 1921.

Communication (2).—In accordance with the National Wages Agreement between the Electrical Trades Union and the National Federated Electrical Association, dated August 7th, 1920, the respective parties hereby accept the joint recommendations of their National Executives dated July 20th, 1921, and agree as follows:—

(1) There shall be variations of the April, 1921, rates of all grades, which variations shall be ascertained by a small Committee of both sides in September, 1921, and afterwards at four-monthly intervals, and shall come into operation on the second pay day of the month following the meeting of the Committee for the period covered by that pay day.

(2) Such variation to be 1 per cent. (one per cent.) for each 3 (three) points variation in the Board of Trade cost of living figure ("all items") from 150 per cent. above July, 1914 (taking the average of the figures published on or about the 18th of the month in which the Committee sits and of the three preceding months).

(3) The Committee at its four-monthly meetings shall, in arriving at the rates payable for the ensuing period of four months, calculate the net result of the variation (if any variation be called for by the terms of this agreement); and shall declare the resultant net hourly rate for each grade of the National Wages Agreement of August, 1920, and in making such calculations any final fraction of a penny less than one-eighth shall be ignored, and any final fraction of a penny or one-eighth or over shall be counted as a farthing.

Signed on behalf of the National { JOSEPH ORRIDGE,
Federated Electrical Association, { H. J. CASH.

Signed on behalf of the Electrical { J. ROWAN,
Trades Union, { J. KINNIBURGH,

September 22nd, 1921.

Electrical Units in Spain.—By a decree of the Ministro de Fomento, the international ohm and ampere are made obligatory in all electric specifications and applications in measuring resistance and current strength.

Electricity v. Gas.—Interesting references to the competition gas has to face were made at the annual conference of the British Commercial Gas Association, held in Glasgow recently. Mr. D. Milne Watson, M.A., LL.B., president of the National Gas Council, and governor of the Gas Light and Coke Co., London, in an exhaustive review of the position of the industry, said that he thought the time might come when gas and electricity might work together in this country as they did elsewhere, each occupying the field where it was most suitable. He said there could be no objection to electricity being supplied cheaply so long as its cheapness was not the product of subsidy by public money, direct or indirect; but they as an industry, must be prepared to sell heat, light, and power still cheaper, or at least as cheaply. It was true that they were able (and in the absence of cheap water power would, he believed, continue to be able) to hold their own in heating and cooking without difficulty if they were progressive in their methods and enlightened in their policy, but in lighting and power they had in many fields a most powerful rival. It had, indeed, already been recognised in many quarters that gas and electricity should work together, but until such a time as that came about they would have to take care that their business was not taken away from them through negligence or awkwardness. From the point of view

of coal conservation, there was no practical difference between gas and electricity when used for light or power purposes. But when it was heat for heating, cooking, and furnace purposes that the consumer needed, the case with regard to coal conservation as between the two sources of heat supply was very different, and was all in favour of gas. He emphasised the fact that if coal was burned at an electric generating station all the valuable chemical by-products of carbonisation were lost to the community just as much as if the coal were burned in household grates or furnaces.

In a paper, Mr. E. W. L. Nicol described the "Sandwich" system of boiler firing, in which alternate layers of coal and coke were used. From figures supplied by the London County Council power station at Greenwich, it was stated that in addition to a great saving in fuel transport and storage, there was a net saving in fuel costs of about 16 per cent. on all steam generated with the "Sandwich" system of firing. This represented an annual saving at the power station of £8,000. The ultimate and only practical solution of the smoke problem would, in his opinion, prove not to be, as many thought, the universal use of electrical energy, but the provision in adequate quantities of a smokeless combustible. The gas industry held the key to the provision of such fuel, and as its advantages became better known coke as a fuel would have a future which should be limited only by the output and consumption of gas. In the discussion which followed, Mr. Alfred J. Phillips, gas engineer, of the American Gas Association, New York, said competition from electricity was even greater in America than on this side, but in heat treatment and other industrial work, gas had held its own.

The Electric Vehicle Committee.—A meeting of the Electric Vehicle Committee of Great Britain was held at the Institution of Electrical Engineers on September 1st, with Mr. Shrapnell-Smith (senior vice-chairman of the committee) in the chair. The committee considered Mr. Ayton's resignation of his positions as chairman and honorary secretary on account of his appointment as joint managing director of Messrs. Ransomes, Sims & Jefferies, Ltd. Mr. Chaddock moved a formal acceptance of Mr. Ayton's resignation, and proposed a vote of thanks to him for his services, saying that he had handled quite 75 per cent. of the work of the committee. After discussion, Mr. Ayton was persuaded to retain the position of chairman until at least March 31st, and Mr. E. E. Hoadley (consulting and resident electrical engineer to the Maidstone Corporation) was elected honorary secretary.

The position created by the refusal of the Electricity Commissioners to authorise municipal electricity supply undertakings to subscribe to the funds of the committee, was then considered. The Commissioners' refusal is based on the contention that the committee, in not possessing a constitution or articles of association, is not an association within the meaning of Section 30 of the Electricity (Supply) Act, 1919. The committee re-appointed the special sub-committee which had considered the question of incorporation and the drawing up of a memorandum of association, and instructed it to make a further report on the subject. The question of the price of energy for charging electric vehicles enforced by certain supply undertakings was considered. An effort will be made by the committee to deal with specific instances, and to encourage the general adoption of a reasonable and attractive system of charging for electricity.—*Electric Vehicle.*

The s.s. "Sophocles."—The new Aberdeen liner, which was launched at the Abercrombie Basin, Belfast, on the 22nd inst., has been built by Messrs. Harland & Wolff, Ltd., to the order of Messrs. George Thompson & Co., for the Australian passenger and freight trade. She has a large electrical equipment. The winches for the four derrick posts and eighteen derricks—dealing with weights up to 40 tons—are electrically driven; no fewer than 1,200 lamps are installed, in addition to a number of large cluster fittings and 2,000-c.p. lights for cargo handling. The electric steering gearing is of the "Wilson-Pirie" pattern, and amongst other apparatus and machinery electrically propelled are the bilge pumps, turbine turning motors, dough mixer, potato peeler; 15 fans varying from 15 to 35 ft. in diameter and having motors from 24 to 15 h.p. The ash hoists are electrically driven. The plant consists of two turbo-generators, each of 150 kW, and one Diesel emergency set of 75 kW above the water line. The *Sophocles* measures 500 ft. in length, has a beam of 63 ft., and a gross tonnage of 12,500. A sister ship, the *Diogenes*, is well forward, and will be ready for launching early in the New Year.

Optical Signalling.—Prior to the closing of the 1920-21 session of the Glasgow and District Radio Club, Dr. Houston lectured to its members on the above subject at the University. Dr. Houston reviewed the various methods of signalling, but his remarks had reference chiefly to the numerous methods of secret signalling by visual means, which had been tried during the war, including ultra-violet and infra-red rays, polarised light, colour filters, &c. A system invented by Dr. Houston, which used an ordinary telescope and a 14-volt bulb, was clearly explained and demonstrated, and aroused great interest. Suitable apparatus was used to illustrate each system.

Bombay Engineering Congress.—The Bombay Engineering Congress will meet this year on December 8th and the two following days.—*Routers' Trade Service* (Bombay).

Electricity Charges: The Operation of the Coal Clause in Contracts.—It may be regarded as an established practice that where separate contracts for electricity supply are arranged with power consumers, the Coal Clause forms part of the terms of such contracts. The clause is framed for the sole purpose of ensuring that producers do not take advantage of the price variations of the raw material nor suffer losses from the same cause.

A member firm of the Federation of British Industries has recently forwarded its electricity accounts especially in order to draw attention to the fact that the Coal Clause has not, in its opinion, operated correctly during the violent fluctuations in the price of coal which have taken place during the space of the last two years.

By calculation this firm shows that the bill could only be justified on a consumption of 6.7 lb. of coal per unit, which, it is suggested, is a ridiculously high figure for a modern power plant consumption. The effect of the Coal Clause has been to increase the price of each unit by almost 300 per cent.

It may be that the clause was framed to meet small variations in the price of fuel, and that the large increases over the basic coal price nullify the value of the clause in preserving fairness in the contract terms. In the case under review the increase above basic price is practically 400 per cent.

Another contributory cause, no doubt, is the fact that the other costs of electricity production, according to the returns made by numerous power companies, have not increased in the same proportion as coal.

In conclusion, the F.B.I. Fuel Economy Department would welcome the opinions of other consumers of power so that the question may be taken up with the supply authorities.—*F.B.I. Bulletin.*

Electric Vehicles.—Mr. J. A. Priestley, cleansing superintendent to the Sheffield Corporation, has since September, 1915, installed a fleet of electric vehicles that now numbers 45. Of these, 24 are fitted with Edison batteries, 11 are Garrett, two Orwell, and eight were supplied by the General Vehicle Co., Ltd.; the Garrett and four others are fitted with Ironclad Exide batteries, while four have flat plate accumulators which are now on trial. The following views of Mr. Priestley, which we abstract from the *Contract Journal*, are of interest. He hesitates to declare a preference for a particular type of battery, but his opinion is that the Edison iron-nickel cell, although it is given a longer guarantee period, has a lower e.m.f., its first cost is higher, and it is more fool-proof than the Ironclad Exide pattern. The latter, besides being cheaper, is better for uphill work, probably on account of its low internal resistance. The advocates of two motors claimed the advantage of dispensing with differential gear, but the single motor gave less trouble. When two were installed it was nearly always the rear side motor that got into difficulties. It was urged that with two motors if one gave out it was possible to get home on the other; but, thinks Mr. Priestley, that usually means the ruin of both. The adoption of two motors was probably the result of too slavish a following of tramway practice, for which they were all right, but the conditions were quite different. In the matter of electric vehicles it seemed that everyone began where those before him had begun, not where they left off. The charging current is at present mainly taken from the Corporation supply station, though part is derived from plant driven by steam from the destructor, but the new works to be built will provide all the current required. The lorries run 38 miles daily and with a recharge at noon would do another 30 miles at night. At distances under three miles horse traction is cheaper than electric, while for very long-distance running petrol and steam cars can compete with it successfully.

One of the most interesting vehicles that participated in the Liverpool parade of commercial motor vehicles on September 24th was a 6-ton electromobile lorry employed by Messrs. Tate & Lyle, Ltd., of Liverpool and London, for transporting sugar from the Liverpool docks to the refineries. It has given excellent service during the two years it has been in operation, and is sometimes employed with a trailer. It has the M.V.7 Ironclad Exide batteries, and is recharged at Messrs. Tate & Lyle's Liverpool works. This machine won first prize in the electric class.

Its only competitors were two Ward L-ton lorries, which are engaged on postal services, the owners being Messrs. J. Blake & Co., Ltd., motor haulage contractors, of Liverpool.

Domestic Electricity Supply in Norway.—A leaflet recently published by the E.D.A. (No. 203), gives some figures relating to the cost of electricity in a typical Norwegian "all-electric" house supplied by a hydro-electric works. There is 14 kW of apparatus installed, including a 7-kW cooking range, fires, washing machine, vacuum cleaner, fan, iron, water heater, and lighting. Electricity is supplied through a current limiter at the price of 18 kr. per 100 volt-amperes per annum plus a war advance of 16.66 per cent. With unrestricted use within the limit, this works out at 210 kr. (at the August 1st rate of exchange, £3 15s.) per kW-year (100 per cent. power factor). The installation dealt with is set at, and pays for, 1.3 kVA, an amount of £11 7s. per annum. In winter coke breeze is used for additional heating, but extra heating energy can be supplied at about .9d. per kWh.

Electricity in the Home.—In a housing scheme which includes the building of a number of five-roomed houses to be let at 25s. a week each, in one of the northern towns, it is proposed entirely to eliminate chimneys. The money saved will be spent in installing electrical equipment, consisting of fires, kitchen range, and the like. The kitchen range will be of a type possessing an elevated oven, so that no stooping is necessary, an innovation which every housewife will appreciate. There is already a "chimneyless" colony on the outskirts of Glasgow.—*Daily Mail.*

INSTITUTION NOTES.

Association of Mining Electrical Engineers.—The annual meeting of the Association was held at Newcastle on September 30th, and October 1st. On the first day the officers were formally elected as follows:—President, Mr. A. B. Muirhead (Glasgow); Vice-presidents, Messrs. G. Raw (Usworth, Co. Durham), and W. T. Anderson (Old Trafford, Manchester); Treasurer, Mr. Alexander Anderson (Wishaw, N.B.). Dr. Thornton, the retiring president, announced the award of the first prize for technical papers to Mr. Sidney Burns, of Newcastle, and the second prize to Mr. G. McLellan, a Scottish member. Mr. A. B. Muirhead, the new president, in his address said the Association had made great strides in the twelve years of its existence, and its early work was now bearing good fruit which was seen in the fact that as an association it occupied a position of first importance in the country's basic industry of coal mining. Speaking of the criticism of the mining industry, he said the Miners' Federation during the recent strikes suggested that the reduction of wages was rendered inevitable not because of economic laws, but by inefficient management and failure to make use of plant and machinery for development, but there was nothing at all advanced to justify this view. The Association had no fault to find with legislation for the regulation of electrical matters in the industry of mining, and it was at all times anxious to offer its experience to the industry.

On the evening of September 30th, the annual dinner was held, when Mr. Muirhead presided.

Association of Engineers-in-Charge.—The 1921-22 session opens on October 12th, with an inaugural address by the president, Capt. H. Riall Sankey, C.B., on "Some Recent Advances in Wireless Telegraphy."

Glasgow Corporation Electricity Department Engineering Society.—The Society held its opening meeting of the session in the head office of the Department on October 3rd, when Mr. R. B. Mitchell, engineer and manager of the Department and president of the Society, delivered his presidential address. Mr. G. Morgan, deputy engineer of the Department and chairman of the Society, presiding. Mr. Mitchell dealt with the progress of the Department during the past year and with its future prospects, and reviewed the effect of certain measures on the development of the electricity supply industry. Mr. R. B. MacCall, secretary and treasurer of the Department, and hon. vice-president of the Society, was also present and addressed the meeting.

Edinburgh Electrical Society.—The first meeting of the new session was held on September 30th. Mr. D. S. Munro presiding, and many new members joined. A lecture on "Magnetic Clutches" was given by Mr. W. E. Townsend. The lecturer referred to the small power required to operate such clutches, and gave an account of the difficulties which had to be overcome in perfecting the design. Methods of overcoming the residual magnetism and so quickening the break on clutches were described. Examples of use of the clutches in Admiralty work, for paper mills, cranes, motor cars, &c., were illustrated.

The next paper, on "Electrochemistry," by Mr. R. W. J. Stark, will be read at the Philosophical Institute on October 14th.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Personal.—Mr. D. H. DAVIES, electrical engineer to the Heywood Corporation, and Mr. Thomas Hadfield, an assistant, were severely burned last week while testing a meter at the Heywood electricity works. A short circuit occurred, and the flame caught the two men about the face and neck. Hadfield being also burnt rather badly on the hands. After first aid had been given, the injured men were removed to the Bury Infirmary for treatment. They are progressing satisfactorily.

Mr. GEORGE WILLIAM HOLFORD, whose portrait is reproduced herewith, was born at Manchester in 1871 and educated at Manchester Grammar School. He entered the service of the Salford Corporation 35 years ago, and became general manager of the Corporation Tramways in 1905. He is hon. secretary of the Lancashire and Cheshire Tramway Managers' Association, and has read several papers on electric tramway matters. During part of the war period his services were requisitioned for organisation work at the Ministry of Food. The tramways



MR. G. W. HOLFORD,
Past President, Municipal Tramways Association (Inc.).

under his charge comprise 75 miles of track; the gross capital expenditure exceeds £750,000, of which £450,000 has been redeemed, while £300,000 has been contributed to the relief of the rates and £160,000 set aside for depreciation and renewals. The annual revenue exceeds half a million sterling, and 80 million passengers have been carried in a twelvemonth. The staff numbers about 1,200 persons. At the annual Conference of the Municipal Tramways Association last year he was elected President of the Association for the period 1920-21.

The marriage took place at Chesterfield on September 24th of Lieut.-Col. J. H. ALEXANDER, M.C., D.S.O., resident engineer at Chesterfield, for the British Thomson-Houston Co., Ltd., and Miss Doris Harrison, of Chesterfield.

Three candidates have been chosen for final consideration for the position of borough electrical engineer of Southport. It is understood that before the appointment is definitely made, a deputation of the Southport Electricity Committee will visit the respective towns of these three gentlemen.

Mr. J. S. CHILD has resigned his position as joint sales manager to the Edison Swan Electric Co., Ltd., after 30 years' service. At present communications should be sent to his private address, Wormley House, Wormley, Herts.

Mr. T. P. STRICKLAND, assistant chief electrical engineer to the New South Wales Government Tramways, has been appointed chief electrical engineer to the Melbourne Tramway Board.—*Tenders.*

The Australian Commonwealth Engineer states that Mr. F. B. SHENSTONE was entertained at dinner recently by the officers of the chief electrical engineer for railways and tramways, N.S.W., on the occasion of his retirement from the position of works manager, Randwick workshops, to take up the general management of Parkinson (Aust.), Ltd., who are erecting works near Sydney for the manufacture of electric motors. Our contemporary also states that Mr. G. H. HARLOW, who for the past four years has been managing the Sydney office of the Metropolitan-Vickers Electrical Co., Ltd., left Melbourne on July 27th by the R.M.S. *Osterley* for England. Mr. Harlow intends spending a few months in England, and will then go to Buenos Aires to open new offices for the above firm, from which all business for the West Coast of South America will be transacted.

We read in the same Australian exchange that Mr. REG. GLADWELL, of Bundaberg, Queensland, who left the Brisbane City Electric Light Co., Ltd., nearly three years ago to join the service of the General Electric Co., Schenectady, on a three years' contract, has passed with distinction, and has been appointed, as that company as turbine engineer with the British Thomson-Houston Co., Rugby, where he will study the efficiency of the present methods of ship propulsion, and run tests on turbines installed in some of the modern ships.

Barnstable Town Council has decided to reduce the salary of the electrical engineer from £425 to £382 per annum, and that of the assistant engineer from £250 to £225, as from September 29th.

Mr. J. O. WIGHAM, late general manager of Edmundsons' Electricity Corporation, has left for Russia to assist in the organisation of famine relief. He expects to be away for about six months.

NEW COMPANIES REGISTERED.

Select-o-Phone, Ltd. (176,994).—Private company. Registered September 27th. Capital, £100 in £1 shares. To construct, maintain and deal in telephones and other electrical devices, &c. The subscribers (each with one share) are: G. Briggs, 122, Tooley Street, London Bridge, S.E.1.; J. L. Rogers, 122, Tooley Street, London Bridge, S.E.1.; S. H. Gossamer, 122, Tooley Street, London Bridge, S.E.1.; and J. L. Rogers, 122, Tooley Street, London Bridge, S.E.1. The first directors are not named. Registered office: 122, Tooley Street, S.E.1.

Shorham and District Electric Lighting and Power Co., Ltd. (176,995).—Private company. Registered September 27th. £18,000 in £1 shares. To enter into an agreement between John ver Mehr and to carry on the business indicated by the title. The first directors are: John ver Mehr, 27, St. James's Square, S.W.1, engineer; Stephen Easter, 40, Bankside, S.E.1, gum merchant, each of whom may retain office for three years subject to holding 20 shares. Solicitors: Law, Weller, Messer and Nicholls, 14, Old Jewry Chambers, E.C.

Bordesley Electrical Accessories Co., Ltd. (176,962).—Private company. Registered September 28th. Capital, £5,000 in £1 shares. To acquire the business of an electrical accessories manufacturer, factor and merchant carried on by F. H. Pountney, at 162, High Street, Bordesley, Birmingham, as the "Bordesley Electrical Accessories Co." The subscribers (each with one share) are: F. H. Pountney, 21, Ivor Road, Sparkhill, Birmingham, electrician; W. J. Rigby, 3, Ampton Road, Edgbaston, Birmingham, solicitor. The first directors are: F. H. Pountney (chairman), W. J. Rigby (life governing directors subject to holding £1,000 ordinary shares each), and W. Pountney. Qualification of ordinary directors, 10 ordinary shares. Solicitors: James, Rigby, Son and Brown, 18, Waterloo Street, Birmingham. Registered office: 162, High Street, Bordesley, Birmingham.

L. T. Allen (Ormskirk and Penrith) Co., Ltd. (177,016).—Private company. Registered September 28th. Capital, £1,000 in £1 shares. To take over the business of an electrical and mechanical engineer and general contractor carried on by L. T. Allen at 15, Moor Street, Ormskirk, Lancs., and at Burroughs, Penrith, Cumberland. The permanent directors are: L. T. Allen, Southport Road, Ormskirk, Lancs.; H. Salisbury, Rose Hill Cottages, Prescott Road, Aughton, Lancs.; C. Rider, Mill Brow, Scarisbrick, Lancs. Qualification, £20. Remuneration, £50 per annum divided between them. Secretary: C. Rider. Registered office: 15, Moor Street, Ormskirk, Lancs.

International Electrolytic Plant Co., Ltd. (177,014).—Private company. Registered September 28th. Capital, £11,000 in 10,000 10 per cent. preference shares of £1 each and 20,000 ordinary shares of 1s. each. To acquire the rights and interests of A. E. Knowles in certain patents for inventions relating to electrolytic apparatus for production of oxygen and hydrogen and the production, treatment, storage, application, distribution and use of gases, electricity and other agents. The subscribers (each with one preference share) are: A. E. Knowles, Denecourt, Hestwall, chemical engineer; Mrs. N. J. Knowles, Denecourt, Hestwall. A. E. Knowles is the first director and life chairman. Qualification, £10. Solicitors: Rowlands and Co., 41, Temple Row, Birmingham.

Asbestos Supply and Covering Co., Ltd. (176,851).—Private company. Registered September 19th. Capital, £1,000 in £1 shares. To acquire the premises at Baltic Yard, Hoe Street, Walthamstow, occupied by F. L. Smith, together with the business carried on by him there, and to carry on the business of proprietors and manufacturers of, and dealers in, various compositions where asbestos is used as a basis, manufacturers of asbestos goods, contractors for boiler and steam pipe coverings and other installations, &c. The first directors are: F. L. Smith, 47, Castle Road, Walthamstow; C. A. Cronin, 14, Keogh Road, Stratford, E.15; S. J. Smith, 85, Albert Road, Walthamstow; H. J. Cole, 100, High Street, Walthamstow. Registered office: Baltic Yard, 213a, Hoe Street, Walthamstow.

Baynes Electrical Co., Ltd. (176,835).—Private company. Registered September 17th. Capital, £2,000 in £1 shares. To carry on the business of electricians, mechanical and electrical engineers, &c. The first directors are: J. Kenyon, 2a, Hornsea Road, Grimsby, Manchester; C. Thurler, 302, Horton Road, Rushmore, Manchester; R. Moore, 67, Moss Lane, Swinton. Registered office: 29, York Street, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Crompton & Co., Ltd.—Capital, £500,000 in 340,000 ordinary and 160,000 preference shares of £1 each. Return dated July 28th, 1921. 326,789 ordinary and 139,770 preference shares taken up. £1 per share called upon 250,000 ordinary and 6,010 preference and 7s. 6d. per share on 133,760 preference. £306,790 1s. 8d. paid in cash, including £621 1s. 8d. on 2,240 forfeited shares, leaving £68 1s. 8d. calls unpaid. £160,382 considered as paid, being £1 per share on 76,762 ordinary and 12s. 6d. per share on 133,760 preference. Mortgages and charges outstanding, £137,000.

Cowey Engineering Co., Ltd.—Satisfaction to the extent of £300 on September 12th, 1921, of debentures dated January 8th, 1915, securing £3,000.

Electric Motors (South Wales), Ltd.—Mortgage dated September 1st, 1921, to secure £13,000, charged on certain freehold and leasehold property in Cardiff. Holders: Branksome China Steamship Co., Ltd., Imperial Buildings, and C. W. Jones, Boston Buildings, Cardiff.

Simoon Engineering Co., Ltd.—Second debenture dated September 14th, 1921, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. Dubois, Riverside House, Twickenham.

Aladdin Lamps (Midlands), Ltd.—Debenture dated September 20th, 1921, to secure £10,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. H. Cochrane, Edwood Hall, Durham.

Veritys, Ltd.—Satisfaction in full (a) on August 31st, 1921, of mortgage dated September 2nd, 1918, securing £400, and (b) on September 1st, 1921, of mortgage dated April 28th, 1913, securing £200.

General Electric Co., Ltd. (67,307).—Return dated August 4th, 1921. Capital, £6,000,000 in £1 shares (1,800,000 "A" preference, 1,000,000 "B" preference, and 2,400,000 preference). £1,705,790 "A" preference, 1,622,891 "B" preference, and 2,111,975 ordinary shares taken up. £4,418,830 paid. £1,021,886 considered as paid. Mortgages and charges, £3,500,000.

An instrument of charge on Magnet House, Kingsway, W.C. (held under a lease for 98 years from June 24th, 1913), under Land Transfer Acts of 1875 and 1897, dated September 9th, 1921, has been filed. The charge is ancillary to trust deed dated July 22nd, 1921, securing £3,500,000 7 per cent. mortgage debenture stock. The trustees for the debenture stock holders are the London City & Midland Executor & Trustee Co., Ltd., 5, Threadneedle Street, E.C.

Birkdale District Electric Supply Co., Ltd.—Capital, £50,000 in 25 shares. Return dated June 21st, 1921. 9,300 shares taken up. £46,000 paid. Mortgages and charges, £6,000.

Liverpool Electric Cable Co., Ltd.—Capital, £30,000 in 21 shares. Return dated July 12th, 1921. All shares taken up. £7,833 paid. £22,167 considered as paid. Mortgages and charges, nil.

Electrical Finance & Securities Co., Ltd.—Issue on August 11th of £1,300, and on September 22nd, 1921, of £1,000 debentures, parts of a series already registered.

Fredk. R. Butt & Co., Ltd.—Particulars of £5,000 second debentures, authorised June 15th, 1921. Present issue £4,000, charged on the company's undertaking and property, present and future, including unutilised capital.

Northampton Electric Light & Power Co., Ltd.—Issue on September 23rd, 1921, of £6,181 7 per cent. second debenture stock, part of a series already registered.

CITY NOTES.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Committee under rule 148a:—

Monterey Railway, Light & Power Co.—\$2,996,562 5 per cent. "A" first mortgage debenture stock; \$2,996,562 5 per cent. "B" cumulative income charge debenture stock; and \$2,675,092 "C" sinking fund debenture stock.

County of London Electric Supply Co.—£500,000 7 per cent. redeemable debenture stock, issued at 94 per cent., 40 per cent. paid and fully paid, after issue of allotment letters.

The undermentioned have been ordered to be officially quoted:—

City of London Electric Lighting Co.—94,050 ordinary shares of £1 each, fully paid (Nos. 1,105,951 to 1,200,000), and 300,000 8 per cent. second cumulative preference shares of £1 each, fully paid (Nos. 1,200,001 to 1,500,000).

Marconi's Wireless Telegraph Co.—27,532 ordinary shares of £1 each, fully paid (Nos. 2,885,727 to 2,913,258).

Newcastle-upon-Tyne Electric Supply Co.—£633,109 4½ per cent. consolidated first mortgage debenture stock, and £100,000 5 per cent. second mortgage debenture stock.

Siemens Bros. & Co.—300,000 10 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 300,000).

Belgium.—The demand for energy from the generating stations of the Compagnie Electrique Anversoise, of Antwerp, increased from 12,130,509 kWh in the financial year 1919-20 to 14,225,231 kWh in 1920-21, an advance of over 17 per cent. During the same periods the number of clients advanced from 15,872 and 18,073, and the directors in their report express the hope that with a continued increase in the demand, which they fully anticipate, the concern will soon be again on a dividend paying basis. The balance sheet for the year shows a profit of 2,921,892 fr., 639,933 fr. of which are being devoted to depreciation, 2,250,456 fr. to wiping off the loss recorded in the previous four years, as a result of the war, leaving a sum of 32,199 fr. to be carried forward to the current year. Work is at present in hand on the establishment of a new transformer station near the Gare Centrale, Antwerp, capable of accommodating five 1,000-kW transformers, two of which are nearly ready for operation.

Prospectuses.—*Clyde Valley Electrical Power Co.*—An issue of 50,000 8 per cent. cumulative second preference shares of £10 each (of which 18,700 shares have been applied for firm and will be allotted in full) has been offered this week. The list was to close on or before October 5th. The proceeds will be applied to repay money advanced by the bankers and towards meeting the cost of additional machinery, plant, and buildings, required to meet further large and urgent demands for electricity.

Cuban Telephone Co.—According to the *Financial Times*, this company has been offering in New York \$4,000,000 first lien refunding mortgage 7½ per cent. bonds, due 1941, at the price of 95 and interest.

The daily Press understands that the *Adelaide Electric Supply Co.* is shortly to raise fresh capital in the London market.

Aluminium Corporation, Ltd.—The directors state that the accounts for the year 1920 have not been completed in time for submission to the annual meeting, which is called for Monday next. It is proposed that the meeting be adjourned until the accounts have been completed. The directors are satisfied that the result of the year's trading justifies them in recommending the payment of the preference dividend (7 per cent.) for 1920.

Parsons Marine Steam Turbine Co., Ltd.—The directors recommend a dividend at the rate of 20 per cent. per annum, free of tax, of which an interim dividend of 7½ per cent. for six months to December 31st was paid, leaving to be carried forward £21,422.

Cuba Submarine Telegraph Co., Ltd.—The directors announce an interim dividend for the six months ended June 30th at the rate of 5 per cent. per annum, free of tax, on the ordinary shares.

Monterey Railway Light & Power Co.—According to the *financial Press*, the plan of reorganisation has been sanctioned by the debenture stockholders.

STOCKS AND SHARES.

TUESDAY EVENING

New issues attract more attention than anything else at the present time in the Stock Exchange markets. Notwithstanding the dearth of money caused by depression in trade and the over-weight of taxation, there still seems to be a good deal of capital available for such new stocks as offer well-covered security with a fair rate of interest. People nowadays think, and not unreasonably, that they ought to be able to get 7½ per cent. on sound stock, and when an opportunity for obtaining this presents itself, there is a rush to take advantage of it.

The County of London Electric Co.'s issue of half-a-million pounds' 7 per cent. debenture stock at 94 affords an illustration of the avidity with which good stocks are snapped up. The subscription-list was open less than three hours, but the stock was covered many times over, and, had the lists remained open for a day, the over-subscription would have been very considerably more. This week, the issue of the prospectus of the Clyde Valley Electric Power Co.'s 8 per cent. cumulative second preference shares of £10 each at par has been available. The underwriting was eagerly sought, and in spite of the company being largely a Glasgow undertaking, there was active demand in the South. Fired by the success of the new issue boomlet, it is not difficult to understand that other companies are looking round to see whether they cannot accommodate the public's willingness to lend money at a time when industry is mostly hard-up for cash.

In the list of Home electricity shares, County of London are ½ lower at 9, owing to a few shares coming to market on behalf of those who wished to take up the new debenture stock. South Londons at 2½ have regained the 2s. dividend deducted last week. Otherwise the list is steady, holding its recent improvements. Some of the manufacturing shares are a little better. Edisons hardened to 8s. 9d., and English Electrics to 10s. 6d. On the other hand, Siemens are easier at 11/16 and General Electrics at 18s. 9d. Judged by the way in which industrial companies are showing, in their reports, how greatly they are feeling the effects of trade depression, it can hardly be expected that the electricity manufacturing industry will fare better than the rest, so far as the present period of slackness is concerned.

The cable group is unusually quiet. For choice, as the Stock Exchange says, the tendency is dull, and the market is inclined to lay the blame upon the multitude of fresh comers for popular favour at the present time. It is now easier to buy the stocks and shares of the Eastern group, for instance, at the middle prices than it is to sell them at such figures. Small parcels of shares dribble in, and the demand has become languid. Eastern ordinary is an exception, gaining 2 points at 165½. Marconis revolve around 11/16, but there has been a spurt in Radio Corporation, the ordinary rising to 11s. 6d., the preference to 10s. 3d. It is still said that the buying pressure comes from the United States.

Interest is stirring in Mexican matters again. A good many bonds are changing hands, though so quietly as to excite little attention. Mexican Light & Power preferred have been steadily rising, and are 6 points better at 25. Mexico Tramways second mortgage bonds at 27 have risen 2 during the past few days. The latter carry arrears of interest at 6 per cent. from July, 1914, arrears which come to over £36 per cent., and are cumulative. It might be very optimistic to look for these to be cleared off in cash, but some day the company will have to promulgate a scheme whereby these back dividends can be dealt with, and a purchase at the present time may be reasonably indicated as a good gamble. The cynic will probably say that the holder is not likely to be worried with income-tax forms in respect of the coupons for some time to come, but even this is an advantage to people who are on the look-out for non-interest bearing stock that has a chance of improvement.

Anglo-Argentine Tramways preference shares are marked down to 2½, but actually a line of the company's first 5½ per cent. preference shares has come to market from the Continent, and at a lower price. Those who remember the interest which Belgium took in the flotation of this company may shrewdly guess the place of origin of the present shares now on offer at £3 10s. 3d. per share. These shares carry a 5½ per cent. cumulative dividend, and are in receipt of their full rates, the 2nd preference having received, just lately, part of their back dividends. The interest falls due on the 1st July and the 1st January, so that there is about three months' accrued dividend in the present price. The return on the money comes to practically 11 per cent. allowing for this. The shares are to be recommended only, of course, to speculative investors prepared to take a risk in order to obtain a high rate of dividend on their money.

Lancashire Electric new debenture stock after touching 3 premium, went back to 2 premium. The Shropshire, Worcestershire, and Staffordshire Electric Power 7½ per cent. debenture stock has gone back to its par price of 37, a decline which, in the market, is deemed partially due to the clumsy title of the security. It may be more correct to assume that so many new issues are being made at the present moment that people who have a profit on scrip, are ready enough to take it if they see an opportunity for getting into something fresh that also offers a prospect of a premium. The stag is very busy in these latter times. In the case of one issue which came out within the past ten days, and which was very largely staged, the company received more than 120 applications from one single individual. It would be interesting to know the result of his energy, but the sequel did not reach us.

Metropolitan ordinary stock is ½ higher, on this week's increase in the company's carrying capacity. Underground Incomes are 2 lower at 73½, with revived gossip of a possible new issue. East London ordinary touched 4, to revert to 3½, and the third debenture is easier at 13.

Last Monday witnessed the public launching of the new Rubber Shareholders' Association, and its inception was sufficiently enthusiastic to arouse logical hopes that it may be able to do serviceable work in the way of extending the uses of rubber, and for assisting the distribution of the enormous stocks of raw material piled up in British warehouses. The iron, coal and steel sections, together with the market for amusement shares, remain under a cloud by reason of the difficulties with which the trade struggles, and which are reflected in dividend announcements that compare unfavourably with those of a year ago.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price		
	1919, 1920.	Oct. 4, 1921.	Rise or fall.	Yield.
Brompton Ordinary ..	12 12	68	—	29 8 2
Charing Cross Ordinary ..	7 8	44	—	9 8 4
do. do. 4½ Pref. ..	14 43	34	—	7 4 4
Chelsea ..	4 6	31	—	9 4 8
City of London ..	13 14	13	—	10 0 0
do. do. 6 per cent. Pref. ..	6 6	17 6	—	6 17 2
County of London ..	8 8	9	—	8 17 10
do. do. 6 per cent. Pref. ..	6 6	8	—	7 10 0
Kenington Ordinary ..	7 9	45	—	7 12 2
London Electric ..	24 24	1	—	7 10 0
do. do. 6 per cent. Pref. ..	6 6	24	—	10 9 0
Metropolitan ..	6 7	4	—	8 15 0
do. 4½ per cent. Pref. ..	44 44	2	—	7 12 2
St. James' and Pall Mall ..	12 12	68	—	9 1 4
South London ..	6 7	24 1	—	10 13 2
South Metropolitan Pref. ..	7 7	15 9	—	8 17 10
Westminster Ordinary ..	10 10	52	—	8 10 2

TELEGRAMS AND TELEPHONES.

	Dividend	Price		
	1919, 1920.	Oct. 4, 1921.	Rise or fall.	Yield.
Anglo-Am. Tel. Pref. ..	6 6	47	—	6 18 0
do. do. Def. ..	14 14	171	—	8 14 3
Chile Telephone ..	6 6	51	—	5 14 3
Cuba Sub. Ord. ..	7 7	74	—	9 6 8
Eastern Extension ..	10 10	163	—	8 1 0
Eastern Tel. Ord. ..	10 10	163	+2	8 0 10
Globe Tel. and T. Ord. ..	10 10	163	—	6 3 1
do. do. Pref. ..	6 6	93 1	—	6 9 9
Great Northern Tel. ..	22 22	241	—	9 11 0
Indo-European ..	10 10	30	—	8 6 8
Marconi ..	25 15	1	—	8 17 10
Oriental Telephone Ord. ..	12 12	24	—	6 16 8
United R. Plate Tel. ..	8 8	74	—	6 13 4
West India and Panama ..	Nil Nil	74	—	Nil
Western Telegraph ..	10 10	163	—	6 1 2

HOME RAILWAYS.

	Dividend	Price		
	1919, 1920.	Oct. 4, 1921.	Rise or fall.	Yield.
Central London Ord. Assented ..	4 4	144	—	8 5 0
Metropolitan ..	14 14	231	+ ½	6 2 5
do. Districts ..	Nil Nil	164	—	Nil
Underground Electric Ordinary ..	Nil Nil	9	—	Nil
do. do. "A" ..	Nil Nil	7 9	—	34
do. do. Income ..	4 2	73 ½	—	11 1 8

PROVINCE TRAMWAYS.

	Dividend	Price		
	1919, 1920.	Oct. 4, 1921.	Rise or fall.	Yield.
Anglo-Arg. Trams, First Pref. ..	12 12	24	—	10 9 6
do. do. 2nd Pref. ..	Nil Nil	24	—	10 9 6
do. do. 5½ Deb. ..	5 5	60 1	—	7 17 0
Brazil Traction ..	Nil Nil	28	—	1
British Columbia Elec. Ry. Pte. ..	6 6	69	—	6 18 8
do. do. Preferred ..	6 6	244	—	8 12 2
do. do. Deferred ..	13 13	55	—	7 11 2
do. do. Deb. ..	44 44	60	+1 ½	7 1 8
Mexico Trams 6 per cent. Bonds ..	Nil Nil	50	—	Nil
do. do. 6 per cent. Bonds ..	Nil Nil	9	—	Nil
Mexican Light Common ..	Nil Nil	25	+6	Nil
do. do. Pref. ..	Nil Nil	25	+6	Nil
do. 1st Bonds ..	Nil 5	60 ½	+2	2 7 0

MANUFACTURING COMPANIES.

	Dividend	Price		
	1919, 1920.	Oct. 4, 1921.	Rise or fall.	Yield.
Babcock & Wilcox ..	16 16	20	—	8 11 2
British Aluminium Ord. ..	10 10	116 1	—	10 10 0
British Insulated Ord. ..	16 16	171	—	10 10 0
Callenders ..	16 16	171	—	10 10 0
do. do. Pref. ..	6 6	171	—	6 18 8
Crompton Ord. ..	10 10	116	—	13 15 0
Edison-Swan ..	10 10	116	—	13 15 0
do. do. 6 per cent. Deb. ..	6 6	68	—	7 7 1
Electric Construction ..	10 10	189	—	11 18 10
English Electric ..	6 6	106 6	+4 1	11 18 10
do. do. Pref. ..	6 6	106 6	+4 1	7 4 6
Gen. Elec. Pref. ..	6 6	106 6	+4 1	10 18 4
do. do. Ord. ..	10 10	189	—	10 18 4
Howley ..	16 16	171	—	10 10 0
do. 4½ Pref. ..	44 44	171	—	6 18 8
India-Rubber ..	10 10	116	—	8 10 8
Met. Vickers Pref. ..	8 8	14	—	8 10 8
Southern Ord. ..	10 10	116	—	8 10 8
Telegraph Con. ..	20 20	214	—	6 11 9

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, October 5th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ..	per lb. 74d.	..
a Ammoniac Sal ..	per ton 285	..
a Ammonia, Murate (large crystal) ..	258	..
a Bauxite of Carbon ..	..	..
a Borax ..	231	..
a Copper Sulphate ..	231	..
a Potash, Chlorate ..	per lb. 6d.	..
a Potash, Chlorate ..	..	..
a Shellac ..	per cwt. £15 10s.	..
a Sulphur, Sublimed Flowers ..	£16	..
a Soda, Chlorate ..	per lb. 21s.	..
a Soda, Chlorate ..	per ton 34d.	..
a Soda, Crystals ..	27	..
a Sodium Bichromate, cakes ..	per lb. 74d.	..
METALS, &c.		
a Babbitt's Metal Ingots ..	per ton £80 to £87 5	..
a Brass (rolled metal 12" basis) ..	per lb. 16d.	..
c " Tubes (solid drawn) ..	..	10s to 10½
c " Wire, basic ..	..	11d.
c Copper Tubes (solid drawn) ..	..	12½
c " Bars (best selected) ..	per ton £103	..
c " Sheet ..	..	£103
c " Rod ..	..	£103
d " (Electrolytic) Bars ..	..	£75 10s.
d " " Sheets ..	..	£145 10s.
d " " Wire Rods ..	..	£91 10s.
d " " H.C. Wire ..	per lb. 11d.	..
f Ebonite Rod ..	..	8/6
f " Sheet ..	..	8/6
g German Silver Wire ..	..	2/9
h Gutta-percha, fine ..	..	12/6
h India-rubber, Para fine ..	..	10½
i Iron Pig (Cleveland Warrants) ..	per ton Nom.	..
i " Wire, galv. No. 8, P.O. qual. ..	..	£24 3s.
l Lead, English Pig ..	..	£24 3s.
l Mercury ..	per bot. £9 10 to £9 12 6	5s. inc.
c Mica (in original cases) small ..	per lb. 3d. to 3/6	..
c " " medium ..	..	4/ to 8/
c " " large ..	..	10/ to 20/ & up
p Phosphor Bronze, plain castings ..	..	1/4 to 1/9
p " " rolled bars and rods ..	..	2/1 to 2/6
p " " rolled strip & sheet ..	..	2/2 to 2/7
d Silicon Bronze Wire ..	per lb. 16s.	4d. dec.
r Steel, Magnet, in bars ..	..	1/6
r Tin, Block (English) ..	per ton £155	..
r Wire, Nos. 1 to 16 ..	per lb. 3/6	..
p White Anti-friction Metals ..	per ton £55 to £275	..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Tilt & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	j Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	k P. Ormiston & Sons.
	l W. F. Dennis & Co.

Rearing Chickens Electrically.—Where facilities are available for obtaining cheap electricity in small country towns, villages, and on farms, it should not be difficult to attract the attention of poultry keepers to the advantages of using electricity for producing the necessary heat for artificially hatching and rearing chickens. With reference to the note on the subject that appeared in our issue of September 2nd, we are informed that the system was introduced a few years ago in the North of Scotland with, it is said, great success, by Messrs. M. K. Cooper & Co., now of Liverpool, but that owing to the war Mr. Cooper was reluctantly compelled to abandon further contemplated activities in this direction. It may, however, be of interest to give some details of tests that were carried out in the spring of 1915 by the Poultry Department of the North of Scotland College of Agriculture, in order to prove the efficiency of this method of raising chickens. The results are stated to have been most successful, and should be of interest to poultry keepers generally. The apparatus used was supplied by Mr. Cooper, and consisted of a "Lo-Lo" incubator and a hover or "mother"; the former had a capacity of 50 eggs, and was fitted with a temperature regulating device and four electric heating lamps each of 32 c.p. The hover was also heated by two lamps of similar c.p., and both pieces of apparatus were constructed of galvanised metal throughout, were simply made, and easy to manage. In one test 31 chickens were hatched out of 40 fertile eggs, and in the other 36 out of 39 eggs. These results are equivalent to 77 and 92 per cent. respectively of chickens hatched from fertile eggs—a comparatively high percentage for artificially hatched chicks. The effectiveness of the hover or rearing is evident from the fact that 65 chicks were reared out of a total hatch of 67, and the quantity of electricity consumed in the hatching and rearing each lot of chicks was 41 k.w.h. The chief advantages of electricity in this connection are the even distribution of heat that is obtainable, which prevents the over-crowding of the young chicks, and the clean fresh atmosphere which is so difficult to get when employing any other methods of heating.

THE MUNICIPAL TRAMWAYS ASSOCIATION (INC.).—I.

THE ANNUAL CONFERENCE AT SALFORD.

The annual Conference of the Municipal Tramways Association was held at the Technical Institute, Peel Park, Salford, on Wednesday and Thursday, September 28th and 29th.

On Wednesday morning the delegates were welcomed by the Mayor of Salford (Ald. F. Hampson, J.P.), who, in his opening remarks, referred to the increased influence which the Association was exercising on behalf of tramway undertakings throughout the country. He trusted that its sphere of usefulness would be still further enlarged as time went on. He also referred to the work of the Association in connection with the settling of labour disputes, and hoped that as its work in this connection became better known and understood, disputes of all kinds would be less frequent and easier of settlement. The tramway industry of this country, to his mind, was destined to be a vital link in the transport system, and he was glad to learn that the Association was working in co-operation with the Ministry of Transport in the interests of efficiency and the well-being of the industry. He regretted that the members or the Association had not with them the late Ald. H. Linsley, D.L., J.P. (late chairman of the Salford Corporation Tramways Committee, and a member of the Executive Council of the Association), who passed away in August last. Finally, he expressed the hope that the visit of the members to Salford would be a happy one, and that the Association would derive material benefit from the Conference.

The President, Mr. G. W. Holford, general manager of the Salford Corporation Tramways, briefly thanked His Worship for the hearty welcome extended to the members of the Association. He then took the chair, and delivered his Presidential Address, of which an abstract follows.

A vote of thanks having been accorded to the President, the secretary (Mr. J. Beckett) read the paper by Mr. J. M. McElroy (general manager, Manchester City Tramways) on "Some Phases of Tramway Development in the Past, and the Outlook." Mr. McElroy was unable to attend the Conference through illness. In reading the paper, the secretary, dealing with the adoption of the decimal coinage system, mentioned by the author, said that Mr. McElroy did not refer to the proposal considered by the Royal Commission, and turned down by it, but rather to the proposal to decimalise the shilling, thus increasing the value of the penny by 20 per cent. That was a proposition which had been submitted by Mr. H. Allcock, of Messrs. W. T. Glover & Co., Ltd., and he had seen nothing anywhere to withstand the weight of the arguments in its favour.

At the end of the morning session a telegram was sent to Mr. McElroy expressing appreciation of his paper, and conveying the heartiest good wishes of the Conference.

The members and visitors were then invited to luncheon at the Town Hall, Pendleton, by the chairman and members of the Salford Corporation Tramways Committee.

In the afternoon the discussion on Mr. McElroy's paper was resumed. At its conclusion, a hearty vote of thanks to Mr. McElroy was carried by acclamation.

Mr. J. B. Hamilton, C.B.E. (general manager, Leeds), then read his paper on "The Operation of Tramway and 'Bus Undertakings under Statutory Powers, in Relation to the Roads Act, 1920."

At the conclusion of the reading of the paper, Mr. Hamilton proposed the following resolution, which indicated the form which the Executive Council thought the remedy for the difficulties dealt with in the paper ought to take:—

"That in the opinion of this Association the competition of motor vehicles with tramways upon inequitable terms relating to (1) local taxation; (2) road maintenance charges; (3) statutory fares for ordinary passengers and workmen; and (4)

regularity of service, will result in further increases in tramway costs and consequently in fares, and that, therefore, representations be made to the Ministry of Transport urging the statutory regulation of such competition in the public interest."

Mr. T. B. Goodyer (general manager, Croydon) seconded, and a discussion followed, which is reported below.

In the evening a conversazione was held at the Salford Town Hall, the members being received by the Mayor, the Mayoress, and Miss Hampson. An admirable musical programme was provided, and the recitations of Miss Hampson were much enjoyed.

The whole of Thursday morning, September 29th, was devoted to the discussion on Mr. Hamilton's paper, and a revised resolution which he put forward as the result of further consideration by the Council. The resolution was carried unanimously, and it was further resolved that copies of it be sent to the Prime Minister, the Minister of Transport, and every municipal corporation which owned and operated tramways.

The Conference then adjourned, and the members proceeded to the Town Hall, Manchester, where they were entertained at luncheon by the chairman and members of the Manchester City Tramways Committee. The Lord Mayor of Manchester and the Mayor of Salford were both present.

In the afternoon Mr. W. Chamberlain (general manager, Oldham) read his paper on "Permanent Way—Public Road—Maintenance." Owing to the shortness of time, the paper was not discussed, but it was agreed that those wishing to discuss it later should send their remarks in writing to the secretary, who would forward them to Mr. Chamberlain for his reply. The whole would then be published.

The business of the annual general meeting was then proceeded with. The report of the Executive Council was unanimously approved.

After discussing questions relating to the operation of tramways on Christmas Day, the adjustment of wages on the sliding scale, and holidays with pay, it was proposed: "That in view of the fact that members of the Executive Council are elected by the representatives of the Municipal Tramway undertakings and act for them as a whole, and not for the individual undertakings to which they happen to belong, it be resolved: That the expenses of the said members incurred in attending the meetings of the Council, or in connection with any other business of the Council, be charged on the funds of the Association." This was defeated.

The following officers were elected for the ensuing year:—

President: Ald. R. Mayne, J.P. (Deputy Lord Mayor of Newcastle-on-Tyne and chairman of Newcastle Tramways Committee).

Vice-President: Coun. J. Timpson, J.P. (Mayor of Portsmouth).

Hon Treasurer: Mr. A. R. Fearnley (general manager, Sheffield) was reappointed.

Hon. Solicitors: Mr. S. F. James (town clerk, Ilkington) and Mr. P. M. Heath (deputy town clerk, Manchester) were reappointed.

Auditor: Mr. J. W. Blakeborough was reappointed.

Ald. H. Clark (Mayor of Rochdale) was unanimously elected a member of Council, to fill the vacancy caused by the election of Coun. Timpson as Vice-president.

Mr. A. L. C. Fell (general manager, London County Council), Mr. J. B. Hamilton, C.B.E. (general manager, Leeds), and Mr. R. L. Horsfield (general manager, Cardiff) were re-elected members of the Executive Council.

At the conclusion of the proceedings, votes of thanks were passed to the retiring President and to the Executive Council. The Conference also recorded its indebtedness to the representatives of the Association on the National Council, for the ability and patience which they had brought to bear on the subjects that occupied

their judgment during the year, and expressed its general satisfaction with the results of the second year's working of that Council. A vote of thanks was also accorded the Salford Corporation for the arrangements made for the conference.

In the evening the annual dinner was held. The principal guest was Mr. Arthur Neal, M.P., Parliamentary Secretary to the Ministry of Transport. Mr. G. H. Roberts, M.P., was also present.

On Friday a large party set off for an excursion by road to Chester in charabancs provided by the South Lancashire Tramways Co. At Chester the members were entertained on the river by the Mayor, the Sheriff, and the chairman of the Tramways Committee.

Presidential Address.

By G. W. HOLLORD (General Manager of Tramways, Salford).
(Abstract.)

After expressing the loss they all felt by the passing of "one of the most lovable men in the public life of Lancashire," the late Alderman Linsley, for many years chairman of the Salford Tramways Committee, and welcoming the Association on its third visit to Salford, the president said the third year since the armistice found the industry in common with every other industry—struggling against the backwash of the war. The results of operating tramways in 1920-21 had been adversely affected by the general depression in trade; in spite of the fact that they received a revenue of £27,101,301 last year (which was an increase of £4,044,356 over the preceding year) only five undertakings succeeded in paying their way after meeting the commercial obligation to provide adequately for renewals. Moreover—as was shown at the recent Court of Inquiry—the increased fares had placed a system of passenger transport, which depended for its prosperity upon cheapness and the measure in which it provided for the needs of all sections of the community, almost beyond the reach of the poorer section of the public.

Further, they were menaced in increasing measure by other forms of road transport, which enjoyed complete immunity from the exacting conditions of many kinds imposed upon themselves.

The railway companies now proposed to come on the public roads in unmeasured weight and quantity, and that Conference would serve a great public purpose if it aroused throughout the country the cry that municipal tramways were in jeopardy by wasteful competition.

They had emerged from the biggest inquiry into the financial conditions of tramways ever made in this country with an admission that they could not bear any further financial burdens and survive.

The Press of the country was constantly insisting upon the co-operation of the employés with the employers to secure and maintain industrial peace. The National Council was, for them, the main instrument for that purpose, and that industry was greatly indebted to those who had so efficiently served it, at great personal sacrifice, on that body during the past year. Such a Council was fast becoming a recognised need in every industry, in order to hold the balance with an even hand, and to keep in check the natural tendency to utilise the moment of favourable conditions, to secure an unfair advantage for either one side or the other.

It would be the duty of the Conference to consider one of the foremost questions which would again, no doubt, meet them early in the New Year, namely, the employés' wages, for wages constituted the biggest item in their ordinary expenditure.

The tramway industry was not a primary industry in the commercial sense. As it obviously followed, and did not precede, industry in general, it could not be expected to yield, as the recompense of labour, higher wages than were paid in the industries it served. There could not be, permanently, any section of a municipal service in which comparable labour could occupy a privileged position. The total maximum war bonus to tramway employés had been 40s. over pre-war rates, in addition to a maximum of 3s. per week added to the basic rates.

The process of adjusting the bonus, definitely, to the changes in the actual cost of living had begun, and it was reduced by 3s. per week in August. Beginning with 135 per cent. as the basis, the reduction or advance followed the rate of 1s. for every five points variation. The rate of increase—basing 40s. upon 135 per cent.—represented, however, 17.77d. for each five points. Assuming that the scheme remained in operation until the pre-war cost of living was reached, then 13s. out of the 40s. would be the balance of unreduced bonus to add to the basic rate.

There was common agreement that post-war wages would not be allowed to fall to the level of pre-war wages, but whether 13s. plus 3s.—a total of 16s.—could be added in the tramway industry to £1 12s. 8d. and £1 9s. 4d. (the pre-war general average wages of motormen and conductors respectively) was a question that probably no man could determine at present.

The question now before the National Council was a general scheme of wages standardisation, which was being investigated by a special committee.

The relation of tramways to other forms of passenger road transport was exercising the minds of the tramway world. The cost of permanent-way renewal or reconstruction stressed the problem. The alternative method of trolley 'buses upon routes where traffic was not heavy was now being seriously considered.

These 'buses paid an excise licence upon their seating capacity, and the operators escaped any obligations for the cost of road maintenance and renewal. They also escaped rating, so far as the roads—the common permanent-way—were concerned. There were factors, however, which must be kept in mind. The maintenance of roads would still be necessary; if the obligation no longer fell upon the travelling public in the shape of fares charged for rides, it would reach them through the channels of rates and taxes to the extent that such cost was not covered—as it did not pretend to be—by the excise licence. This in turn raised the question of the payment of the whole of the cost of maintenance of roads by all the users of the roads, and if that principle were once again laid down, the excise licence would have to be raised to an amount sufficient to cover such cost.

Similarly, other rateable property would bear the local rates now thrown upon tramways. These charges would not cease to exist upon somebody. Clearly they would be merely transferred—not abolished.

Lord Montagu had recently made an attack on tramways in *The Times*; he apparently did not realise that municipal tramway undertakings were essentially public utility services; that they were there to meet the requirements of vast populations of working people who had to be carried to and from their places of employment, and that without such transport facilities these people would suffer great hardship. Nor did he seem to realise that they had been the means of encouraging a large percentage of the population to leave the congested portions of towns and cities, in order to reside in the suburbs, where the environment was of a much more healthy and pleasant character. Tramways were, in fact, necessary for our modern industrial conditions.

During the last parliamentary session no fewer than 36 Local Acts were obtained relating to tramways—a number probably without precedent in the history of the industry.

The Association included within its membership practically the whole of the municipally owned and operated tramway undertakings. There were 102 such undertakings in the country, representing a capital of £57,993,898. During the past year they carried over 3,632 million passengers, and the track operated upon measured 1,705 miles.

The Operation of Tramways and 'Bus Undertakings under Statutory Powers as Affected by the Roads Act, 1920.

By J. B. HAMILTON (General Manager, Leeds City Tramways).
(Abstract.)

Each tramway must maintain the part of the roadway on which it is placed and for 18 in. outside, and although the surface is subject to the wear of all vehicles no financial assistance is granted by the Roads Board Section of the Ministry of Transport. It also pays rates on all its street works in addition to depots, offices, and power stations, and I have made a careful examination and estimate of the annual amount which a tramway provides in the relief of public burdens, with the following result, so far as Leeds is concerned:—

1. Rating assessment on lines only £40,211 at 16s. in the £	£32,169
Average amount paid per car per annum	£124
2. Annual cost of paying repairs and renewals, £33,708	
Annual charge per car	168
Total	£292

In many towns the fact is frequently overlooked that the tramway undertaking is usually the largest taxpayer, besides maintaining road surfaces and often paying a considerable proportion of widenings and improvements. These figures, which are comparable with the £70 or £80 paid annually by a motor 'bus, show that apart from its other burden a tramcar contributes four times as much to the public purse as any other form of traction.

Previous to the war there was considerable development of self-propelled internal combustion vehicles utilising petrol or benzol as the propelling force. Powers were granted to public authorities in many cases to utilise these vehicles for traffic in less populated districts, but in all cases during the last eight or nine years a charge for road adaptation and for maintenance of the highways thereafter was imposed.

Until 1916 the curious anomaly was continued under which privately-owned vehicles of identically the same type and road-wearing effect as municipally owned ones, could be run without any corresponding road charges being made whatever. In that year, however, powers were granted to road authorities under the Local Government Board Emergency Road Legislation Act to enforce a road maintenance charge as a condition of operation.

This Act continued in force until the official termination of the war on August 31st last, and gave considerable protection to municipal operators of tramways, as in many cases they are the road authorities in their area and could refuse sanction to ply for hire over their highways. With the death of the Act and the birth of the Roads Act, 1920, a new set of conditions and a great danger to the successful continuance of tramway operation have arisen. An eminent parliamentary agent says:—

"By Section 7 (4) of the Roads Act the Minister of Transport is empowered on the application of a road authority, after holding a public inquiry, to prohibit or restrict the driving of vehicles of any specified class on any specified highway within the area of the council in any case in which it appears to him as the result of the inquiry to be proved 'that a vehicle of that class cannot be used on that highway without endangering the safety of the vehicles or the persons therein or of other traffic using the highway or that the highway is unsuitable for use by a vehicle of that class.'

"This clearly limits the powers of refusal to the three points referred to therein.

"The war having officially terminated on August 31st, 1921, the position now is that Section 37 of the Town Police Clauses Act, 1847 (which has never ceased to be in force) will continue in operation subject to the provisions as to appeal contained in Section 14 of the Roads Act, 1920.

"The effect of this will be that whenever application is made for a licence for an omnibus to ply for hire the application will have to be considered judicially, and that unless there are valid reasons for refusing it the application must be granted without payment of any fee, there being a right of appeal to the Minister of Transport against an unreasonable or improper refusal or against unreasonable conditions attached to the grant of the licence. . . . It is practically certain that a licensing authority would not be considered to be justified in refusing a licence merely on the ground that the running of the proposed vehicles would set up competition with a service of tramways or omnibuses of the authority. . . .

"Section 7 (4) of the Roads Act, 1920, provides machinery by which a County Council or the Council of a county borough may secure the prevention of the use by vehicles of a specified class of specified highways, but the grounds on which such action can be taken are expressly limited, and do not, in our opinion, permit of the taking into consideration of the question of competition with a transport authority of the Council."

The effect of all this seems to be that an owner of a vehicle who has paid the Inland Revenue tax required for carrying passengers cannot be refused on application for right to ply for hire in an area, except upon the three grounds I have referred to.

Neither of these provides any remedy to a local authority or a private company operating under statutory powers tramways, light railways, railless or motor-bus services on any road on the ground that the service is unnecessary and wasteful in the public interest and injurious to the statutory undertakers.

It is surely a gross misuse of public duties which permits of competition being set up in passenger services by any casual person who may be the owner of a mechanically-propelled vehicle. No examination as to its suitability for this class of work may have taken place, and yet he may run it at any time without obligation with regard to fares or services.

In Sub-clause (3) Clause 14 of the Roads Act, 1920, it is provided that "Where, upon application for a licence to ply for hire with an omnibus, the licensing authority either refuses to grant a licence or grants a licence subject to conditions, in either case the applicant shall have a right of appeal to the Minister of Transport from the decision of the licensing authority and the Minister shall have power to make such order thereon as he thinks fit, and such order shall be binding upon the licensing authority."

"An order made by the Minister under this sub-section shall be final, and not subject to appeal to any court, and shall, on the application of the Minister, be enforceable by writ of mandamus."

On the one hand there is an application to Parliament, a long and careful examination of the necessity for the service, a thorough examination of the physical condition of the roadway, the examination of the details of construction of permanent way and rolling stock, the establishment of a concern which undoubtedly costs large sums of money, the building-up of a permanent service of a more or less remunerative character, the obtaining of the confidence of the public that such a service will be continued, the obligation to provide special services to labouring classes at low fares, and the imposition of a maximum fare for other passengers and goods and parcels, and so on; and on the other hand, an application from a practically unknown person or company in the sense that they have not had to provide any public *bona fides*, the absence entirely of any obligation with regard to fares to be charged or to continuation of services, and the initiation of competitive services, which whilst they may be quite unremunerative to the new-comer, may so impinge upon the revenues of the established undertaking that they are unable to carry on with a low rate of fares.

In recent promotions where local authorities have asked for powers to run omnibuses over routes beyond their boundaries, if there has at any previous date been a service, however slight, by private enterprise, petitions have been lodged

and the case fought before the Parliamentary Committee. The first comer has claimed a right to the monopoly of motor-bus services, and in quite a number of instances has succeeded in inducing committees not to grant natural extension of omnibus services by tramway operators from suitable traffic points.

In statutory undertakings the obligations as to fares and services imposed by Parliament entirely eliminate the possibility of a monopoly of street passenger transport in any form becoming injurious to the travelling public.

Consider the effects of superimposing additional services and competition upon any road which, having regard to the fluctuations of traffic, may be considered as already adequately served. It means that in cases where capital expenditure has had to be met a modified service must be ultimately come to.

If, as would be probable, the competitors would limit their efforts to the period of maximum demand, then it inevitably follows that the ordinary services would be curtailed and the interest and redemption fund upon the original outlay would increase per mile as the mileage decreased.

To meet this service of debt the public would require to be charged higher fares, and this action and reaction might go on until it was impossible for a statutory undertaking to continue to operate on a self-supporting basis.

Suppose, then, it were withdrawn, what now remains?

The service formed in consequence of the Roads Act, 1920, without any liabilities beyond the payment of a licence duty and Inland Revenue tax for road maintenance, without any obligation with regard to fares or services either special or ordinary, and with no rating assessment beyond that imposed upon depots and offices.

I say that Parliament has undoubtedly, in considering the claims for the establishment of services and in granting these, intended that monopolies of transport on the highways under consideration should be formed. A parallel for this view can be found in other public utilities, such as electricity, water, and gas undertakings. In all of these, monopolies have been set up by the clear and expressed wish of Parliament, and no overlapping or competition is permitted with them in the slightest degree.

It seems evident, therefore, that action must be taken by Parliament to prevent the menace of uneconomical competition and great waste of public expenditure which is possible to occur now under the powers set up by the Roads Act, 1920.

In quite a number of towns in the country already services have been set up over tramway routes, and also, in many cases, over railless and omnibus routes which have long been established and are working in virtue of statutory powers.

The present peril is not directed against tramways *per se*, but against municipal utilities and private companies which operate under statutory powers tramways or bus services on routes which they have established very often at great cost.

It is, therefore, of the utmost moment that the members of this Association, who are responsible for the carrying-on of these great undertakings, upon the maintenance of which much of the comfort and prosperity of the country depends, should make their undoubted power in Parliament felt so as more clearly to define their rights and privileges obtained after full examination by Committees of both Houses of Parliament and by Parliament itself.

DISCUSSION.

Ald. C. HIGHAM (Blackburn), in supporting the resolution, which was put forward by Mr. Hamilton (see p. 481), dealt at some length with the position of the municipally-owned tramway undertaking at the present time. The present chaotic competition was a very great danger indeed, to small undertakings especially. They just existed by being able to take advantage of the rush hours, so to speak. Throughout certain hours of certain days of the week the tramways were running at a loss. During some of the hours in which they might be able to make the tramways pay their way to make up for the loss, the duty of giving special facilities for workmen was imposed upon them, and they could not distinguish between workmen and other classes of passengers. When, however, as in the case of a football or cricket match, there were plenty of people prepared to fill the cars, along came somebody else with charabancs and picked up the passengers. These omnibuses varied their charges in accordance with circumstances. Another point to consider was that these buses were running on roads not made for the purpose, in many instances, and in consequence, considerable damage was done to water and gas mains. The resolution should be emphatically supported, not only in the interests of tramway undertakings of the country, but in the interests of public safety and convenience. Surely it was not a great thing to ask that anyone plying for hire should be subject to the same limitations as the tramway undertakings, or that the latter should be given the same opportunities for making their undertakings pay as were given to anyone who could afford to buy a charabanc and pay about £70 for a licence to run it.

COUN. R. L. BERRY (Abbeville) said that some time ago application had been made to his Council by people living some distance outside the area for power to travel over the roads of the district. This the Council refused, but when the applicants appealed to the Ministry of Transport, the Ministry advised the Council to draft the licence subject to the licensees' not taking up passengers on the roads served by the Council's tramways. That was a concession towards the object of the resolution, and showed what might be done.

Mr. E. S. RAYSON (general manager, Hull) said that Parliament had granted enormous sums of public money, and it was only reasonable to expect that Parliament should give the people the benefit of these sums by granting legitimate protection after the manner of the Municipal Authorities had to prove to Parliament the necessity of a service before they were granted a licence, but in increase was a man who proposed to run omnibuses asked whether an adequate service already existed along the particular route for which he was applying for power. This unfair competition was going to force them either to run a reasonably cheap service and throw the loss on the rates, or else to run such an expensive service that it would be of no use to the workmen. Furthermore, the people who had the powers to compete with them could not substitute the service which the tramways would have to withhold.

Mr. H. P. STOKES (general manager, Plymouth) asked whether it was proposed to work in unison with the Tramways and Light Railways Association, because the present peril affected both municipalities and statutory companies.

Mr. W. C. FENON (Sheffield) referred to the clause in the Roads Act which gave power of appeal by people who had been refused licences, or obtained them with certain conditions, to the Ministry of Transport, which he thought was a most unjust arrangement. If justice was to be done to municipal tramways, that was one of the clauses which should be repealed, because the local authorities knew best whether competition should be instituted in the district or not.

On Thursday, September 29th, the Conference resumed the discussion on Mr. Hamilton's paper.

Mr. HAMILTON, dealing with the resolution which had been put to the meeting, said that the Executive Council felt that it was a little too narrow. It based their case upon unfair competition alone. He had written his paper under the guidance of their legal adviser, whose view was that the Roads Act, in its operation, if carried out literally, was contrary to the intention of Parliament. He himself thought they should bring forward a resolution embracing that, and therefore he would propose a resolution which would place their position on broader lines than the one submitted on the previous day. It was not a question for the municipal tramways only, but for the whole of the travelling public. Therefore, they would like to take up the position, first, that the operation of the Act was contrary to the spirit of Parliament, and secondly, that it would be wasteful and most unfair to the public forms of transport they had to carry on. They had seen in the Press that morning a statement, which he hoped those wishing to speak would absolutely nail to the table, as being improper and absolutely incorrect, to the effect that tramways had passed away. He would say that the tramway for urban services, and for density of population, was unequalled, and would be unequalled for many years to come. The resolution was as follows: "That in the opinion of this Association, representing the whole of the municipal tramways of Great Britain, the Roads Act of 1920 encourages wasteful and overlapping competition with statutory undertakings, which will inevitably result in increased travelling charges to the public, and is contrary to the intentions of Parliament, and that, therefore, representation be made at once to the Minister of Transport urging the statutory regulation of such competition in the public interest."

Mr. A. L. C. FELL (general manager, London County Council Tramways) seconded the resolution.

COUN. E. LEE (St. Annes-on-Sea) supported the resolution. His Council had spent a large sum of money on taking over the undertaking of a private company to run its cars from Blackpool to Lytham, and now no fewer than 500 charabanc journeys a week were being made between these two places, mostly in competition with the tramways. Free competition was good for everybody, but it must be fair competition. These charabancs were not run at regular intervals, and sometimes the charges were varied. His Council had had a similar application made to it as had the Aberdeen Council, some three months ago. It approached the Ministry of Transport, who sent down an inspector to make inquiries. Despite the fact that the Council had pointed out that the tramways covered the requirements of the public, and that the Council had powers in the Bill to run motor omnibuses at any time it was considered the public convenience demanded it, the inspector went away giving them the impression that the Minister would grant power to the outside company.

Mr. J. C. F. BELLAMY (general manager, St. Helens) referred to Mr. Hamilton's reference to public authorities being granted powers to run motor vehicles, where he said that in all cases during the last eight or nine years a charge for road adaptation and maintenance thereafter was imposed. In the last session of Parliament Mr. Hamilton had made a terrific effort for all of them to get this question of adaptation put right. He had claimed that Parliament had never intended that motor buses, company or municipal, should pay anything more than the Excess licence. The St. Helens Corporation had had inserted in its Bill a clause which provided that it must pay for the adaptation of the roads over which it intended to run buses. The result was that it had powers to run its buses, but the Lancashire County Council or the Ministry of Transport telling it how much it must pay towards the adaptation of the roads. That was very improper. If the Corporation had to pay a large sum to the Lancashire County Council for remaking the roads, it was an

invitation to the County Council to remake the road and get as much as it could out of the omnibus undertaking. Not only that, but it was making better roads for competitors. The St. Helens Corporation had sought powers to run motor buses over its own tramways outside the borough boundary, if necessary, where the Tramways Committee was, in fact, the highway authority, but the powers were not granted.

Mr. C. CLARKE (general manager, Birkenhead) mentioned his experience with motor bus undertakings. In 1914 his Corporation had obtained Parliamentary powers to run motor omnibuses to a village about 2½ miles beyond the tramway terminus. That meant running outside the borough into the county area. Later, a company commenced operations, and applied to the county for permission to run over a portion of the borough route up to the borough boundary, which was granted. The company then applied for permission to run over a further portion of the bus route, to the tramway terminus, but the Corporation refused licences. That was twelve months ago. The company appealed to the Ministry of Transport, but before the Ministry's decision was given, the company commenced running to the terminus. The Corporation told the Ministry that the company had run its vehicles into the borough illegally before the Ministry's decision was given, and the Corporation refused to have any further dealings with it, but had not heard anything further.

ALD. E. H. SELLERS (Huddersfield) mentioned how Huddersfield had dealt with a similar case to that mentioned. In this case the competitor was told that if he did not go away and leave the Corporation to its rights, the Corporation would put a service on the road and run him off, and that if he would not be run off the road by fair means, the Corporation would institute a penny fare. This frightened the man, with the result that he had left this particular route to the Corporation.

ALD. R. MAYNE (Newcastle-on-Tyne) also dealt with the handicap of a statutory undertaking as compared with a private undertaking, especially with regard to regular services. If the public could only realise that they might be left to a haphazard method of carrying them, rather than to a well-regulated method, he thought public influence would be brought to bear upon Parliament.

COUN. A. DIGBY WILLUGHBY (Hull) said he considered that during the course of the next two years the tramway undertakings would recover. Very few tramway undertakings were capable of dealing with large crowds alone, and to his mind, in his own city, it was a very good thing that they could have charabancs to move the passengers.

Mr. W. T. YOUNG (general manager, Dundee) said that his Corporation had applied last year for a Provisional Order to enable it to run buses outside the city area. During the time when the Provisional Order was deposited and obtained, a competitive syndicate began to run buses over every one of the routes stipulated in the Order, with the result that when the matter was before the Parliamentary Committee, the syndicate appeared as objectors on account of the fact that services were already in operation. He had come to the opinion that under the Model Clauses Act no Corporation in Scotland would be permitted to run outside its borough boundary, and he proposed that after the words "statutory regulation" in the resolution, the words "of motor vehicle traffic by competitive corporations and companies either inside or outside the city areas" should be added.

Mr. W. MURRAY (general manager, Walthamstow) mentioned a case in which a municipal tramway undertaking was competing with an omnibus undertaking, and in which the municipal undertaking had felt compelled to raise its fares, and establish a minimum. The buses elsewhere had also been in the same position, and had found it necessary to establish a 1½d. minimum fare. In this particular locality where it was competing with the tramways, however, the company did not raise its fares, and when it was approached in this connection it stated that it could not see its way to raising the minimum fare. Referring to the great amount of influence which these omnibus companies possessed, Mr. Murray said he knew of one authority which went to the Ministry of Transport for powers to run railless trolley buses to a new housing scheme, but was told that there was no need, the advice of the Ministry being that it should apply to the bus company and ask the latter to run a service. He suggested that after the words "will inevitably result in increased travelling charges to the public," the words "prove ruinous to the tramway industry and finally result in imposing intolerable financial burdens on tramway-owning municipal authorities" should be added.

COUN. W. J. SQUIRES, J.P., L.C.C., supporting the resolution, contended that no form of transit or transport which was going to compete with municipal tramways should be permitted to operate until it conformed to the regulations and conditions which were placed upon municipal undertakings. It seemed to him that the only remedy was the one which the resolution would embrace, and that was, to go to Parliament. He was not a pessimist as regarded the future.

Mr. J. S. D. MOFFET (general manager, Belfast) said that given fair competition, he was sure that no motor vehicle could hold its own under the same conditions. There was no comparison between the London area and the provinces. In London there was four or five square miles with a teeming

population untapped by anything but motor 'buses and underground railways. He agreed that some action should be taken to stop the unfair competition which was going on, but he would not like it to go out that they were afraid of reasonable and fair competition.

COUN. W. T. NEWLING (East Ham) also referred to the sufferings of the metropolitan boroughs from unfair competition. In East Ham there were a dozen different services running through the borough, taking a huge amount of revenue away from the tramway system every day. A poor undertaking struggling to pay its way would have to inflict a heavy deficit year after year on the ratepayers, because something to the tune of £130,000 per annum was being taken out of the borough by unfair competition.

COUN. J. CRABTREE (Keighley) said that recently one of the principal companies in the town had asked for permission to run charabancs on one of the tramway routes, but permission had been refused. The company then wrote a letter to the effect that the Council could not refuse permission, and that it had only asked out of courtesy. It would, therefore, put its vehicles on the road and compete with the tramways.

MR. A. L. C. FELL (general manager, London County Council Tramways) said that in London they had been ploughing a lonely furrow. When it was considered that on the tramway routes in London they had had to pay £820,000 for widening streets, over which the omnibuses ran, and in addition, £140,000 a year in permanent-way rates, while the 'buses were paying nothing, it was simply a scandalous position. He also

referred to the London County Council's attempt last year to get powers to extend the traffic from dead-end tramway terminals by using motor 'buses; it was told that a company was a private company operating, that company should be asked to supply the needs before the London County Council was given the powers. In conclusion, he referred to a paragraph in the report of the Select Committee on Transport in the Metropolitan Area, in which the committee stated that there should be equal financial treatment of all surface locomotion.

ALD. D. J. DAVIES, J.P. (Mayor of West Ham) said the only solution of the whole matter was that local authorities should have the last word in respect of allowing other people to run through their routes.

MR. HAMILTON suggested that the resolution as originally put that morning should be sufficient to enable the Executive Council to carry it into effect.

MR. L. E. HARVEY (general manager, Ilford) suggested that the Light Railways Association should be approached, with a view to obtaining the support of that body.

THE PRESIDENT said the matter had been considered by the Executive Council, and it was thought proper that the resolution should be confined to municipally-owned tramways.

MR. MURRAY's amendment was put to the meeting, and defeated by a substantial majority, and the resolution as already given was carried unanimously. It was further resolved "That copies of the resolution be forwarded to the Prime Minister, the Minister of Transport, and to every municipal corporation that owns and operates tramways."

NEW BOILER-HOUSE PLANT AT WIMBLEDON ELECTRICITY WORKS.

In common with other electricity stations, the Wimbledon undertaking has experienced a steady development of the demand for electricity supply. In the early years of its existence the district served was chiefly residential, and it is still largely so, but the demand for electricity for industrial purposes has been steadily increasing, and the industrial factor may soon become of very great importance. In 1910 the total number of units generated was 3,052,933, as against 4,968,230 for 1920, an increase of 1,935,297 units. Analysing these figures further, we find that in 1910, of the total units sold, those for lighting purposes amounted to 1,708,659, whilst in 1920 the figures were 1,939,175, an increase of only 230,518. On the other hand, the power units, which in 1910 were only 503,274, amounted in 1920 to 1,676,687, an increase of 1,173,413. This figure was only once or twice exceeded during the most strenuous days of the war, and represents a continuous increase in the demand for power for industrial purposes.

Wimbledon, although an old station, and not too conveniently planned, possessed at least the advantage of being able to place its new boilers in such a position as regarded the generating plant as to secure a much higher overall thermal efficiency than could have been obtained by extending the already existing boiler house.

This new boiler-house plant consists of two "Spearing" water tube boilers (fig. 1), each having an evaporating capacity of 25,000 lb. of steam per hour at 250 lb. per sq. in. pressure, with a superheat of 250 deg. F. These boilers are fitted with "Bennis" drum grate stokers (fig. 2) and "Ferguson" superheaters. The gases pass out at the back of each boiler along a flue under each boiler, and these two flues converge into a short main flue which is connected to a steel chimney about 70 ft. high. A "Sirocco" motor-driven induced-draught fan is installed at the base of the chimney, with the usual damper arrangements. An ash tunnel is built beneath the boilers and flues. The valves and fittings were manufactured by Messrs. Shaw, Son and Greenhalgh.

The battery of boilers, with its flues, chimney, &c., is one complete self-contained steam-raising unit, the intention being that any further extension should be by similar units.

The "Spearing" boilers have been constructed to the specification of Mr. H. Tomlinson-Lee, the borough electrical engineer, by the Spearing Boiler Co., Ltd., the principal contractors. The specification prescribed a factor of safety of 5.5. There is thus a considerable margin for wear and tear above what is requisite for safety at working pressure.

It will be seen from the illustrations that there are three drums, namely, the main steam and water drum, 4 ft. in diameter; the top circulating drum, 3 ft. in diameter; and the bottom reservoir mud drum, 2 ft. 6 in. in diameter. Each

of these drums has a distinctive function beyond that of thermal storage.

Next to the main steam and water drum the reservoir mud drum is the most vital link in the design of the boiler, combined with the down-come pipes which connect the main steam and water drum with the reservoir mud drum. The down-come pipes in this case are 8 in. in internal diameter. The feed water is delivered into the usual type of trough in the main steam and water drum, and by gravity travels down the down-come pipes into and through the mud drum. The result is that all the water in the boiler must circulate and recirculate during working operation through the mud drum, which thus becomes a real mud collector. In this respect the "Spearing" boiler radically differs from all other boiler

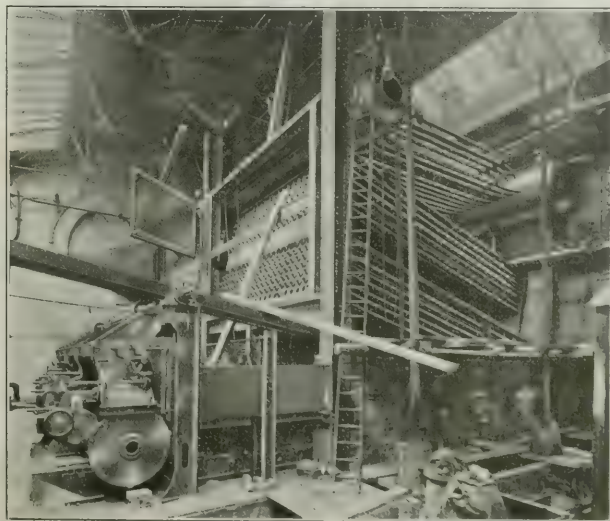


FIG. 1. SPEARING BOILERS AND BENNIS STOKERS IN COURSE OF ERECTION

types of boilers, through the mud boxes of which there is no circulation, the water in them being stagnant except when the blow-off cock is open. Another purpose served by the reservoir mud drum, which again distinguishes the Spearing from the other header types of boiler, is that the water is supplied to the steam generating tubes in the natural order; the bottom tubes, which do the greatest proportion of the evaporation, get their water first, and the upper tubes later in the true order of their demand.

Again, the nipples connecting the headers to the bottom

reservoir drum and the front circulation drum are 4½ in. in diameter, that is to say, they have an internal area of about 14 sq. in. The steam and nipple tubes have about 11 sq. in., so that 4½ in. nipples have about 28 per cent. more area for the inlet and outlet of water and steam to and from the headers. The circulation through the tubes and headers is thus greatly improved.

A most distinctive feature is that the headers are straight and not sinuous. It is claimed that this facilitates circulation, and it has other advantages such as more uniform thickness in construction and ease in cleaning are obtained.

The front circulation drum also deserves remark. Its value is in steadying the circulation, increasing the thermal storage, and in checking surging at high rates of duty. There is also the advantage that it enables the upper row of tubes connecting the front circular drum to the steam drum to be made steam carriers. These steam tubes also act as steam drivers.

The number of tubes in each boiler is 308, contained in 22 sections. The diameter of the tubes is 4 in. and the length 18 ft.

The superheater is of the well-known Ferguson type, and consists of 22 complete sections, comprising three solid-drawn steel tubes 1½ in. external diameter, and 1¼ in. internal diameter. Each section of tubes can be withdrawn or inserted separately from the rest. This facilitates repairs and inspection. As the superheater is fitted in the side, and the headers and joints of the sections are accessible without entering the

Each grate is provided with a totally enclosed change-speed gear box, which allows six variations in the speed of the grate, so that the speed of travel can be regulated within wide limits. The starting and stopping of the stoker and the variations of speed are effected through the gear box. The gear is operated by means of a handle arranged to engage with the notches of a gate. It is impossible to interlock more than one gear at a time, and the grate can be put out of action through the gate change at any point, without having to go through intermediate gears.

The motion of the drive is continuous, ensuring smoothness in running, and provision is made on the driving gear for automatically stopping the grate in the event of jamming.

The stokers are driven by belt from a continuous line-shaft running overhead, the bearings being carried on the stoker jamb columns immediately behind the chain grates. The shafting is driven by belt from a 10-h.p. "Brook" motor.

An underground system is employed for handling the ashes. They fall over the end of the chain grate stokers on to radial dumping plates, from which they are dropped when necessary into capacious hoppers which are sufficiently commodious to hold the ashes of about an eight-hour full-load run. From them the ashes are discharged into an ash truck, which is pushed by hand along a light track laid on the basement floor, to an electric hoist placed at the end of the ash tunnel. The truck is large enough to hold from 4 to 5 cwt. of ashes. It is raised to the boiler-house level by the hoist, passes through the boiler house, and outside to the tipping platform.

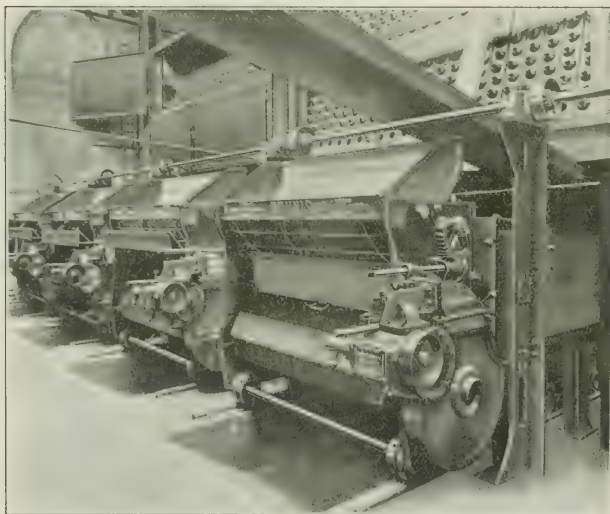


FIG. 2. "BENNIS" CHAIN GRATE STOKERS.

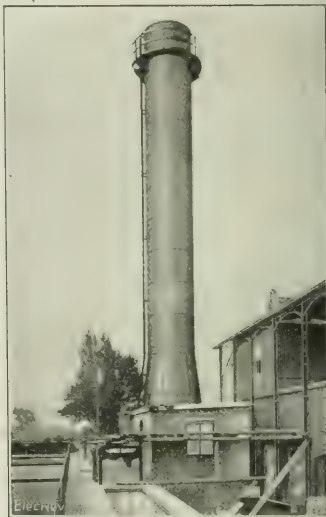


FIG. 3.—STEEL CHIMNEY.

boiler flues, the joints can be seen and examined, and tube withdrawals effected if necessary. Each set of three superheater tubes is expanded into a square 1 in. mild steel plate. The plates are secured to the superheater headers by studs and nuts, and the joints are made by copper and asbestos rings. We are informed that these joints stand up to 850 deg. F. in direct-fired superheaters.

Each superheater is designed to give 250 deg. superheat at full load.

The borough electrical engineer's specification called for mechanical stokers suitable for burning Midland nutty slack (10,500 B.t.u.) with induced draught, and so designed that they could be hand-fired if necessary. The mechanical stokers fitted are "Bennis" chain grates, two to each boiler, each 6 ft. wide by 13 ft. 9 in. long, giving a total effective grate area in each boiler of approximately 165 sq. ft.

The grates (fig. 4) are built up of the "Bennis" patent links with halved joints and corrugated air spaces. By halving the link at the joint with the succeeding link in the series, an uninterrupted surface is obtained, which prevents the admission of an excess of air, whilst it ensures a sufficient supply for perfect combustion, and the continuous surface avoids the possibility of ashes passing through the joints of the links when passing over the grate drums. The corrugated air spaces, evenly divided, prevent thin flaky fuel passing through the grates.

Provision is made in the design to hold broken links in the correct position, to prevent them falling and causing breakdown. This is achieved by each link being fitted with dowels which project from the side of the link. The dowel fits loosely into a corresponding recess on the next link, so that in case a link breaks it is impossible for it to fall out of position. The grate can thus continue running until it is convenient to replace the link.

The hoist consists of a substantial steel structure with an electrically operated traveling car, and balance weights. It is provided with two vertical sliding iron gates which open and close automatically as the car travels.

To prevent overwinding at each end of the travel, limit switches are fitted which break the circuits of the "up" and "down" directions respectively. This switch is fitted in the motor room, and is operated by the car should the latter by any chance travel past the direction limits. It breaks the main and car feed circuits, and can be replaced in a moment without having to wind the car and balance weight.

The induced-draught installation consists of a 55 in. diameter "Sirocco" fan, semi-upcast, full housing type, made by Messrs. Davidson & Co., Belfast. The construction is specially designed to deal with hot gases, and ample wheel clearance is left for expansion when dealing with gases at high temperatures. The fan is driven by a three-phase motor of E. Brook's manufacture, through a "Hans Renold" double driving chain.

The chain is enclosed in a gear case which is provided with forced lubrication. The motor is arranged for a speed of 960 r.p.m., and the fan speed is 380 r.p.m., requiring for maximum duty 37 b.h.p. The intensity of the draught produced will be equal to that of a chimney 180 ft. high, working under purely natural draught conditions.

The steel chimney is self supporting, and is 60 ft. high above the brick base. It is 7 ft. diameter tapered outward to 10 ft. at the base. The first 12 ft. from the base consists of 5/16 in. thick steel plates, and the remainder consists of ¼ in. thick steel plates.

The feed pump is one of Worthington-Simpson's 14 by 9 by 24 in. vertical simplex double-acting piston pattern pumps, capable of delivering up to 10,000 gallons of feed water per hour against boiler pressure.

The pump is fitted with the latest type of steam valve gear.

which is of very simple construction, the working parts consisting of a main slide valve which controls the admission of steam to the main steam cylinder, a steam-thrown plunger which operates the slide valve, and a small auxiliary slide valve, which controls the motion of the steam-thrown plunger. These three parts, together with the valve rod connections to the lever, which move the auxiliary valve, make up the whole working mechanism. It is particularly adapted for operation

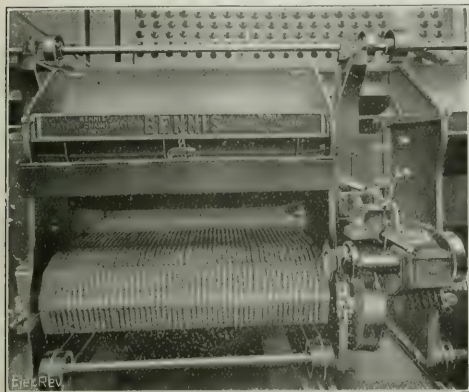


FIG. 4.—GRATE OF BENNIS STOKER.

with high-pressure steam, the small auxiliary valve being the only working part directly connected to the valve rod, which valve, due to its small area, is subject to but little friction from the pressure of steam upon it, and consequently wear and strain on the connections are minimised.

The difficulties of lubricating at such temperatures being overcome by the design of the parts, the mechanism can, if necessary, run perfectly without any cylinder lubrication at all. The auxiliary cylinder carrying the steam thrown plunger is at right angles to the length of the main cylinder, in order to give the necessary support to the weights of plunger and main valve, thus preventing any possibility of the parts dropping and short-stroking the pump. From this construction, it follows that the auxiliary steam valve moves in line with the main piston rod, while the main valve operates at right angles to it.

Acknowledgments are due to Mr. H. Tomlinson-Lee for facilities to obtain photographs, and to the manufacturers for particulars of the plant.

LEGAL.

F. W. HARVEY & Co. v. NEW ENTERPRISES, LTD.

At Marylebone County Court, last week, before Judge Walworth H. Roberts, plaintiffs, electrical manufacturers, of 15, Edbrook Road, Paddington, sued defendants, of 69, Church Street, Edgware Road, W., for £30 for goods sold. Plaintiffs' case was that at defendants' picture palace in Church Street, there was installed an electric generator, but it commenced running badly and plaintiffs were asked to see to it. They completely overhauled the machine and supplied new parts where necessary. Defendants' case was that they refused to pay plaintiffs the amount charged because the work was not properly done. Mr. James Lambert, general manager of the theatre, stated that after the work had been done the generator frequently stopped, and continued like this for about three weeks, the result being that he was at a loss of about £30. It emitted showers of sparks and became very hot.

In reply to several questions, a witness stated that the machine was of German make, and suited for 2,000 revolutions a minute, but was unable to withstand 2,800 revolutions a minute at which it was sometimes driven.

A witness for the plaintiffs stated that the reason the machine became hot was either that it received insufficient lubrication or else some foreign substance got into the generator.

His Honour gave judgment for the plaintiffs for the amount claimed with costs.

CHARLES PEACOCK & Co., LTD., v. J. R. WEST

At Marylebone County Court, before Judge Walworth H. Roberts, last week, plaintiffs, of Clapham, sued defendant, of Brondesbury, for £70 14s. 2d. for goods sold.

Evidence was given by the manager of the repetition wood work department in plaintiffs' works, who stated that in January, 1920, Mr. West gave an order for a number of fuse boxes which were to be made of Cyprus stained teak wood,

at the same time supplying a box as a sample of what he required. Plaintiffs duly delivered a number of boxes, but they had not been paid for, except so far as the delivery up till February was concerned. Defendant had contended the boxes were not equal to sample, and when witness attended with him at the Electrical Supplies Co., Tottenham Court Road, he (witness) was shown a piece of stained wood, a material which witness denied was similar to that of the sample box originally given by the defendant. Witness had known that the defendant had some connection with the Electrical Supplies Co. The piece of wood was stained walnut.

Later in the hearing, Mr. A. Farr, merchant and electrical supplies manufacturer, of Kennington Road, said he was asked to attend at defendant's works to examine some of the boxes in question. There were about 300 boxes, but he examined only about 50 or 60. He should say they were fairly up to sample, but one of them produced he would not pass. He added that before the war fire insurance companies might have passed boxes made of soft wood; they might also have done so during part of the war, but after 1920, owing to the attitude of fire insurance companies, he was unable to sell fuse boxes unless they were made of very hard wood.

His Honour said the whole subject in dispute was more fit for the determination of an expert.

Mr. KING said they originally proposed that the matter should be referred to arbitration.

Mr. HARTLEY said defendant had a number of fuse boxes sent back to him by customers, but they would be made the subject of an after claim.

His Honour: They might become a question of law after the settlement of the present claim.

It was then agreed to appoint an expert referee to inquire into the material from which the boxes were made, the quality of workmanship, &c., and report to the Court.

WESTON ELECTRIC LAMP CO. v. SUMART.

In the Shoreditch County Court on Monday, before Judge Cluer, plaintiffs, Sun Street, Finsbury Square, E.C., sued defendant, of Ramsgate, a dealer in lamps, &c., to recover £20 11s. 1d. for goods sold and delivered. The defendant admitted £5 8s. only. Mr. A. E. ROBINSON appeared for the plaintiffs, and said the amount was £63 13s., and credit had been given to the defendant for commission on sales to the amount of £43 1s. 11d., leaving the balance claimed. Mr. Robinson went on to say that they claimed that the defendant was not entitled to commission on returned or unpaid-for goods, and that was the dispute. Judge CLUER pointed out to the defendant that if there was a dispute he should have put in a counterclaim, but if the plaintiffs were willing to go on he would proceed with the case. Mr. ROBINSON agreed. Mr. HARRY FENNIMAN, sales manager to the plaintiffs, said there was no dispute that goods had been supplied, but defendant wanted more commission than he was entitled to; they only paid on cash received. They had deducted £15 2s. 11d. for commission on returned goods and bad debts, but he seemed to think he had been treated hardly. The defendant said he never knew how he stood with the plaintiffs, as he was constantly asking for the monthly statement, which was in his agreement, but never got it. He then asked the witness: "Did you not say you were manufacturers of these electric lamps?" Witness: Certainly not; we are not manufacturers. Defendant: The whole trouble was that they would send lamps from five or six manufacturers in one consignment, some of them inferior, and of course they were rejected. Plaintiffs' witness strongly denied that this had ever occurred. Judge CLUER told the defendant that it hardly concerned the case as to whether the lamps were inferior or not. They might have been made by workmen who purposely spoil their work, in which case they could of course be rejected. In such circumstances, of course, they would not be accepted by the buyer, and the defendant could not expect to draw any commission. There would have to be a verdict for the plaintiffs for £20 11s. 1d., and costs.

COMPENSATION AWARD.

In the Mayor's and City of London Court on Monday, Charles Harding, labourer, 4, Petersfield Road, Acton, claimed compensation against the British Thomson-Houston Co., Ltd., electrical engineers and manufacturers, 83, Cannon Street, E.C., for injuries which befell him on February 16th at Acton. He was assisting to move machinery by placing rollers underneath, when one of the rollers slipped and the machinery fell on to his right hand. He had a crushed little finger of the right hand. Mr. Dale, counsel for the defendants, said they had agreed to pay £15 compensation and 5 guineas costs, which plaintiff would accept. Judge JACKSON concurred.

The Shackleton-Rowett Antarctic Expedition.—We learn from the "Ceag" Miners' Supply Co., Ltd., of Barnsley, that Sir Ernest Shackleton's ship, the *Quest*, carries on board a complete equipment of standard "Ceag" miners' lamps, Cap lamps and Bull's-Eye lamps and all accessories, also a charging stand of their bulk-head type specially adapted for ship use.

(NOT YET PUBLISHED.)

25,282 "Storage battery plates." Chloride Electrical Storage Co., Ltd.
(B. Ford). September 23rd.

25,284 "Electric switches." Soc. E. Spengler & H. Chenu. September 23rd.

25,285 "Electric transformers." British Power Railway Signal Co., Ltd.
(C. G. Call, H. Tinsley, and H. Tinsley & Co. September 23rd.

25,325 "Electric condensers." F. F. Wall. September 24th.

25,326 "Electric light condit fixture." G. F. Tusch. September 24th.

25,328 "Electric discharge devices." Radio Communication Co., Ltd.
and J. Scott-Taggart. September 24th.

25,344 Apparatus for distribution of ~~and on~~ tramway, & , rails. J. J. Spowart.
March 24th.

25,348 "Trolleys for electric vehicles." D. M. Hutchinson and J. Spowart.
September 24th.

25,348 "Electric motor control." British Thomson-Houston Co., Ltd.
(General Electric Co.). September 24th.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

6,656 "Automatic or semi-automatic telephone systems." D. C. Cross.
June 4th, 1920. (108,661).
9,987 "Process of and apparatus for electrical welding." Wilson Welder
and Metals Co., Ltd., April 22nd, 1919. (142,090).
9,993 "Adjustable standard for electric lamps." L. S. Hammarback.
April 4th, 1919. (141,354).
12,593 "Recording mechanism for use with electrical sign telegraphs." H. K. Harwood.
May 1st, 1920. (108,694).
14,829 "Electrical plug socket and switch combinations." J. A. Crabtree,
June 1st, 1920. (108,641).
14,890 "Relay contacts and method of making the same." F. L. Dodgson.
June 1st, 1920. (108,695).
14,977 "Indicating or adjusting devices for wireless direction-finding coils
and other devices." S. F. Woodell. June 2nd, 1920. (108,649).
15,008 "Method of and means for electrically synchronising apparatus over
a distance." H. G. B. Brown. July 12th, 1920. (108,696).
15,195 "Modulated signalling systems particularly applicable to wireless
signalling." N. Lea and Radio Communication Co., Ltd. June 4th, 1920.
(108,660).
15,196 "Electric foot and foot heater and expander." L. A. Edwards.
June 4th, 1920. (108,661).
15,276 "Filaments and like bodies." British Thomson-Houston Co., Ltd.
(General Electric Co.). June 5th, 1920. (108,669).
15,367 "Means for automatically controlling the temperature of electric
heating apparatus." Soc. Anon Des Etablissements L. Beriot. February
5th, 1919. (144,669).
16,070 "Telephone systems." Western Electric Co., Ltd. June 14th, 1915.
(145,034).
16,071 "Electric signalling systems especially applicable to telephone
systems." Western Electric Co., Ltd. August 31st, 1915. (145,066).
16,328 "Alternating current motors." R. Kimura and T. Seinskusho.
June 16th, 1920. (108,685).
16,369 "Electrometallurgical process for manufacture of ductile bodies
of high fusing metals and alloys of same." E. Ayoyagi. June 17th, 1920.
(108,697).
16,455 "Vacuum rectifiers with rotating electric arc." Siemens Schuckert-
werke Ges., October 23rd, 1915. (145,423).
16,806 "Automatic electric switches for use more especially in relay
circuits." Austin Motor Co., Ltd., and C. B. Walker. June 22nd, 1920.
(108,706).
16,807 "Electrical switchgear." W. A. Coates, G. E. Gettings, D. R.
Davies, and Metropolitan-Vickers Electrical Co., Ltd. June 22nd, 1920.
(108,707).
17,849 "Automatically-operated electric switching mechanism for use in con-
nection with cinematograph apparatus to cut off the current in case of
breakage of a film." J. W. Cliffe and T. B. Rutter. June 30th, 1920.
(108,723).
19,334 "Production of high-power currents of constant frequency." Ges.
für Drahtlose Telegraphie. December 31st, 1915. (147,431).
19,375 "Electro-magnetic wave signalling systems." M. Latour. November
11th, 1915. (147,402).
19,381 "Electricity meters." Siemens Schuckertwerke Ges., March 15th,
1918. (147,479).
19,900 "Membranous transmitters or receivers for subaqueous sound
signals." Signal Ges., May 8th, 1915. (147,935).
19,991 "Submarine sound-producing devices." Signal Ges., June 14th,
1915. (147,947).
19,996 "Subaqueous sound producers or receivers." Signal Ges., November
27th, 1917. (147,941).
20,002 "Receiving device for submarine sound signals with a receiving
member abutting on the water and a detecting device." Signal Ges., October
26th, 1914. (147,947).
20,231 "Arrangement for carrying wireless stations." Dr. I. F. Höp-
f, September 30th, 1913. (148,317).
20,272 "Electric heating apparatus." L. de Saussure, December 19th,
1913. (148,359).
20,824 "Electrical contact device." Ges. für Nautische Instrumente.
May 11th, 1916. (148,964).
21,000 "Contacted carbon lamp provided with magnetic regulations of the
arc." R. Mylo. January 28th, 1918. (144,204).
21,004 "Contacts for electric switches and other circuit-closing devices." A.
West & Co., Ltd., and C. G. Long. July 12th, 1920. (108,741).
23,100 "Circuit starting single armature converters from the incan-
descent current side." Akt-Ges. Brown, Boveri & Cie. August 16th, 1919.
(149,920).
23,240 "Safety controlling apparatus for mechanically-driven vehicles."
C. G. Farmer. May 26th, 1920. (160,742).
26,654 "Resistor for high-frequency electric power-line system." Westing-
house Co., Ltd. September 30th, 1919. (151,729).
26,809 "Electromechanical device for controlling lights and the like." H.
Apostoli. April 27th, 1920. (151,730).
29,967 "Controlled for electric machines." Erwin Elektro Co., Ltd.
and Hammer Mundt & Co., November 2nd, 1919. (108,804).
34,265 "Electrical treatment of ferrous metal surfaces." H. W.
Höppner. July 12th, 1920. (151,731). (108,812).

1921.

16,634. "Electrical controls" - Metropolitan Edison Co., Ltd.
July 15th, 1920. (166,518.)

New Capital in Germany.—In the first quarter of 1921 the creation of fresh capital in Germany amounted to 11,598,000,000 marks. Of this total, the electrical industry figured for 375,000,000 marks in shares and bonds, while the capital of new companies totalled 380,000,000 marks.

THE

ELECTRICAL REVIEW.

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No. 2,290.

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BRITISH 'PARSIMONY': AMERICAN
EXPANSION.

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A NEW departure in what the Government of the United States terms its "foreign trade service" has just been inaugurated, and is of particular interest in view of the general conviction that the greatest hope of relieving unemployment in the United Kingdom lies in the expansion of our own overseas trade. For many years the Bureau of Foreign and Domestic Commerce at Washington has issued daily a printed collection of information which it received from its oversea officers. The material was not classified, save under a rough geographical arrangement, and it was only at very long intervals that indexes were compiled. Over the signature of Mr. Hoover an announcement now appears to the effect that these Consular and similar reports will be issued weekly and edited and classified according to the branches of trade or industry affected. In order that there may be the wide circulation and no delay, urgent information that may be received will be released to the Press immediately upon its arrival, in advance of the weekly publication.

The special preparation of these "Commerce Reports" in their new weekly form has been rendered possible by the incorporation in the Bureau of Commerce of experts in the more important branches of American industry. These commercial officers at home maintain close intercourse with trade associations, and thus keep in touch with the nature of the service, information, and investigation needed in the various branches of production. Already eleven different trade divisions have been formed in the Bureau, one of the latest being that dealing with electrical equipment and supplies. It will be seen that in this reorganisation scheme there is an element of economy, viz., in changing "Commerce Reports" from a daily to a weekly publication, whilst by the provision for the immediate issue of urgent items efficiency is in no way sacrificed. At the same time, the general value of the whole "foreign-trade service" should be greatly enhanced by the addition of advisory experts in charge of divisions at home. This last feature is similar to that which formed part of the war-time reorganisation scheme of the Department of Overseas Trade.

It would be interesting to learn whether our own Government knew in advance of these American plans, and if so, whether it was acquainted with them at the time the present Parliamentary Secretary to the Department formulated his plans for effecting the 20 per cent. reduction ordered by the Treasury. Judging by statements made more or less officially at the time of the publication of the report of the Holmes Economy Committee, the economy axe will fall at the D.O.T. upon that side of its activities which the United States Government has just paid it the compliment of imitating. Further, the new Parliamentary head of the Department whose energies in exploring new trade outlets need more encouragement now than ever before, is said to have decided upon a 40 to 50 per cent. cut instead of the 20 per cent. ordered. As the dismissal of a permanent civil servant is not possible in such circumstances, the temporary men would have to go, viz., the men with special commercial experience impossible of attainment in any Government department.

We yield to none in our desire to see the drastic curtailment of all wasteful expenditure. We hold no brief for the D.O.T., but as our readers are well aware, we welcomed its war-time reorganisation, and we hoped for great things from the extension of its Trade Com-

missioner and Commercial Attaché services. We have always considered that the sum spent officially in this country on trade development was absurdly inadequate, bearing in mind the magnitude and diversity of its commerce. During the past financial year it cost the country less than half a million pounds. And now, just at a period when it would have the best possible chance of justifying its existence, it is to be sacrificed because apparently other branches of the Civil Service pretend that they cannot possibly economise to the extent desired by the Treasury. Does this mean that the vacancies which have lately occurred in the Trade Commissioner Service will not be filled? It will be remembered that certain Trade Associations have shared with the Department the work and expense of undertaking joint investigations into overseas markets for the commodities in which they are interested. Are these investigations to be abandoned? Again, the collection and display of samples of foreign competing manufactures have proved of value and utility. Will these operations cease? Adverting to the matter of the staff of the D.O.T., which obviously will be restricted by the "cut" to the established Government officials, is it seriously believed by the "competent authorities" that a D.O.T. recruited solely through the usual Civil Service channels will be able either to initiate or to carry out intelligently any work of utility to commerce and industry? The business community is entitled to fuller information on all these points. At present the proposals have the appearance of economy run mad.

An Important Trade Union Development.

THE proposed working agreement between the Electrical Power Engineers' Association and the Electrical Trades Union, to which we referred in recent issues, is a matter of considerable significance to the electricity supply industry. There has been, of course, in the past, a certain amount of "action in common" between these two unions. It is now proposed to establish permanent machinery for future co-operation. This arrangement for reciprocal support—which implies the joint action of these two unions in the future—introduces a very important new element into the industrial situation, the full incidence of which it is difficult to foresee. In the first place, if the proposal matures and the disagreement on the detail pointed out by Mr. Webb in his letter last week is got over, the E.P.E.A. will apparently throw in its lot with the manual workers; and the fact that its decision is by way of agreement with the Electrical Trades Union introduces further features—as presumably the E.P.E.A. is fully aware of the general policy of the E.T.U. The latter proposes to ingather if possible the whole of the manual workers under their particular unions; its theoretical ambitions ultimately, we understand, even extend to *everybody* in the industry. It wants to form one big industrial union and eliminate all the craft unions that at present butt in (as it would say) into the industry. The support and co-operation of the E.P.E.A. is obviously an element, and a most important one, in this scheme.

In coming to the present agreement we take it that the E.P.E.A. is aware of the full significance of the step it is taking. We should under-estimate both the ability and the initiative of the E.T.U. if we did not anticipate that it would endeavour to use this "working agreement" as a lever to bring about closer and closer union. We may assume that it will not fail to emphasise at least one of the items specified as of "common interest," namely, "the desirability of all employees enrolling in a bona-fide trade union." Mr. Webb most candidly told the Electricity Commissioners at the recent Greater London Joint Electricity Authority Inquiry that the E.T.U.'s views were that the workers should jointly control the industry, and the present agreement is obviously a step in the direction of that policy.

We are not at the moment commenting on the merits or demerits of the policy of either of these bodies. Our purpose is merely to point out the significance of the

movement, and to indicate the important bearing it may have on the working conditions of the industry in the future. Many of the labour troubles in the industry have been due to a lack of study of the essential facts of the situation at any given time. Hence our present explanations.

THE old procedure of taking out a Provisional Order was a somewhat formidable matter. It was particularly onerous where the subject of the Order in question was very simple, say, in the case of power to supply a small village where everyone was agreeable. Here, indeed, such ponderous legal machinery seemed very much out of place. In the Electricity Supply Act of 1919 an attempt is made to remedy this and to simplify the procedure. Section 26 allowing a "Special Order" to be substituted for a Provisional Order. The fee for this Order is £35. In addition to this, if an Inquiry is necessary or if any additional expenses are incurred, the amount is charged to the applicant. Beyond this there is nothing except any expense incurred by the applicant in the preparation of the draft Order. The Commissioners have issued two printed forms of explanation which set out the procedure so exactly that an Order might actually be put through without much, if any, legal assistance at all.

These Special Orders can, of course, be used to amend any existing Provisional Order. Where they are most likely to be of use is in connection with maximum charges. In some cases, of course, companies are holding Provisional Orders which do not include any clause for the revision of prices; this could be amended by a Special Order. Also the reinstatement of the minimum charge in those Orders where it is at present omitted could presumably be dealt with by a Special Order. In this and similar cases the Special Order would be particularly simple. The relevant part of it, in fact, would be little more than a few words, so that the drafting and putting through would be a small matter. In addition to the simplification of procedure thus made under the Act, there is also a further point of advantage which nowadays obtains, namely, the courteous assistance which is always at the disposal of any inquirers at the Electricity Commission. There is here nothing of the stand-off, get-rid-of-you-quick attitude of the traditional Government Department.

German Syndicates and the Abuse of Power.

IT was no uncommon practice in pre-war times for coal and steel syndicates in Germany to tie down industrial consumers to conditions under which the latter were compelled always to procure their supplies of coal, and coke, and of iron and steel, exclusively from the constituents of the syndicates. In the event of customers making any such purchases from other sources without the previous consent of the syndicates, the latter on becoming aware of the facts refused to deliver any further supplies to the customers except on penalty terms. Such arbitrary action in these industries has been nullified since the armistice, owing to Government control over them and Government insistence that the requirements of the inland market must first be met before the export trade is taken into consideration, and as the syndicates do not wish to see State control rendered more strict, they are careful not to arouse any complaints on the part of their customers that might stimulate further State action. In other industries, however, the abuse of the power of syndicates or monopolies continues its merry course.

One instance of this kind relates to the supply of glow lamps, and a second to that of insulating tubes. In the former case the Community of Interests of German Electrical Wholesale Merchants and Exporters points out that the conditions of delivery announced on September 2nd by the Osram Co., in the preparation of which the Electrical Wholesale Merchants' Association of Germany co-operated to the exclusion of other leading unions of merchants, have evoked great alarm in the glow-lamp market. Merchant circles have adopted a negative atti-

tude particularly in relation to the demand put forward by the Osram Co. to be supplied with a copy of the invoice for each customer's order, which would furnish the company with a complete list of these customers; and they also reject with astonishment the demand that the Osram Co. should have the right of deciding whether, and if so, how many, lamps should be allotted to the wholesalers' customers. Apart from further striking defects in the matter of discount scale, the exclusion of the legitimate exporter and various "innovations" in mercantile life, the Community of Interests states that the points set forth above are felt to represent a wounding of the dignity and self-consciousness of the merchant profession, and it is said that if the demands are accepted without opposition, the result will be to encourage further circles of the manufacturing industry to exercise their lust for power. Under these circumstances, a meeting of protest has been arranged by the Community in connection with the Lighting Merchants' Syndicate and other interests concerned, including consumers' associations.

The second instance relates to the general conditions of the Sales Bureau of the United Insulating Tube Manufacturers. Among other matters, the conditions stipulate that prices, extras and discounts, as well as the time of delivery, are non-binding. The express reservation is made that alterations in prices can be made at any time without special notice being given, and the day of delivery is considered as the given day of grace. If the particular member of the Association entrusted by the Bureau with the execution of the order is unable to effect delivery, the Bureau imposes the condition that it is justified in transferring the order to another firm without the customer being able to make any claims whatever arising from the resulting delays. It thus appears that merchants and consumers in both the cases quoted are to be handed over to the tender mercies of manufacturers.

The Belfast Imbroglio. EVENTS at Belfast last week reached a climax; the Council passed a resolution to dismiss the consulting engineers, and the Electricity Committee, as a natural consequence, resigned *en bloc*. The case is unique in our experience. It is clear, however, that the action of the Council was in the last degree unwise, and most certainly was not taken in the best interests of the electricity supply undertaking. To throw over the Committee at a time when the undertaking was passing through a process of transformation and reorganisation, and to dismiss the consulting engineers who had developed the new scheme, meant that the latter would be delayed indefinitely and that the shortage of electricity from which the city has suffered would be prolonged probably until 1923, whilst the outlay was certain to be greatly increased. It was equally certain that the Council would be hard put to it to secure a competent Electricity Committee, and would pay dearly for the fit of temper in which it made its hasty decision.

However, as we go to press we learn that on Monday the Council rescinded the resolution, and no doubt every effort will be made to induce the members of the Committee to withdraw their resignations.

The Electrical Trades Benevolent Institution. Now, when the Annual Festival of the Electrical Trades Benevolent Institution is approaching, is the time to awaken interest in its constitution and objects, to secure new members, and to

collect funds for its purposes. Every one of us can do this; all that is needed in the way of personal sacrifice is just to overcome that feeling of diffidence which deters one from opening the subject. It is a trifling effort; one would not hesitate to solicit contributions, say, to a benefit football match, or to sell tickets for a concert or a dance—why, then, should one shrink from engaging in so laudable a campaign as that of the E.T.B.I., which has for its object the relief of necessitous comrades? It will be found, by those who put it to the test, that the topic will command the sympathetic interest of every

worthy citizen; and if every individual reader of this paragraph were to take his share in the effort that is now being made, we have no doubt that a new record of successful exertion would be set up, even in the short time that now remains.

Those who are in a position to post notices in their works and offices—will they not draw the attention of their associates and employés to the Institution by that means, briefly detailing its objects and methods? 0.5 sheet of notepaper, 5 minutes' personal application to the subject—and 50 or 500 persons, many of whom have never heard of the Institution which exists for their especial benefit, are made aware of its objects; some of them will follow up the matter, and some will in due course take up membership.

Even this small effort may be avoided by using the notice which will be found printed on p. 41 of our advertisement supplement in this issue; cut it out and post it up!—and you will have the satisfaction of knowing that you have at least done something to help in a good cause.

The Ten-penny Shilling. SECOND in interest only to the question of unfair competition, at the Municipal Tramways Association's Conference, was that of a reformed

coinage. As Mr. McElroy pointed out, the tramway business was built up on small coins, with the penny as the unit, and the change in the value of the currency had involved it in immense difficulties. The existing system of coinage was lacking in flexibility, and compelled the managers to increase or reduce fares by excessively wide jumps. Had the coinage been decimal, the adjustment of fares would have been easier, and the reduction of fares, when the time was ripe for it, could be effected gradually.

The proposal of Mr. Harry Allcock, that the penny should be declared to be worth one-tenth of a shilling, was welcomed by the meeting generally, and the matter was referred to the Executive Council for full consideration. The great advantages of this simple proposal are that it requires no new coins, it does not alter the value of any silver coin, and it entails no loss to any holder of coins. It is unquestionably the simplest, cheapest, and most practical method of effecting fundamental reform of our currency that has yet been devised.

As tramway managers stated at the Conference, the existence of a coin worth 20 per cent. more than the old penny would have carried them over their difficulties; but it is not only in connection with tramways that the reform would be beneficial. It would bear fruit in every branch of accountancy, and would enormously reduce the labour involved in that compound arithmetic which wastes the time and fatigues the brains of the whole nation.

Trade with Canada. WE know—only too well!—that profitable trade with countries where the exchange is heavily against us is practically impossible. Logically, then, we should devote all the more attention to those countries where the exchange is in the neighbourhood of par or in our favour (from the standpoint of the seller), and particularly those from which we must purchase food, amongst which are, of course, the British Dominions.

A letter from an export specialist printed in our "Correspondence" columns to-day draws timely attention to the high prices charged for electric irons in Canada, and the splendid opportunity for British makers, who also have the benefit of a preferential tariff. In our last issue Mr. R. B. Mitchell pointed out, in a letter on the Glasgow hiring scheme, that American cookers cost three times as much as British makes (incidentally, the first 100 have been let already, and another hundred have been ordered). It appears, therefore, that a splendid outlet for British cooking and heating apparatus is standing wide open, and we trust that our manufacturers will seize the chance of introducing their products, not only in these but also in other lines, into the Canadian and American markets.

LARGE MERCURY ARC RECTIFIERS.

RECENT INSTALLATIONS.

Three interesting Brown-Boveri rectifier equipments have recently been installed at Ipswich, Birmingham, and Wolverhampton, by Messrs. Power Rectifiers, Ltd. Though now quite a common sight on the Continent, these are the first to be set to work in this country. Considerable progress has been made during the last two or three years, and many large contracts have been obtained for this class of plant.

Their relatively high efficiency over a wide range of output, and ease of operation, together with extremely low maintenance cost, are advantages that cannot be overlooked by those contemplating extensions to their sub-station plant. When one considers the strong position occupied by the rotary converter and motor-generator, the advance made with the mercury arc rectifier is almost

low-pressure a.c. and d.c. panel containing the usual instruments, back-of-board type of main circuit-breaker, and most of the rectifier's standard auxiliary gear. Next to it is a plain panel containing the automatically operated induction regulator, the controlling element of which is the well-known Brown-Boveri automatic pressure regulator, which is seen mounted on the centre of the d.c. panel. With this automatic gear the d.c. pressure is maintained constant at 475 volts at all loads. In the distance can be seen the high-pressure panel, and next to it the Corporation cubicle. Behind this, the main step-down transformer is placed. A noticeable feature of the panels is that they are entirely self-contained and of very pleasing appearance. The little sub-station is a model of its kind, and can be commended to those

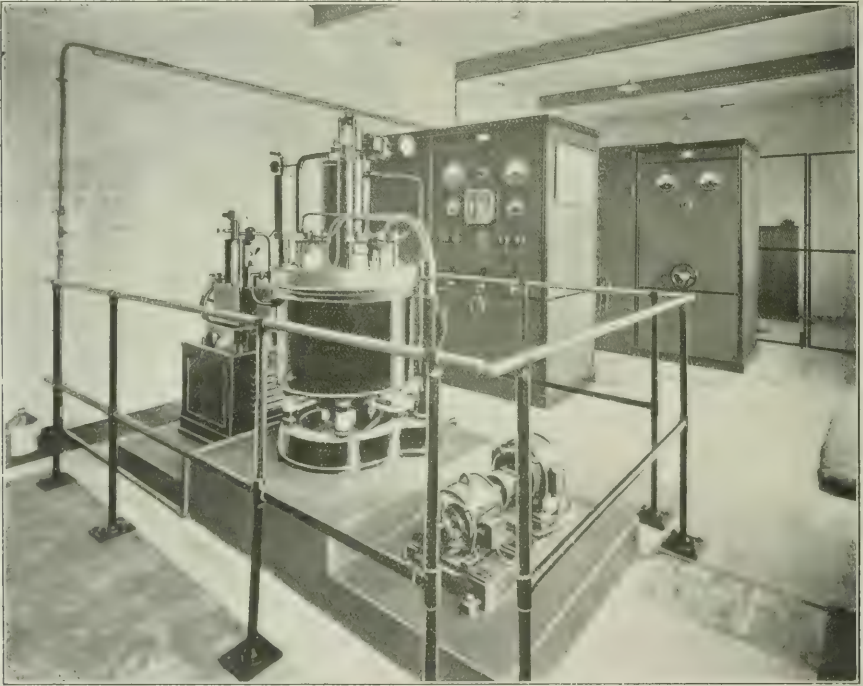


FIG. 1. RECTIFIER PLANT AT IPSWICH.

phenomenal. That the rectifier has come to stay, and may eventually largely supersede the older types of rotating converters, is the opinion of those having many years' experience with such plant. The rectifier is in many ways specially suited to traction and similar conditions, and it is stated by those intimately connected with them that they are so insensible to heavy fluctuations that any type of load, however severe, can be handled with the greatest ease.

The first plant was installed some six months ago at the new works of Messrs. E. H. & F. Turner at Ipswich, and though only of small output, it is quite typical of its class, and, we understand, has operated to their entire satisfaction. It has a capacity of 120 kW at 475 volts, the three-phase a.c. supply being obtained from the Corporation at 3,000 volts, 50 cycles per second. The load is of a highly fluctuating nature, consisting of cranes, compressors, &c. Fig. 1 shows the rectifier with its vacuum-pump set and ignition converter in the immediate foreground; in the middle distance is the

who too often throw such places together and expect to obtain the very maximum of benefit with little expenditure.

The second set to be put to work is on the Birmingham Corporation's system, and is installed at the War Lane sub-station, Harborne. It is seen in fig. 2, and is rated for 500 amps. at 450 volts (225 kW). The current rating, which is the basis upon which the output of a rectifier is figured, has since been increased to 600 amps. continuously, because experience has shown that the additional capacity can be obtained without impairing its efficiency. In this instance, the primary supply is three-phase at 5,000 volts and 25 cycles. The larger rectifiers are characterised by the long anode radiator coolers seen in the illustration. This set has been in operation for upwards of three months on the lighting and power three-wire distributing network. It is run connected across the outer conductors of the network in parallel with the station battery, and also with rotary converters. Balancers are used between the outers and

the neutral wires. The voltage regulation on the rectifier has proved to be quite satisfactory, and variations in the load are automatically shared between the rotaries and the rectifier. The experience so far gained points to the apparatus being eminently satisfactory. The

POWER FACTOR.—II.

By E. W. DOREY, A.M.I.E.E.

IN the generation and distribution of alternating-current electricity supply, the maximum over-all commercial efficiency will be obtained when the power factor of each and every individual load is approximately unity. Where special means have to be provided to improve the power factor, it is undesirable to aim at correcting to a higher value than 95 per cent. owing to the enormous relative increase in condenser capacity which is necessary for improvement between 95 per cent. and unity. To improve the power factor of each individual load of a network system to about 95 per cent. (assuming an induction motor load) is a practical impossibility owing to the high capital outlay necessary, but there is ample margin for the improvement of power factor to the limit mentioned for larger motor loads, say, 75/100 kVA and upwards, and for the improvement of the overall power factor of a group of smaller loads fed from a sub-station.

We are, therefore, brought to the consumer of energy, who, unless penalised for low power factor, is usually not in the least concerned whether the power factor of the load is high or low, and will be quite content to use a 100-h.p. motor for a 50-h.p. maximum load if no more suitable machine is available. Such conditions, which are quite general to-day throughout the country, can-

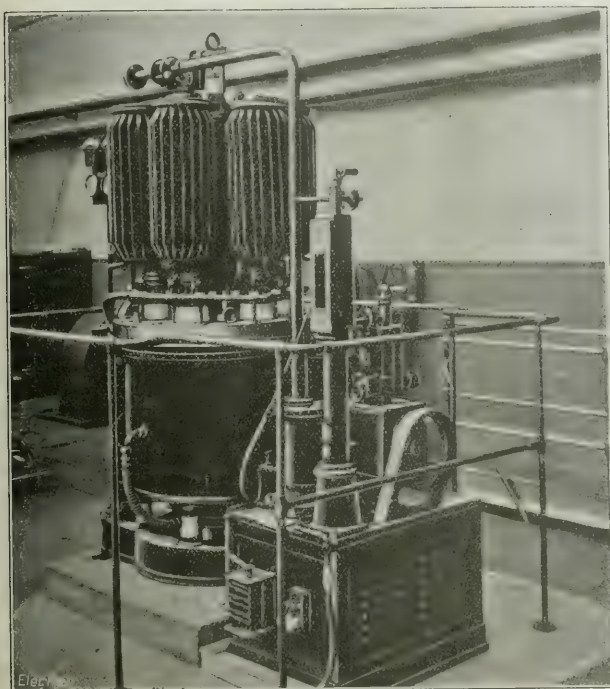


FIG. 2.—THE BIRMINGHAM RECTIFIER PLANT.

overall efficiency is high over a wide range of load, while its silent working is particularly noticeable, practically, the only noise being due to the belt-driven vacuum pump. In the future, even this will be eliminated, because the new pumps are to be direct-coupled. It is proposed later on experimentally to transfer the apparatus from the lighting supply to the overhead tramway traction supply at a pressure of 550 volts, the higher pressure being, of course, obtained by altering the tapings on the three-phase transformer.

The last set is at the Tettenhall sub-station of the Wolverhampton Corporation. It has, however, only been in operation a short time, so that it is too early to form any definite opinion, though indications so far are satisfactory. The technical particulars are approximately the same as for the Birmingham plant, with the exception that the frequency in this case is 50 cycles. A photograph is reproduced in fig. 3; the six-phase main transformer, with anode fuses and disconnectors, is shown on the right of the rectifier. This set is running on the three-wire lighting and power network, in parallel with a rotary converter.

A fourth set is at present in course of erection, and others will rapidly follow.

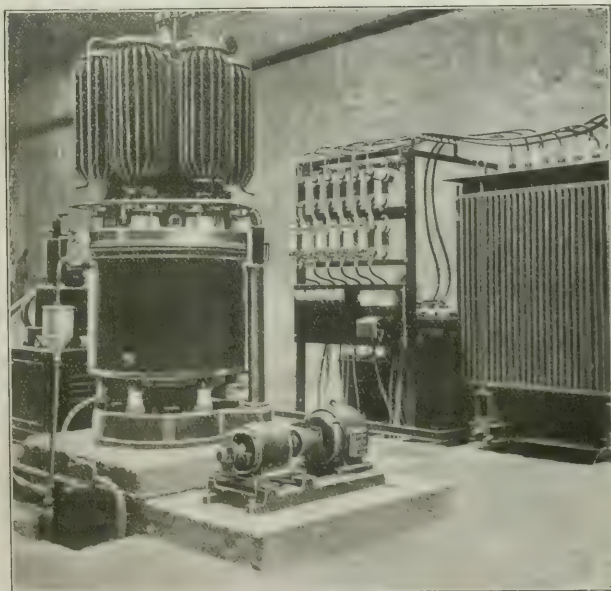


FIG. 3.—RECTIFIER IN TETTENHALL SUB-STATION, WOLVERHAMPTON.

not continue as alternating load develops, and many large supply undertakings are now realising this to their cost; some known to the author are at present operating with a power factor even as low as 60 per cent., with most

serious consequences to the general operation of the system. Throughout the country to-day rates for electricity supply are in force which take no consideration whatever of the power factor, with the result that the consumer having a high power factor must necessarily suffer for the benefit of the consumer with low power factor, as the rates are based on average conditions. Such rates remain in force because it is argued that the consumer dislikes a complicated charge involving power factor, and from the commercial standpoint it is absolutely necessary to quote either a flat rate or a sliding-scale rate based on average conditions. The pursuance of such a policy has resulted, and will always continue to result, in low power factor on the general system, and this, in turn, must involve unnecessary capital expenditure on cables, transformers, switchgear, alternators, &c., to deal with the high reactive current, as well as considerable increase in losses on the system which must inevitably increase the average price per unit chargeable to the consumer.

To-day, when there is considerable difficulty in raising the capital necessary for the operation of supply undertakings, it would be interesting to know how many thousands of pounds are being spent on cables, transformers, sub-stations, and the like which could have been avoided had a bold policy been adopted for penalising consumers for low power factor. It must be admitted that to educate the average consumer to a kVA system of charge is no easy matter, but when it is put in the light of an ultimate saving in £ s.d. it usually carries the day. The question really resolves itself into the choice of two evils—either to ignore power factor and to allow the average price per unit to soar to such a height that energy will not become marketable when compared with other alternative means of obtaining power, or to enforce a bold policy of a penalty for low power factor with perhaps a consequent loss of a few fractious consumers, who eventually will revert to a right frame of mind.

To carry the argument to its logical conclusion let us take the following hypothetical cases:—

Sub-station capacity is 1,370 kVA.

Load A.—300 kW at 60 per cent. p.f. = 500 kVA.

Load B.—522 kW at 60 per cent. p.f. = 870 kVA.

Load C.—1,000 kW at unity p.f. = 1,000 kVA.

If loads A and B are fed from the sub-station:—

Load A.—300 kW, 60 per cent. p.f., 500 kVA.

Load B.—522 kW, 60 per cent. p.f., 870 kVA.

Loads A and B.—822 kW, 60 per cent. p.f., 1,370 kVA.

If loads A and C are fed from the sub-station:—

Load A.—300 kW, 60 per cent. p.f., 500 kVA.

Load C.—1,000 kW, unity p.f., 1,000 kVA.

Loads A and C (vectorial sum).—1,300 kW., 94.8 per cent. p.f., 1,370 kVA.

An analysis of the foregoing simple but practical example indicates the following:—

(A) By connecting consumer C to the mains in lieu of consumer B, it is possible to supply through the same mains, transformers, &c., an additional 1,300 – 822 = 478 kW load or 478 units per hour.

(B) If consumer A above is connected, the demand on the mains, &c., is 500 kVA, whereas if consumer C above is connected (unity p.f.), the demand will be 1,000 kVA. Combining the two gives a demand of 1,370 kVA, therefore the connection of C's load has actually improved the power factor of A's load, resulting in a reduction of A's load by 1,500 – 1,370 = 130 kVA.

This condition of affairs at present exists to a greater or less extent in supply undertakings throughout the country. Is it logical or commercially sound to charge consumer C the same rate as consumers A and B, when with given plant, A and B with 822 kW will fully load the mains, &c., whereas A and C will enable an additional 478 kW to be taken on the same plant?

Some form of penalty for low power factor is vital to the supply industry, and will be dealt with in a later article.

A PHASE-SHIFTING DEVICE FOR METER TESTING.

[COMMUNICATED.]

THE present article describes a home-made arrangement for testing watt-hour meters on various power factors.

The scheme was arranged in the test room of an undertaking giving the bulk of its consumers a single-phase a.c. supply which was originally generated by single-phase alternators at a frequency of 60 cycles. In course of time these machines were superseded, and 3-phase generation was adopted, the single-phase high-pressure network being split into two portions, and fed from a Scott-connected transformer bank in the usual way. On the change-over from the old reciprocating plant to the 3-phase turbo-alternators, the frequency was lowered from 60 to 50 cycles. For some time previous to this change, a.c. meters had been ordered for, and tested with, the proposed new frequency. Tests had also been taken on representative meters of the types in common use, with a view to determining the probable alteration in the accuracy of the meter when the new frequency was adopted. These tests showed that an alteration of the order of 3 per cent. was to be anticipated on lagging power factors of about 0.5. As the power factor of the day load was known to be bad, being often below 0.7, it was felt that the effect of the change of frequency was too pronounced to be passed over, and that power meters of any size should be changed as soon as possible after the lowering of the frequency, and replaced by meters calibrated for 50-cycle circuits.

The arrangements for testing meters at power factors other than approximately unity had been very inadequate, the only apparatus available for this purpose

being a number of choking coils, most of them having closed iron circuits. The maximum current that could be obtained at a power factor of 0.5, lagging, had been about 40 amperes, and the nature of the reactance was such that a very distorted current wave was probable. It was felt that the quickest and best way of adjusting a number of meters for accurate quadrature of the pressure flux would be to adjust them for stand-still at zero power factor.

The testing equipment for a.c. work comprised an adjustable lamp bank, adjustable resistances, a 10-kVA, 200/20-10 transformer, and a series of Kelvin astatic wattmeters. The supply for testing was obtained from a 50-kVA transformer excited from the 2,000-volt a.c. busbars, which transformer supplied a small local network. The low-pressure 3-phase supply in the works was located at the end of the building remote from the test room, and the running of mains from this position would have been a costly matter. As cheapness of the projected scheme was a *sine qua non*, it was decided to obtain in the test room a low pressure two-phase supply, and to see what could be done in the way of arranging some sort of phase adjusting device in connection with this supply.

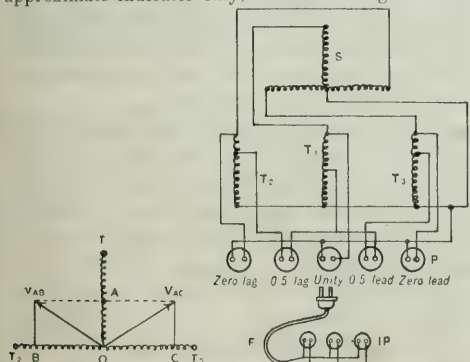
The quadrature phase from that already in the test room was obtained from an old 5-kVA transformer, which was placed in a spare feeder cubicle on the 2,000-volt board, the primary being supplied through the fuse intended for the feeder booster. The secondary was arranged for a 400-volt, 3-wire supply, the 400-volt terminals being connected to a spare pair of leads run-

ning from the test room to the 2,000-volt switchboard, the neutral terminal being earthed. This gave a voltage system represented by three equal vectors arranged T fashion. These would enable a meter whose current coils were supplied through a non-inductive load from the original testing circuit, to have its power factor changed to approximately zero, either leading or lagging. In order to obtain power factors of approximately 0.5, a quantity of obsolete gear was examined, and three auto-transformers were obtained; one had a ratio of 200/160. By connecting these transformers having a ratio of 200/40 and, of course, giving also a ratio of 200/160. By connecting these transformers as shown in fig. 1, voltages V_{AB} and V_{AC} were obtained from the tapping points A and B, and A and C, of a magnitude of about 190, displaced in phase position from the voltage OA by about 58 deg., thus enabling power factors of about 0.5 lagging and leading, to be obtained. In order to indicate approximately the power factor of the meters under test, a single-phase switchboard-type power-factor meter was fixed up, the pressure circuit of which was excited from the same potential as that applied to the meters through a third arc lamp transformer on which a 200,800 tapping was discovered, the current coil being supplied, either direct with the testing current or by a meter current transformer of appropriate ratio. When meters supplied from current transformers were being tested, the power-factor meter was connected in series with one of the meters; being shorted out after the indication had been noted. The power-factor meter was used as an approximate indicator only, and its readings were not

for quadrature by supplying them at zero power. required that this condition could be obtained accurately. With a Kelvin wattmeter in a circuit giving a full-scale deflection at unity power factor, with a lamp load, transferring the potential to the zero power-factor plugs gave a wattmeter reading of about 4 per cent. of the kVA in the circuit. Although the wattmeter could not be trusted to have zero phase angle, the reading was sufficient to show that true quadrature of the current and voltage in the meter had not been obtained. Unsteadiness of the voltage, and the fact that only two voltmeters were available, made it impossible to obtain particulars of the voltage triangle by simultaneous observations of the two-phase voltages and their resultant.

As there was no apparent method, with the gear to hand, of obtaining small adjustments of the phase of the voltage applied to the meters, attempts were made to adjust the power factor by small changes in the phase of the current. This was successfully accomplished by compounding with the main current through the wattmeter and the meters a small current derived from the quadrature phase and supplied by a current transformer. For this purpose, an old 80/10 current transformer of high capacity was used, the 80-ampere winding being connected to the ends of the series of instruments, the 10-ampere winding being connected in series with a small bank of lamps supplied from the quadrature phase. The connections and vector diagram are illustrated in fig. 3. The method proved to be most successful, and small adjustments of the phase of the current were easily and conveniently obtained.

Having the means of accurately adjusting the phase angle between the current and the potentials applied to the meters, the question of determining the criterion for

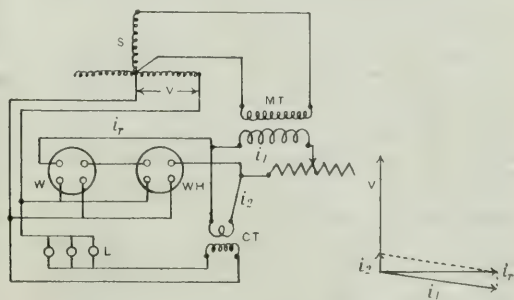


T₁ Ratio 200/100;
T₂ & T₃ Ratio 200/160.

FIG. 1.

S, 2 phase supply; T₁, 200/100 ratio; T₂ & T₃, 200/160 ratio; P, plug sockets; F, flexible lead and plug; IP, instrument plug socket.

FIG. 2.



S, 2-phase supply; W, wattmeter; WH, watt-hour meter; L, lamps; MT, main transformer; CT, current transformer.

FIG. 3.

VECTOR DIAGRAM.

utilised for any of the actual tests, although the instrument proved to be very reliable, giving an accurate indication of zero power factor.

The whole of the wires from the arrangement of auto-transformers were brought to a number of 5-amp. plug sockets. A further series of sockets was arranged under the first, these latter being intended to take the potential leads for the meters, and the wattmeter. The instrument sockets were connected to a flexible lead, terminating in a plug which could be inserted in the sockets giving the various power factors. The arrangement is shown diagrammatically in fig. 2.

The practice had been to test small meters on a lamp load, whilst large meters beyond the capacity or the lamp bank were tested on the two-circuit principle, the heavy current being supplied at either 10 or 20 volts from the 10-kVA transformer already referred to. Experience had shown that with the apparatus in use the power factor of the secondary supply from this transformer was nearly unity, even when the load was 200 amperes. It was, therefore, possible to test all meters at power factors of approximately 0.5, leading and lagging, by merely inserting the instrument socket plug into the correct power-factor sockets.

To carry out the proposed idea of adjusting meters

zero power factor then arose. Had the various wattmeters all been devoid of phase angle, the adjustment required would simply have been to obtain zero reading, but this condition did not obtain. An approximation to the actual phase angles of the various instruments was obtained from particulars of National Physical Laboratory tests that had been taken. Examination of the test certificates showed a consistent difference between the accuracies at unity and at 0.5 power factor. From this difference the phase angle was calculated. Having determined these angles, it was merely necessary so to adjust the power factor that the reading of the wattmeter was a percentage of the volt-amperes equal to the sine of the phase angle. As an example of the calculation of the phase angle by this method a wattmeter showed a difference in accuracy of 1.2 per cent. between unity and 0.5 power factor, being fast on a lagging current. This indicates that the apparent power factor in the wattmeter was $\cos^{-1} 0.5 \times 0.1012$, or $\cos^{-1} 0.506$, corresponding to an apparent angle of lag of 59 deg. 36 min. The difference between this angle and 60 deg., i.e., 24 min., is the phase angle of the wattmeter. On zero lagging power factor, therefore, the wattmeter will give a forward reading equal to $\sin 24 \text{ min.} \times \text{volt amperes}$, or 0.7 per cent. of the reading when the pressure

coil of the instrument is supplied from the unity power factor socket.

It may be added that this method gave most satisfactory results. The phase of the current having been adjusted to give the required reading on the wattmeter, the quadrature rings on the pressure magnets were so adjusted that the rotors were stationary. Careful tests of meters so adjusted could reveal no difference in the constants of the meters at unity, 0.5 leading, and lagging power factors.

The writer was indebted to the Metropolitan-Vickers Electrical Co., Ltd., for the idea of compounding with the main current supply to the meters, another current considerably displaced in phase from it, to obtain adjustment of the power factor on the meters.

The advantage of the method described above is that, as the adjusting current is very nearly in quadrature with the main current, small variations of this adjusting current have a negligible effect on the magnitude of the resultant current, merely affecting its phase.

INCREASED REVENUE FROM SMALL CONSUMERS.

By "INTERESTED."

THE discussion at the Institution this year serves to illustrate more fully a point which I have had in mind a long time, *i.e.*, the failure of many engineers or managers of electricity supply stations fully to realise that their undertakings are like unto business concerns selling a particular class of goods, and that the question of non-paying services should be looked at in the light of getting more business from present customers.

The capital in connection with a new service to a small consumer is the equivalent of the cost to a business man of a customer's first purchase, where such trade is more or less confined to a certain class of goods. It is by repeat orders or purchases that increased business is done, and engineers should make such arrangements as will ensure, in their case, that a new consumer repeats his order, or, in other words, extends or increases his original demand for electricity for cooking, washing, heating, lighting, ventilating, &c.

Municipal supply undertakings are, of course, handicapped to a certain extent owing to the local opposition to municipal trading, but every endeavour should be made strongly to put forward the case in the proper light for certain forms of trading by way of supplying radiators, kettles, stoves, fans, irons, &c.

A business man arranges to advertise and illustrate the goods he has for sale in the most up-to-date and efficient manner possible for the purpose of increasing sales and obtaining repeat orders. The efforts of those whose business it is to sell electricity often cease when the service is laid, and the supply connected to a customers' mains. That is just where the business man scores; he follows up inquiries and orders. On the other hand, a small consumer of electricity usually hears nothing further from the supply authorities, once the service is completed and connection made, except an occasional account for energy consumed or, may-be, the notification of increased charges.

No one calls, or even inquires by letter, whether the supply is satisfactory to the purchaser, or whether he (or she) would welcome further information concerning the possibilities of effecting saving by extending the use of electricity for heating water or cooking breakfast, or about the advantages of one or two small radiators or fans about the house, shop, or offices.

The electricity undertaking manager should make every endeavour to turn that originally unprofitable service eventually into a paying one. Proper, neat, lucid, illustrated correspondence following up at periodic intervals, together with the offer of a representative to call and advise or explain any points not quite clear, or to give a demonstration of any apparatus, would do much towards reducing the number of unprofitable cus-

tomers. The aim should be increased revenue from present customers, rather than to get many more customers with but a small increase in receipts.

Many methods could be adopted. The small consumer himself could become an advertisement by providing an illustration of how inexpensive it is to light small property by electricity, showing the saving effected in redecoration and laborious spring cleaning, and by demonstrating the cheap and handy methods of using electricity to boil water for tea, coffee, or cocoa, &c. That little shaving-water heater or curling tongs could be mentioned, pointing out that both are cheap and suitable gifts at seasonable times; and electric irons should be in universal use. Ignorance of the cost and capabilities of these goods on the part of the consumer is no doubt the reason why so few are in use.

Evidently many small consumers of electricity experience a feeling of being "left out in the cold" as compared with larger customers, and the occasional receipt of a polite inquiry and offer of advice and demonstration, in view of possible extensions, would at least serve to dispel that feeling and bring consumers more into sympathy with the whole business of the undertaking.

The small man wants small electrical goods on the hire-purchase system, provided some form of guaranteed maintenance is arranged, which, whilst costing him a small sum per quarter, enables him to feel free from heavy expense for repair or replacement, yet enables him to use the apparatus with confidence, fearing no mysterious connections or breakages; these, if they occur, are the job of the "maintenance man."

That great stumbling block "peak load" could be made a little less steep by installing limiters on small property using electricity for purposes other than lighting. Such customers would not worry provided the whole just cause, reason, and effect were clearly and politely explained and demonstrated.

Invitations to simple demonstrations will more than pay for their cost by bringing in more revenue without further capital outlay. From conversation with not a few small electricity consumers, I learn that more information regarding the possibilities of using electricity for purposes other than lighting would be welcomed. A few simple demonstrations in the district whence they obtain their supply would do much to this end. Exhibitions on a large scale are certainly generally advantageous; but many there are who refrain from inquiring about the pressure, voltage, or consumption of the apparatus on show, fearing lest their ignorance of the subject should afford amusement to onlookers.

There is yet a large market for electrical domestic apparatus in small property—but not without that maintenance agreement. The "All-in" policy is what is required, and would well pay each undertaking instituting it.

Automatic Train Control.—The Angus system for the automatic prevention of railway collisions was given a successful trial on the railway at Dyke, near Brighton, on September 22nd, when a large number of railway officials and other interested persons were present. The system, it is claimed, protects trains from collision at every part of the railway track, single or double, junctions, termini, crossings, sidings, &c. Each train is automatically warned if there is a risk of collision, but if not acted upon promptly then each locomotive automatically shuts off its motive power and applies the brakes to the train. A train thus stopped cannot proceed until the track is clear again. Trains can run at full speed through the densest fog or other adverse weather conditions without danger of collision. Each train is automatically protected against derailment at curves and points. Each locomotive is fitted with electrical instruments and mechanical appliances. It is to be specially noted that no shoes, contacts, or ramps are used on the tracks. The rails are bonded together with copper wires, and the line is divided into insulated sections. One of the locomotives was switched on to the same line as the other locomotive. When the two engines were nearing the same section two whistles were heard, and both engines were stopped automatically. No action whatever had been taken by the drivers. Mr. Angus's system is so arranged that the engine is stopped when there is anything on the line causing a short circuit. A defect on the locomotive, a breakage of the apparatus, a rail misplaced or a wire down—all have the same effect—the locomotive is brought to a stop.—*The Times*.

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

A Sensitive Meter.

With reference to the above in your issue of October 7th, the writer fails to see why the meter, rotating with both switches closed, should occasion your correspondent surprise.

Assuming no meter in circuit, the leads between each switch to be the same in all respects, and no difference in the contact resistance across each switch, one would naturally expect the current to divide equally between the two leads.

Introducing the meter into lead A₁ B₁ increases (normally, only slightly) the resistance of that leg, and coupled with this, there may be a higher contact resistance across switch A than exists across B, all of which resistance would tend to keep the current in the meter leads at a lower value than in lead A₁ B₁, but not so low as "Surprised" would give us to understand.

The writer is of opinion that, with both switches closed, the meter should normally rotate at a speed somewhat less than half that at which it would rotate when all the current was flowing through it.

If it does not, then either the total resistance of the meter, meter leads and switch A contacts is abnormally high (compared with lead A₁ B₁), or the meter (no reflections on Messrs. C. & H.) is very sluggish.

F. W. B.

Birkenhead.
October 8th, 1921.

The Durability of Lead-covered Wiring.

I propose installing electric lighting in my house, my intention being to wire it with lead-covered wire, but on discussing the matter with a practical electrician he condemned it; the reason given was that in six or seven years' time one has practically to renew the wiring through deterioration of the lead covering. I shall be glad to have the opinions and experience of your readers.

W. T. J.

The E.P.E.A. and the E.T.U.

Further to Mr. Webb's letter on the above matter in your issue of the 7th inst., I enclose a copy of our reply thereto.

I do not propose to discuss the issue raised by Mr. Webb, as the disadvantage to all concerned will be obvious to your readers. Furthermore, the negotiations to which reference has been made are between the National Executives of the two organisations.

W. Arthur Jones,
General Secretary,
Electrical Power Engineers' Association.

London.
October 10th, 1921.

[The enclosure indicated that the Committee of the E.P.E.A. would reply as early as possible.—EDS. ELEC. REV.]

Small Waterpowers.

I have a bungalow, near which runs a stream, about 4 ft. wide and 6 in. in depth. There is a fall of about 3 ft. The question is: Could I get sufficient power from it to generate enough electricity to light the bungalow? I should like to know before pursuing this matter further.

A. C. Burt.

London.
October 8th, 1921.

[It is probable that by utilising the whole of the available energy of the stream, our correspondent would be able to light a bungalow. The cost of the waterwheel and generating plant would, however, be prohibitive. We hope to publish an article on the possibilities of power generation from small waterwheels shortly.—EDS. ELEC. REV.]

Lighting Bakers' Ovens.

I have fitted electric light for lighting bakers' ovens, which is accomplished by the use of a double-swing bracket fitted to the side of the oven entrance. When bread is being put into or removed from the oven, the bracket is swung into the oven.

This bracket is wired with asbestos braided flexible, and fitted with an ordinary screwed lamp-holder, and a 250-volt, 32-c.p. carbon lamp.

The lamp is affected by the heat in that the cap becomes detached from the bulb, also the solder melts from the contacts; otherwise the lamp is all right.

Could any of your readers give any suggestions to overcome the above difficulty?

Electro.

October 8th, 1921.

A Spare Armature Incident.

With reference to "F. W. G.'s" problem, I am convinced that the armatures are electrically interchangeable subject to slight modification of connections, and that the interpole field winding was not correct with the second armature fitted.

To solve the problem I propose adopting the "Scotch" method, i.e., by asking another question: What caused the reversal of rotation when the second armature was fitted without altering any connections? It must be borne in mind that to obtain satisfactory reversal of an interpole motor it is necessary to reverse either (a) the shunt field winding, or (b) the armature and interpole winding.

When the second armature was fitted, the only possible thing that could have happened was a reversal of the direction of current in the armature winding itself. In short, one armature was wound "progressive" and the other "retrogressive," but in all other respects they were similar and interchangeable.

It should be pointed out under condition (b) that both the armature and the interpole winding should be reversed, so that in this instance the second armature was automatically reversed, but not the interpole winding, and this caused the fireworks. When the shunt field windings were still not correct the rotation, the interpole windings were still not functioning correctly. This was the cause of the fireworks. If "F. W. G." had tested the polarity of the field windings he would have discovered this error. To permit the second armature to be fitted and keep the correct rotation, "F. W. G." could have (c) reversed the armature leads at the brushes, or (d) reversed the shunt field, and also the interpoles in this instance.

The statement in "F. W. G.'s" letter that "on starting the motor ran in the opposite direction and of course sparked" would appear to indicate that he did not expect satisfactory running in both directions. The very fact that the motor is fitted with interpoles ensures satisfactory reversal (if they are properly connected) without commutation trouble or "fireworks."

G. W. T.

Glasgow.
October 10th, 1921.

The Contractors Future.

I have read with great interest the article under the above heading in your issue of the 16th September, and consider that the scheme put forward is one which deserves the consideration of every electrical contractor.

There is no doubt that if all local contractors joined forces, and were thus enabled to provide first-class show-rooms and so display electrical goods to the very best advantage, it must automatically increase sales, which is the beginning of the development of an electrical contractor's business. The fact also that there would not be that local rivalry, would naturally, level up prices, and the accumulation of assets and finance should greatly assist in reducing overhead charges to a minimum, with a maximum of efficiency in display and control.

I have also read a letter in your issue of September 30th, signed "Britain First," and I am inclined to think that the writer has missed the essentials of the article in your issue of September 16th, and treated it as purely a personal letter.

It would appear to me that the article written by Mr. Hawkins is one to encourage the development of the electrical business in this country, and not with a view solely of developing the goods of an American electrical company which he represents. Whether the goods sold are of American origin or British, the great thing is to display and sell, and if this principle is acknowledged as being the first essential, the question of the purchase of goods rests with the contractor. It is only natural that Mr. Hawkins wishes to develop more extensively his goods on the British market, and at the same time it is in the interests of the country that both the import and export trade should be developed. Obviously if goods cannot be produced in this country at the same figure, or of an equal quality to those of other countries, the consumer will, naturally, wish to buy the goods which are the cheapest and best, and it is only by increasing sales all round that the country will get back to its old position, whether in the electrical industry or in any other.

The remark in the last paragraph of the letter written by "Britain First," as to appealing to an American factor for protection and advice as to how to run our affairs, does not enter into the question, and is not worth considering.

R. Durnford.

London.
October 4th, 1921.

As a provincial contractor I am very interested in the recent articles and correspondence on the above subject, and I hope it will promote a healthy and helpful discussion on the subject.

Unlike an ordinary retailer, the contractor's responsibility does not end when the various appliances leave the shop; the client has to be educated into their uses, and there is always the difficulty of arranging for the attachment to the circuit, as the number of plug tops, adapters, and connectors is legion.

Again, much of the apparatus on the market at the present

time, although fundamentally right, lacks perfection in electrical details to a very serious extent. We are offered apparatus in which electro-plate and finish are made special features. This is all very well for the wealthy customer, but if shop sales are going to do big things for the contractor, he must be able to touch the middle-class customer with a "Ford" type of apparatus.

I believe the wonderful advance in the efficiency and detail improvement of the modern motor-car has been achieved mainly from the criticism offered in the "Correspondence" columns of the Motor Press, and although it would perhaps be considered *ultra dig.* to use the ELECTRICAL REVIEW to such an extent for this purpose, I think it would be an advantage if manufacturers were criticised without being accused of advertising their wares.

Speaking of the contractor generally, I consider him as one of the greatest pioneers of modern times, and if one rarely hears of him as retiring from business, it is not because he is devoid of business qualities, but because his profits are absorbed in convincing the British public of the great advantage electricity offers. No doubt when manufacturers are able to offer fool-proof apparatus that will appeal to the pockets of the ordinary consumer, and compare with his present standard of reliability, the contractor will be found willing to undertake the organisation of the sales department to any suitable dimensions.

Grimsby.

October 4th, 1921.

The subject matter of the article which appeared in your issue of the 16th ultimo opens a vast field for discussion, and if approached in the proper spirit would no doubt lead to good results to all concerned in our industry, and therefore the gratuitous advertisement letter should make way for practical suggestions on this very interesting topic.

Mr. Hawkins's article contains some good suggestions, but in the main I feel inclined to endorse "Britain First's" remarks. Mr. Hodge has gone to some pains to point out that the average contractor does not know his business, and would be better off if the manufacturers were allowed to supervise his contracts, and no doubt Mr. Hodge would be willing, if called upon, to give the name of the only manufacturer who is capable of this expert supervision.

I have a great deal of sympathy with the often despised contractors, and their so-called want of enterprise. I should like to hear how the contractor is expected to compete with the well-equipped show-rooms in practically every district run in connection with the supply company, and generally at a loss, which loss the ratepayer has to bear. Another question is how many contractors receive the orders for electric light fittings, or lamps, for installations which they install? Even with the careful attention now given by the wholesale suppliers to allowing trade discounts, there is still a considerable leakage, which affects the contractor adversely. Until the contractor can be certain in his mind that no user can obtain trade terms, he will be very chary of stocking show and sales rooms, and engaging expensive sales assistants.

W. C. Jeary.
Managing Director,
The Jeary Elect. Co., Ltd.

London,
October 4th, 1921.

Situations Vacant.

Allow me to endorse the opinion of "Watts" in your issue of September 23rd, calling attention to the number of advertisements in your columns of situations vacant, which afford no clue to their locality. I would also like to call attention to the lack of consideration shown by many advertisers in neglecting to notify unsuccessful applicants that the appointment has been filled. Personally, I have been answering advertisements of situations vacant in your columns for the past nine months, and although I often enclose a stamped addressed envelope for reply, not 2 per cent. of the advertisers had the courtesy to reply. I am aware that you have placed a column at the disposal of advertisers, wherein they may announce that the vacancy has been filled, yet how many of them think it worth while to study the convenience of the

Unsuccessful Applicant?

October 5th, 1921.

Cleaning Enamelled Slate.

I have made very extensive enquiries, and made a great number of experiments, to try and find the best material for cleaning and polishing enamelled slate switchboards, but without success so far.

Probably some of your readers may have solved the problem. I have found that neither petrol, paraffin, nor methylated spirit is of the slightest use, as they all leave greasy-looking streaks, and make the surface look worse than before.

Oil picks up too much dust.

Any assistance you can give will be greatly appreciated.

J. H. Robbards.
Chief Electrician.

Lewisham Hippodrome
October 4th, 1921.

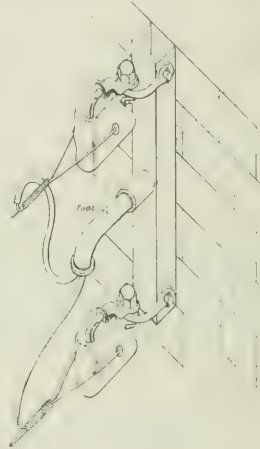
Leading-in from Overhead Mains.

In response to the inquiry in your issue of the 16th ult., we have recently erected a number of service brackets for the Manchester Corporation on the Blackley Housing Estate, the design of which may prove of interest to your correspondents.

The accompanying sketch, together with the following details, will, we think, clearly explain the construction employed.

The channel steel member carrying the insulators, and placed with its flanges toward the wall to minimise the possibility of rotation, is held in position by a tube passing through the wall and secured by lock nuts, which bear against the square washer shown. A bend is fitted at the outer end to prevent ingress of rain, and insulating bushes are fixed at the ends of tube and bend to guard against abrasion of the insulated leads connecting overhead service wires to the main cut-outs.

By utilising the lead-in tube as a fixing, the work of erection is simplified, since one hole only has to be made in the wall.



The insulators used are of our standard disk pattern, the fittings of which are so arranged that the porcelain is in compression, and since a resilient medium is interposed between the porcelain and fitting, abrasion is prevented.

The insulators are attached to the channel steel support by "D" links, and being free to move both horizontally and vertically through a wide range, will set themselves to almost any angle at which the service wires may approach the bracket. The supporting member may be placed horizontally if desired for use with two wires run side by side, the insulators being equally efficient in either position. The leading-in tube may, by means of an adapter, be extended by conduit to the cut-out board, thus affording continuous protection to the leading-in wires. This is not easily effected when porcelain tubes are used.

Geo. V. Twiss,
Managing Director,
Twiss Electric Transmission, Ltd.

London.
October 5th, 1921.

Electric Irons in Canada.

I have recently been struck by the comparatively high price at which electric irons retail in Canada; \$6.00 each less a wholesale discount of about 30 per cent. for large quantities seems the average figure. I am sure that at this price there are many British manufacturers who could compete, and I think it will be worth while calling their attention to this market.

American irons are being largely sold, but as there is a preferential Customs duty on British irons, and the American exchange is against Canada and in favour of this country there should be every reason to expect a good sale for British irons.

It should be borne in mind that electric irons are far more universally in use in Canada than they are in England, and sell in corresponding large numbers.

A sample iron, if submitted, has to be inspected and passed by the Underwriters' Bureau, but that is a mere formality with a good grade English iron.

The Department of Overseas Trade here will gladly assist British manufacturers to cater for this market.

Export.

London,
October 5th, 1921.

Coventry Corporation and the E.P.E.A.

I hear that following the dispute which existed between the Yorkshire Electric Power Co. and the E.P.E.A. some trouble has arisen in connection with the appointment of one of the Yorkshire Electric Power Co.'s engineers by the electricity department of the Coventry Corporation, and it would be of public interest if the secretary of the E.P.E.A. could supply any particulars of the exact position taken up by them.

October 10th, 1921.

Fair Play.

[We have submitted a copy of this letter to the general secretary of the E.P.E.A., Mr. W. Arthur Jones, who says:—
"The incident to which your correspondent refers, and which might have culminated in a serious dispute, was a difference between the Coventry Corporation and the E.P.E.A. in connection with an appointment recently made by the Corporation to the technical staff of its electricity undertaking.
"Negotiations between the Corporation and the Association having reached a deadlock, the matter was referred to the National Joint Board of Employers and Members of Staffs. That body has now given its decision on the matter, and this decision has been agreed to by both parties to the dispute."—
EDS. ELEC. REV.]

Accumulator Froth.

Whilst appreciating the service rendered by your correspondent Mr. Thos. Hesketh, in ventilating this question so energetically, one cannot but feel that his recent unfortunate experiences have led him to attach to this question an importance which might not be shared by the generality of accumulator manufacturers and users. It must surely have long been recognised by progressive makers of accumulators, that the hope of all advance is founded on consistent scientific experiment and control, and the present problem is just such a one as would naturally be entrusted to the scientific adviser.

Mr. Hesketh runs the grave risk of prejudging the question by starting with the assumption that frothing is due solely to the celluloid box, and he suggests a palliative which would rob the celluloid box of its useful property of transparency. It would appear preferable to determine whether or not such factors as the decomposition of the separators and the gassing of carbonated plates (following insufficient formation) are in any way operative, and if the celluloid should eventually prove to be the sole delinquent, to replace it by celluloid which is unattacked by exposure at 40 deg. C. to sulphuric acid of specific gravity 1.250. This is not a severe test, and material which will not pass it should be considered unsuitable for accumulator work.

No doubt Mr. Hesketh would consider himself well repaid if he received from the manufacturers whose goods have proved unsatisfactory, an assurance that such a test was now included in their regular laboratory routine.

The firm with which the present writer is associated has wide experience of the manufacture and use of accumulators of all sizes and descriptions in celluloid containers. For the greater part these accumulators supply a market where they are subjected to uncommonly hard usage, and where scrutiny with respect to quality and life of the accumulator is systematic and severe. The inference is unavoidable that if frothing of the electrolyte had occurred on any considerable scale, the deleterious effects would have given cause for wide-spread complaints, which in point of fact have never been received, although upwards of 200,000 Oldham special process accumulators in celluloid cases are in use throughout the British coalfields alone.

Herbert E. Clarke.

Manchester,
October 5th, 1921.

Research Laboratory,
Oldham & Son, Ltd.

The discussion which is being carried on *re* the above subject is very interesting. Makers evidently have no solution to offer, either as to the cause or to a method of prevention. I have under my care accumulators of all makes—good and bad—and frothing occurs (or occurred) on them all. I tried the following method, which has been very successful: I emptied out the acid, filled the cells with distilled water, and put them on charge. After this was finished the dirt found at the bottom of the case was washed out. Acid of the correct specific gravity was then put in and the cells were charged up. Since trying this "cure" I am not now troubled with this disease. I take care to see that no acid is added. In my opinion, frothing is due to the acid being of high specific gravity and eventually eating into the celluloid.

Edinburgh.

J. H. H.

October 8th, 1921.

We were much interested in the discussion on "Accumulator Froth," and as we have been large users of celluloid in the past, we think the conclusions we have drawn from our experience in this connection may be of interest.

In the first place, we would say that provided an approved quality of celluloid is employed, the instructions of most makers are such that if they are carefully followed out the gravity of the acid will never be sufficiently high to cause trouble. In such cases, the attack on the celluloid almost invariably arises from the user failing to control either the temperature or the gravity.

In practice, it is often almost impossible to control these factors at all times, as it demands a degree of attention and a control of charging rates which are often unattainable. This is particularly the case with batteries employed for motor car work, where the charging rates bear, as a rule, little relation to the requirements of the battery. Even in temperate climates neglect to "top up" regularly will cause the acid concentration to endanger the celluloid, and in tropical climates, in addition to the greatly increased risks from this cause, the working temperature is often sufficient to start the attack. As has been pointed out by others, once chemical action is commenced it is only possible to restrain the frothing by fairly frequent renewals of acid. There is, however, a greater danger than frothing involved in the action of nitrogenous compounds on the lead grids.

Investigation of frothing cells points to the fact that the separators are more liable to attack than the walls of the case, owing no doubt to the greater concentration of the acid between the plates and to the fact that each perforation exhibits a raw edge which is less resistant than the finished surface of the celluloid sheet. To meet this trouble we have developed ebomite separators, both of the ribbed and the corrugated variety. Many makers prefer the corrugated separator, and it has, in our opinion, certain advantages over the ribbed type. Hitherto, however, corrugated ebomite separators have always been supplied in a very brittle state. We are now producing these in a quality practically as soft and flexible as celluloid.

It will be seen, therefore, that while celluloid containers will probably for a long time to come be demanded by the public who are attracted by their appearance, the main danger of frothing can be eliminated, at all events for temperate climates, by the use of ebomite or wood separators with these containers.

As Mr. Coates pointed out, manufacturers have to supply what the public demand, but while doing this, it is possible at the same time to aim at substituting for celluloid, as far as possible, materials which are unaffected by acid.

Strangely enough, the only advantage claimed by the user for celluloid containers acts far more frequently as a disadvantage. We allude to the assumption that the user can tell the condition of a battery from the appearance of the plates. Very few people, on the contrary, are qualified to diagnose condition by inspection through semi-opaque material and liquid. Were ebomite to be employed entirely in containers, this rough and misleading test would be abolished and the user would be reduced to the simple and reliable methods of measuring acid gravity and p.d.

It is our experience that the more scientific type of user is learning to prefer opaque containers which are unaffected by acid, and to rely on gravity and p.d. readings in place of visual inspection through a material rendered semi-opaque by sludge.

R. E. Beswick.

London.
October 5th, 1921. Fuller's United Electric Works, Ltd.

A Motor Problem.

Two 500-V. 5-h.p. motors driving centrifugal pumps are driven together with other auxiliary gear from a set of auxiliary busbars, which in turn are fed through fuses direct from the traction generators by means of connections to the switchboard ends of the generator main cables.

When the generator is loaded and a fault occurs on the line, bringing out the respective circuit breakers, the fuses of the two 5-h.p. motors (and sometimes the auxiliary busbar fuses as well) blow out in a most decided manner. The reason for this can, I think, be attributed to the following causes:—

When a fault occurs, the generator being loaded, there is a momentary drop in volts. The water flowing through the pumps is sufficient to keep up the speed of the 5-h.p. motors, and consequently the back e.m.f. of the motors becomes higher than the generator voltage, with the result already stated.

The writer was advised to try, and did try, a coil of several hundreds of turns of heavy-gauge wire in circuit with the motors to act as a choking coil at the moment of reversal of current, but without result. The substitution of circuit-breakers or reverse-action trips is not desired, as it eliminates the purpose of the auxiliary set of busbars, which is to prevent the closing down of the auxiliary gear when the traction busbar voltage falls.

Leslie G. Hillman.

October 4th, 1921.

[Apparently the motors become generators as stated, and being in parallel with the main generators, they supply current to the line fault, blowing their own fuses. The reverse current from the motors does not pass into the main generators because, being connected to the same busbars, they are necessarily at the same voltage.]

Possibly the trouble might be remedied by a few turns of series winding on the fields of the motors, normally assisting the shunt winding, but producing a rapid drop of e.m.f. on reversal.—EDS. ELEC. REV.]

[Many letters have been held over for lack of space.—EDS. ELEC. REV.]

BUSINESS NOTES.

Company Liquidations.—R. B. HAND & CO., LTD.—Particulars of this should be sent to the liquidators Mr. W. A. J. OSBORN, 1, Market House, Finsbury Pavement, E.C.2, and Mr. P. J. HENDER, 33, Broadway, Westminster, S.W., by November 1921.

J.B.S. ELECTRICAL CONSTRUCTION CO., LTD., 68, Victoria Street, London, S.W.—Meeting of creditors to be held October 20th at Westminster House, London, E.C. Liquidator: Mr. I. C. GOSMAN, Broad Street House, E.C.2.

Bankruptcy Proceedings.—G. W. ENDALL (Endall & Co.), electrical, mechanical and automobile engineer, Canal Motor Works, Canal Bridge, St. Helens. First meeting, October 18th, at the Official Receiver's, 11, Dale Street, Liverpool. Public examination November 7th, at the Court House, Victoria Street, Liverpool.

KIRKUP, electrical engineer, 103, Golden Street, Blackley, Manchester. First meeting, October 18th, at the Official Receiver's offices, Byron Street, Manchester. Public examination, October 28th, at the Court House, Manchester.

V. B. WORTHINGTON, electrical and mechanical engineer, Ellesmere Yard, Walkden.—Receiving order made October 4th on debtor's own petition.

E. E. MATHERS, electrical engineer, 10c, High Street, Doncaster.—First meeting October 14th at the Official Receiver's Office, Sheffield. Public examination October 20th, at the County Court Hall, Sheffield.

E. CLONEY, tramways divisional traffic superintendent, 5, St. Alban's Road, Parliament Hill Fields, N.W.—Trustee (Mr. W. P. Bowyer, Senior Official Receiver, Carey Street, W.C.) released September 22nd.

G. F. KIVERON, electrical engineer, Sheffield.—Trustee (Mr. L. J. Clegg, Official Receiver, 14, Figtree Lane, Sheffield) released July 22nd.

Dissolutions of Partnership.—ASTON AYRES & CO., electrical and mechanical engineers, Church End, Arlsey.—Mr. E. W. Brackenbury and Mr. N. A. Ayres have dissolved partnership.

G. BEITH & SONS, electrical engineers, Fairlawn, Pontypridd.—Mr. J. R. Beith, Mr. G. R. Beith, and Mr. R. D. Beith have dissolved partnership. Debts will be attended to on behalf of the late firm by Mr. A. Mart, 8, Park Place, Cardiff.

Trade Announcements.—MESSRS. FRANCIS POLDEN & CO., LTD., have opened a showroom and West End branch at 17, Wells Street, Oxford Street, London, W.

MESSRS. PERRY & BLACKWELL have commenced business as electrical and mechanical engineers and suppliers at 10, Marsden Street, Chapel Walks, Manchester. They invite manufacturers to send copies of stock lists, catalogues, and other such literature.

MESSRS. LESLIE DIXON & Co. have removed to new offices and showrooms at 9, Colonial Avenue, Minories, E.C.1.

THE PHENIX INDUSTRIAL SERVICES have moved to 12, London Wall, E.C.2. Telephone number: London Wall 3374.

MR. FREDK. HARVEY, general engineer, has opened an electrical department and showrooms at 4, Wellington Street, Teignmouth, where a public electricity supply system is shortly to be inaugurated. He desires to receive catalogues.

MESSRS. PARKER & TURNBULL, electrical engineers, have opened premises at 81, Shakespear Street, Dumfries.

MR. PAUL W. RANDS has taken additional premises in Caxton House for the purpose of showing heating, cooking, and general domestic electric appliances in operation.

MR. JAMES WALKER, electrical manager, has severed his connection with Messrs. Wood & Cairns, Ltd., Edinburgh, and has opened up business (entirely wholesale) under the name of The Walker Electrical Service, at 11, Clyde Street, Edinburgh.

MESSRS. WIGGLESWORTH & CROSSLEY, electrical engineers and heating specialists, are opening extensive premises at the junction of Bradford Road and Aireville Road, Frizinghall, Bradford.

THE HOLLAND HOUSE ELECTRICAL CO., LTD., have removed to larger premises at 241a, West George Street, Glasgow.

Catalogues and Lists.—THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester. Leaflet 4.102/6.

—An illustrated price list of various types of "Cosmos" vacuum and gas-filled lamps.

PARK ROYAL ENGINEERING WORKS, LTD., Cumberland Avenue, N.W. 10.—"Modern Switchgear," a well-illustrated catalogue of high- and low-pressure gear, including oil switches, cubicles, switch-fuses, ironclad distribution boards, &c.

MESSRS. GAMBRELL BROS., LTD., Merton Road, Southfields, S.W. 18.—A bound series of leaflets dealing with electrical testing instruments, &c., including potentiometers, Wheatstone bridges, special plug contacts, and galvanometers.

MESSRS. CHOW, TOOGOOD & CO., 15, Wardour Mews, D'Arbury Street, Wardour Street, London, W.1.—Net trade price list of electrical accessories (October and November).

MESSRS. COLE, MARCHEM & MORLEY, LTD., Bradford.—Pamphlet No. 66, illustrating and describing "Delas" air extractors.

MESSRS. PATERSON, LTD., 100, Street, Birmingham.—An illustrated folder giving prices of electric fires, kettles, toasters, and irons.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Leaflet No. H-2694, illustrating and describing "Magnet" ornamental cast-iron electric fires; also Leaflet No. H-2697, giving revised prices of "Magnet" electric cooking and heating appliances.

MESSRS. L. C. HAWKINS & Co., 116, Charing Cross Road, W.C.2.—Showcard advertising the "Universal" portable radiator and a descriptive folder dealing with the "Universal" vacuum cleaner.

MESSRS. X-RAYS, LTD., 11, Torrington Place, Gower Street, London, W.C.1.—Circular relating to the prices of X-ray tubes and apparatus, and the effect of trade combinations upon the selling prices of such products.

MESSRS. HIGGS BROS., Sand Pits, Birmingham.—Specification No. 7, giving full descriptions, illustrations, and dimensions of d.c. motors and dynamos and a.c. motors, as well as controlling gear.

Private Arrangement.—JOHN VICTOR PERRY, trading as J. V. Perry & Co., Conway Street, Birkenhead, electrical engineer.—A meeting of the creditors of the above was held recently at the Exchange Hotel, Liverpool, when a statement of affairs was presented which had been prepared by Mr. J. F. Warburton, accountant, Manchester, disclosing liabilities of £850, all of which were due to the trade. After allowing £20 for preferential claims the assets were estimated to realise £923, or a surplus of £71. The assets were as follows: Stock-in-trade £1,108, estimated to realise £554; fixtures, fittings, utensils, &c., £54, expected to produce £40; office furniture valued at £20; life policies £18; motor cycle, cost £170, expected to realise £100; work in progress £50; and book-debts, valued at £90. It was stated that the debtor commenced trading on his own account at Broad Street, Pendleton, Manchester, in September 1919, with a capital of £100. He was later joined by a partner who brought in £20, but in July last he gave up the Manchester business and started at his present address, when the partner retired. The latter received nothing on going out. The total purchases at Birkenhead up to September 3rd last were £1,492, but since that date the books had not been written up. In the same period the sales were £256, and it was estimated that a gross profit of 35 per cent. was made. During the period the debtor had employed four men, two boys and a girl, at total wages of 18 guineas per week, while his personal drawings were £3 weekly, and he had expended £150 on advertising and £80 on office equipment and printing. The present position was attributed to the slump in trade. The debtor made an offer to pay his creditors in full, it being proposed that he should set aside a sum of £40 per month. After discussing the position it was decided that the deed of assignment already executed to Mr. Warburton should be confirmed and a committee of inspection was appointed consisting of the representative of the General Electric Co., Ltd., Mr. J. Airey, and Mr. Parkin S. Booth. The following are creditors:—

Metropolitan - Vickers Electrical	Galley Bros.	£
Co., Ltd.	...	22
...	...	30
Cable Accessories Co., Ltd.	...	30
Douglas & Davies, Ltd.	...	22
Electrical Specialties Co.	...	20
O'Brien, Ltd., Ilkesh.	...	20
Lamp Factors Co., Ltd.	...	20
Hinson & Co.	...	23

Calendar.—An attractive calendar running from July, 1921, to June, 1922, has been sent to us by the METROPOLITAN-VICKERS ELECTRICAL CO., LTD. This bears an eleven-colour design of a draped female figure seated on a terrestrial sphere and holding a "Cosmos" lamp. The calendar is interspersed with humorous illustrations of "Cosmos characters."

Electricity Supply Rifle League.—The following are the results of matches shot during September:—

City Co., 571. Central Co., 555; City Co., 564. Fulham, 487; Shoreditch, 576. Central Co., 557; Hackney, 524. Fulham, 461; County Co., 550. Hackney, 542. The City Co. now heads the League with 18 points.

Electrical Trade in South Africa.—A cable from the National Bank of South Africa, Cape Town, states that imports into British South Africa for the seven months ended July show a falling away of £17,500,000 compared with the corresponding period of 1920. Iron and steel manufactures (excluding machinery) declined by £825,000, or 35 per cent., whereas imports of the following have risen:

Manufacturing machinery, £429,000, or 66 per cent.
Mining machinery, £456,000, or 112 per cent.
Other machinery, £50,000, or 44 per cent.
Implements and tools (including agricultural machinery), £262,000, or 31 per cent.
Electrical material, £453,000, or 53 per cent.
The following exhibited declines:—
Hardware and cutlery, £554,000, or 26 per cent.
Rubber (including tires), £659,000, or 79 per cent.

Inquiries for electrical goods are more numerous than in recent months, and the tendency is better. Some reduction in prices of lamps, adaptors, lampholders, switches, and ceiling roses is reported.—Birmingham Post.

Our Foreign Trade. SEPTEMBER FIGURES. The following were the values of imports and exports of electrical goods and machinery during September, 1921:

	Sept., 1921.	Inc. or dec. £	9 months, 1921. Inc. or dec. £
IMPORTS.			
Electrical goods, &c.	123,713	- 57,067	+ 503,857
Machinery ...	546,737	- 1,129,063	- 5,597,065
EXPORTS.			
Electrical goods, &c.	924,767	+ 36,530	+ 2,642,340
Machinery ...	5,197,917	- 349,785	+ 15,356,340
RE-EXPORTS.			
Electrical goods, &c.	13,607	- 3,481	+ 77,065
Machinery ...	104,577	- 52,104	- 231,880

Trade with France.—The British Chamber of Commerce in Paris, in connection with efforts to bring about a revival of British trade in France, is preparing a new Trade Index of British manufacturers and exporters. It will be distributed broadcast among all French industrial and commercial organisations, Chambers of Commerce, Chambres Syndicales, &c., and numerous industrial buyers in France. The address of the Chamber is 6, Rue Halévy, Paris.

A Chinese Inquiry.—It is stated that the Chinese Ministry of Communications recently invited a number of electrical experts, both Chinese and foreign, to a conference on the promotion of the electrical industry.

Chinese Notes.—The Chinese Foreign Office has been negotiating with the French Government with a view to securing the cancellation of the Sino-French agreement relative to the formation of the Peking Tramways Co.

The Government recently notified the Chile authorities that a thorough investigation of copper and iron deposits should be instituted owing to the increasing needs of the Mint.

The Tsung Hua Electric Apparatus Manufacturing Co., Ltd., organised by Shih Shao-sen, recently petitioned the Ministry of Agriculture and Commerce for registration.

The Kweisui Electric Light Co. has been established at Kweisui, Shansi, by Yung Yau-sen. The Ming Ming Electric Light Co., of Tienningchwang, Kiahshin, has been organised by Chiao Shen-ching.

Book Notices.—Scientific Paper No. 418 of the U.S. Bureau of Standards, "Spectro-radiometric Investigation of the Transmission of Various Substances, II." Washington: Government Printing Office. Price 5 cents.—The paper gives transmission data in the spectra of a series of mineral, animal, and vegetable oils (containing fatty acids), nitrocellulose, bakelite, and selenite. It is shown that the absorption spectra of the oils are so nearly identical that they cannot be used for detecting the adulteration of one oil with another.

The *Journal of the South African Institution of Engineers*. Vol. XX, No. 2, September, 1921. Price 2s.—The Inaugural Address of the new President (Mr. R. C. Atkinson) is included in this number, as well as several discussions of papers, and a list of recent South African patents.

The *Transactions of the South African Institute of Electrical Engineers*, Vol. XII, Part 8, August, 1921. Price 2s.—Mr. J. W. Beauchamp's paper on "Multi-part Tariffs," recently read before the I.E.E., is reproduced in this issue, together with a discussion.

"Bibliographie des Sciences et de l'Industrie," September, 1921.—A list of scientific works in all languages published by Dunod, Quai des Grands-Augustins, 47 et 49, Paris VI. The title and price of each book is accompanied by a short summary of contents.

"Hydro-electric Engineering," by A. H. Gibson, Vol. I, Civil and Mechanical, pp. x+232; 164 figs. Price 25s. net. "Fuel and Refractory Materials," by A. H. Sexton, new edition, revised and enlarged, by W. B. Davidson, 368 pp.; 109 figs. Price 12s. 6d. net. London: Blackie & Son, Ltd.

"Fifty Years of Electricity—The Memories of an Electrical Engineer," by J. A. Fleming, pp. xii+371; numerous figs. and many illustrations. London: The Wireless Press, Ltd. Price 30s. net.

"The Motor Electrical Manual," pp. 168; illustrated. London: Temple Press, Ltd. Price 3s. net.

The attention of readers who wish to maintain their knowledge of the French language is directed to a new weekly paper, *La France*, which is being published at 2d. by Messrs. Evans Bros., of Montague House, Russell Square, W.C. 1. The first number appeared on October 6th. Its object is to assist students in schools and colleges and assistants in business offices, and we believe it will be welcomed by such.

Scientific Paper No. 415 of the U.S. Bureau of Standards, "Use of the Ulbricht Sphere in Measuring Reflection and Transmission Factors." Washington: Government Printing Office. Price 5 cents. In this paper a general survey is given of the theory and use of a hollow sphere in measuring the reflection factor of surfaces. The theory of the infinite luminous planes and instruments based upon them are also discussed.

Specification No. 4-1921 of the British Engineering Standards Association, "Dimensions and Properties of British Standard Channels and Beams for Structural Purposes." London: Crosby Lockwood & Son. Price 1s. net. This gives such details as moments of inertia, weight per foot, moduli of sections, radii of gyration, &c., for the sections set out in a previous specification.

Conservancy Vehicles for Calcutta.—The Calcutta Corporation is experimenting with a conservancy lorry service in certain wards. A trial is also being given to electric vehicles. When the question between electric and petrol lorries is settled a large number of lorries will be required by the Corporation.—*Reuter's Trade Service* (Bombay).

An Australian Cable Manufacturing Company.—We have before us a copy of a prospectus that we understand was issued in Australia in July inviting subscriptions for 150,000 ordinary shares of £1 each in Commonwealth Cables, Ltd. The nominal capital is £200,000, and in addition to the shares offered, 10,000 deferred shares of £1 each were to be issued to the vendors and promoters as full consideration for the transfer to the company of an agreement entered into with the P.M.G. (Australia) for the supply of telephone cables. 40,000 shares of £1 each were to be held in reserve. The estimated expenditure upon works and equipment and leaving £40,000 for working capital and preliminary expenses, figured at £85,000, but as the whole of this was not required at once, the company was to go to allotment when 60,000 contributing shares had been applied for. It is proposed to manufacture all classes of cables and insulated wires for electrical work, but in the first instance attention is to be devoted to the manufacture of lead-sheathed telephone cables for the P.M.G.'s department. A contract signed with the P.M.G. amounts to £217,606 and is expected to yield a net profit of £38,400. It is stated that the requirements of the department should reach at least £500,000 per annum in future. The "provisional directors" are C. A. Gibson and J. J. Hughes, and the vendors and promoters are Messrs. C. A., W. G., and H. Gibson and J. J. Hughes. Mr. W. G. Gibson will act as managing director. He was in this country from 1916 to 1919 under the Ministry of Munitions, and during that period he made exhaustive inquiries into the methods adopted in modern works for the successful manufacture of cables and their economical production in Australia. The company will have the services of an electrical engineer with over 20 years' experience of the manufacture of cables in three of the largest works in England and on the Continent. The prospectus contains an estimate of profits anticipating a dividend of 20 per cent. It was expected to begin the delivery of cable three months after the completion of the works. The plant was to be completed within eight months from the date of order.

Sydney Turbo-Generator Contract.—WRIT SERVED.—At a meeting of the Sydney City Council in August the town clerk reported that he had received a letter from Messrs. Sly and Russell, solicitors, of Sydney, on behalf of the English Electric Co. of Australia, Ltd. This had reference to a report that the Electric Supply Committee of the City Council had decided to adopt the tender of Messrs. Thompson Bros., of Castlemaine, Victoria, for an Australian-made turbo-generator, to be portion of the new electric light and power plant to meet the estimated demand in 1923, the contract price being £125,000. Messrs. Sly & Russell stated they had instructions to proceed in the matter and that their clients intended to claim £60,000 damages against the City Council. The town clerk added that he had accepted service of the writ.

A G.E.C. Window Display.—One of the means adopted by the GENERAL ELECTRIC CO., LTD., for popularising its "Magnet" heating and cooking appliances is a window display which places in contrast the old insanitary and inconvenient ways of cooking, &c., and the new electrical way. Retailers of "Magnet" appliances may obtain this display from the company, as well as pamphlets, overprinted with their name and address. The company also offers to assist in the provision of suitable publicity matter for insertion in local papers, &c.

Export Credit Insurance and Unemployment.—Sir Edward Mountain, chairman and managing director of the Eagle Star & British Dominions Insurance Co., interviewed in the *Manchester Guardian Commercial*, says:—"It is apparent to everybody that some urgent steps will have to be taken to relieve unemployment. My suggestion is that the Government should appoint a committee of our leading financiers and commercial men, who should conduct the export credit insurance on behalf of the Government, free of all expense for services rendered. The committee should consist of our leading bankers, insurance experts, representatives of our leading merchants in shipping, and Government representatives from the Treasury and the Board of Trade. One of their first businesses would be to send for the leading bankers and financiers of the countries who wish to buy our goods and endeavour in conference with them to overcome some of the difficulties which at present exist. I suggest that one of their first methods of doing business would be to get a syndicate of the leading banks of any such purchasing country, who would jointly and severally guarantee the purchasing merchant of that country, and that, in addition to that, the Government of the country should also give their guarantee. The committee could on behalf of the Government grant credit insurance wherever they were satisfied that the purchasing merchant could give immediate security or future security." Questioned as to the relation between his scheme and the Board of Trade and the Ter Meulen scheme, Sir Edward pointed out that there was no question of competition between the Ter Meulen scheme and his own. The two were complementary and could work in together.

Exhibition at Huddersfield.—An International Domestic Economy and Trades Exhibition is to be held in the Drill Hall, Huddersfield, from November 17th to 26th. All kinds of cooking apparatus and domestic appliances will be included in one of its sections. Particulars regarding space, rates, &c., can be had on application to the general manager, Mr. P. J. Hogben, at the Drill Hall.

Engineering Industry.—The Times announces that the British Engineers' Association has called a conference of its members on October 13th to consider means of restoring vitality to the engineering industry.

Manufacture of Telegraph and Telephone Material in Czecho-Slovakia.—The *Journée Industrielle* learns from Prague that the Telefrafia combine has obtained during the year orders to the value of 16 million kronen, the more important orders coming from Russia, Bulgaria, Yugo-Slavia, and Belgium. The Czecho-Slovak Ministry of Posts and Telegraphs has just placed all orders in connection with the public telephones in Prague in the hands of the company. The Telefrafia, which has a capital of 8 million kronen, 60 per cent. of which is subscribed by the State, represents a fusion at the instigation of the State of three companies, all founded since the end of the war.—*Reuter's Trade Service* (Paris).

Tariff Uncertainty in Spain.—Several British firms trading with Spain have recently shown uneasiness at the apparent inactivity of their agents in the Spanish market. The Commercial Secretary to His Majesty's Legation in Madrid (Mr. S. G. Irving), writing to the Department of Overseas Trade states that this supposed "inactivity" may be easily explained up to a point by the two obvious factors which are at present combining to restrict the Spanish import trade, namely: the general depression and the high import duties. The general depression has been accentuated by the failure of the Bank of Barcelona and indirectly by military events in Morocco. Another obstacle is the restriction of credit owing to the necessitous condition of the Government. Most of the Treasury Bonds issued in the past year have been taken up by the banks, who have had some difficulty in putting them on the market. A still more effective check on orders than any of these three factors exists in the prospect of an early alteration of the import duties, possibly in January next. As they have been already raised once this year they are hardly likely to be further increased except in certain instances, whilst it is expected that some may be lowered. Importers are not unnaturally inclined to wait and see; the more so since several of them bought considerable stocks in anticipation of the increase in May last.

This applies chiefly to machinery. In the interval, while the revision of the tariff is actually taking place, there is no firm basis for making calculations, and until importers can adjust their buying policy on such a firm basis as a fixed tariff will provide—whether at higher or lower rates than at present obtain—it is unlikely that import trade in Spain will show increased liveliness.

Copper and Lead Prices.—Messrs. F. Smith & Co. report on October 12th:—Copper (electrolytic) bars, £77 10s., £2 increase; ditto sheets, no change; ditto wire rods, £93 10s., £2 increase; ditto h.c. wire, 11 9/16d., 5/16d. increase.

Messrs. James & Shakespear report October 12th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £24 10s., 5s. increase on last week's prices.

Chilean Electric Railway Contract.—The Westinghouse Electric International Co. announces that it has received final confirmation of the contract to supply the equipment to electrify the Chilean State Railroad between Valparaiso and Santiago, and the Los Andes branch. This contract was received from the Chilean Government. The main line, which is 116 miles long, is now under steam operation. It connects the leading seaport (Valparaiso) with the capital (Santiago), while the line to Los Andes is 28 miles long, and forms the Chilean State Railway section of the trans-Continental line to Buenos Aires. The contract (\$7,000,000), it is stated, was secured after keen competition from Germany and other European companies. The equipment to be furnished consists of eleven local passenger locomotives, fifteen road freight locomotives, seven switching engines, and five substations of 4,000 kW capacity each. The 3,000-volt direct-current system which will be used will be strictly American in character. The capacity of the equipment will be 50 per cent. greater than the present traffic demands, and the plans have been drawn that an increase of traffic capacity to three times the present demands can readily be met. It is stated that owing to the abundance of water power in Chile, and the high price of fuel, all of the Chilean railroads will eventually be electrified, and the present project is the first step in this progress. The contract is the third large order for electric railway supplies recently received by the Westinghouse International Co. from foreign countries in the past few months, the others being obtained from France and Japan.

In the same connection it is reported from Valparaiso that "The Government has authorised the Chilean Minister at Washington to accept a proposal by New York bankers for a loan of 25,000,000 pesos gold of 16d. and \$10,000,000 (U.S.), which will be principally used for the payment of expenses in connection with the electrification of the railways."

Fire.—The CENTRAL LONDON ELECTRICAL CO., of Great Queen Street, W.C.2, states that the loss sustained by fire on its premises last Friday is fully covered by insurance. Temporary inconvenience occurred owing to the loss of several rooms, but the company reports that it is carrying on as usual.

Miners' Electric Lamps.—Draft Regulations have been made by the Board of Trade under the Coal Mines Act, 1911, relating to electric safety lamps to the following effect:—

1. Every outer case of an electric safety lamp of approved type shall be inscribed by the maker of the lamps of that type with his name and the name of the type of lamp, and all the integral parts of the lamps of that type shall be inscribed with a distinctive trade mark registered by the makers of the lamp. For the purposes of these regulations the integral parts of the lamp shall be the outer case, the whole of the accumulator, the bulb, the detachable part (if any) of the outer case and such other parts (if any) of the lamp as are named in the official specification.

2. All the integral parts of any of such lamps as aforesaid shall conform with the provisions as to integral parts contained in these regulations, and any such lamp containing an integral part which does not so conform shall be deemed not to be a lamp of the approved type: Provided that nothing in this regulation shall preclude the Board of Trade from approving the said lamp as a lamp of a different type, subject to such conditions as the Board may see fit.

3. The respective makers of all approved types of electric safety lamp shall inspect, gauge, or test before issue, in such manner as the Board of Trade may prescribe, all lamps and all integral parts of lamps bearing their name or trade mark.

These draft regulations are based upon the unanimous recommendations of the Miners' Lamps Committee in their Report (Memorandum No. 3) on "The Supply of Spare Parts or Fittings for the repair and renewal of Safety Lamps," and should be considered in the light of that report. In particular, the proviso to the second regulation should be read in conjunction with paragraphs 13 and 33 of the report and with recommendations (a) and (b).

Any objection with respect to the draft regulations must be sent to the Secretary for Mines within 30 days from October 10th.

For Sale.—By direction of the Disposal Board, Mr. C. D. Phillips will offer by auction on October 25th and following days at the National Shipyard, Beachley, near Chepstow, Mon., a shipyard plant, comprising cranes, machine tools, electric motors, cable, electrical stores, &c. For particulars see our advertisement pages in this issue.

By order of Nobel Industries, Ltd., Messrs. Fuller, Horsey, Sons & Cassell will sell by auction on November 8th and following days, at Angel Road, Edmonton, surplus plant and machinery. (See this issue.)

Dranfield's Special Three-phase Voltmeter.—With reference to the note on this subject, on page 377, we learn that it was sent to us under a misunderstanding. Mr. Dranfield's agreement with Messrs. Ferranti, Ltd., having expired, the sole licensees for the manufacture and sale of the instrument are now Messrs. Nalder Bros. & Thompson, Ltd. (London).

Electrical Wages in Scotland.—The Electrical Contractors' Association of Scotland and the Electrical Trades Union have agreed to a reduction of 1d. per hour in wages from October 1st, to be followed by a reduction of 1d. per hour on November 1st. Further consideration of wages is to be subject to one month's notice on either side.

Turbine Furnaces.—The TURBINE FURNACE CO., LTD., has received a contract for a set of its patent turbine furnaces, for a Davey, Paxman boiler, from Messrs. Edwards & Armstrong, of Bow Bridge, near Stroud, and one for a set for a Lancashire boiler for the Pembroke Urban District Council's Electricity Works, Dublin.

Russian Electrical Undertakings.—The annual report of the Zurich Bank for Electrical Undertakings, states that no recent news has been received concerning the Petrograd Electric Lighting Co., of 1886, or the Moscow Electric Power Transmission Co., of Moscow and Petrograd whose works had been declared by the Soviet Government to be national undertakings and taken over by the State. Nevertheless, it seems that material damage to the works has not occurred, and limited working continues to be maintained.

Annual Outing.—The employés of the Blackpool electricity and tramways departments made the Lake district the venue for their annual picnic. The party of seventy was conveyed in motor charabancs, lunch being served at Grange-over-Sands, and tea at Lancaster.

False Marking of German Goods.—The *Daily Telegraph* correspondent at Copenhagen states that the Association of Danish Manufacturers, having learned that a German machinery firm in Flensburg was using false Danish trade marks in order to export its goods to France, has informed the French Legation at Copenhagen. It appears that other German firms are adopting similar tricks in order to export their goods to Allied countries.

Electric Vehicle Batteries.—A booklet recently issued by the D.P. BATTERY CO., LTD., entitled "A New Development in Electric Vehicle Batteries" describes the cell which the company has developed, with flat lead plates of the pasted type, formed by a special process, and fitted with the "D.P. patent combined separator," which is porous, elastic under compression, and quite unaffected by sulphuric acid or electrolytic action, and, it is claimed, enables the cell to stand rough work without injury.

The cells are made in 14 standard sizes, and assembled in wooden crates with iron lifting straps. The booklet contains clear instructions for installing and working the batteries.

Railway Interests in Germany.—The electric railway and allied departments of the Siemens & Halske Co., of Berlin, have been transferred to a partnership company under the style of the Constructional Union of Berlin and Munich, and a capital of 20,300,000 marks, which is held by the Siemens and Halske Co., the Siemens-Schuckert Works, and the Schuckert Co., of Nuremberg. Besides railways, the new company will undertake hydro-electric works, harbour, river, and reinforced concrete works, &c.

A Glow Lamp Holding Co.—A holding company has been formed at Aarau, Switzerland, under the title of the Aarau Glow Lamp Works Co. A Zurich newspaper states that the Dutch Philips Co. and the German Auer Co. are interested in the new company.

The German Electrical Industry.—The German correspondent of a Dutch newspaper states that activity in the German electrical industry has recently largely increased so that most of the manufacturing works have sufficient orders on hand for some months forward. It is calculated that with the abolition of the "sanctions" the demand will become brisk, as these compulsory measures have had a disturbing effect on trade between the occupied and non-occupied districts. Certain foreign countries have placed large orders with the German works, although serious complaints are being made that it is impossible to raise sale prices because foreign competitors in various countries, less well supplied with orders, are offering at prices at which the German works are unable to earn any profits. A considerable improvement has taken place in the orders for dynamos and transformers; the installation business for motors has so far been active, and the early harvest has increased the demand for small motors. A specially large call is noticed for high-pressure plant in connection with the extension of the large central stations, while the low-pressure department also improved in September, as compared with the previous month. A somewhat similar report, although briefer, has also appeared in the German newspapers.

Belgian Interests in Russia.—Addressing the shareholders at the ordinary meeting of the Imatra Société pour la Production de l'Energie Electrique, held in Brussels on October 4th, Mr. Jean Rollin, chairman, is reported to have stated that the company's Russian branch—the Société des Centrales Electriques Regionales—experienced considerable development owing to the war, and had been able to declare dividends at the ratio of 4 per cent. for the years 1914 to 1916 inclusive. The undertaking was at present nationalised by the Soviet Government. Concerning the company's branch in Finland, which owned the water power of the Little Imatra, the chairman mentioned that as a result of events the branch had been unable to begin the execution of the essential programme, which aimed at the production and transmission of energy to Petrograd. The directors of the parent company had examined various schemes for the provisional utilisation of a portion of the available water power for Finnish purposes, but had been unable to carry out any one of them owing to the industrial uncertainty in Finland.

The Engineering Trade Dispute.—The form of ballot paper to be issued to members of the Engineering and Shipbuilding trade unions with regard to the withdrawal of the munitions bonus was decided upon on Tuesday. Ballot papers are returnable by October 26th.

Inquiry.—The address of makers of the "Eanda" universal laboratory motor and controllers (Messrs. Eimer and Amend, New York) or their representatives is asked for.

Catalogues Wanted.—Messrs. Wilson & Ridley, electrical engineers, New Bridge Street Station, Newcastle-on-Tyne, desire to receive catalogues and price lists of washing machines and domestic appliances.

31st, 1926. £1,150,000; expenditure on normal extensions of mains and sub-stations during the years 1924-26. £600,000. It was recommended that authority be sought immediately to borrow all or part of this money.

Bedford.—INCREASED DISCOUNT.—The Town Council has increased the discount allowed to consumers for power from 2½ to 5 per cent.

Belfast.—CONSULTANTS' REPORT.—At a meeting of the City Council, in committee, on September 29th, a further report by Messrs. Preece, Cardew & Rider, dated August 29th, was "received." According to the *Irish News*, the first paragraph of the report was as follows:—

"We now have pleasure in reporting on the financial position of the electricity undertaking as we estimate it to be when the first section of the Harbour power station is completed with 24,000 kW of installed plant. We have had the advantage of a consultation with several of the Council's officials since our report of June 7th (now withdrawn) was submitted, and a number of the factors to which we had previously not given sufficient weight were frankly discussed. As a result we have reconsidered the whole subject, and believe that this report now fairly sets out the correct position."

From an attached schedule it appears the capital expenditure amounts to £1,833,234, but this does not include the work done by local labour under the supervision of Mr. Bloxam in connection with either cable-laying or plant erection in the various sub-stations, &c., which, it is mentioned, will add materially to the total; nor does it include any of the irrecoverable cost of equipping the temporary power station, which the consultants presumed would be repaid out of revenue.

Mr. J. H. Rider was present, and made a long explanatory statement. Councillor Campbell asked him to state the factors alluded to in the first paragraph of the report, but Mr. Rider mentioned that the report of June 7th, having been withdrawn, was not now in existence, and declined to give them. Councillor Campbell thereupon moved a resolution that as Mr. Rider declined to disclose the factors alluded to, and that as members of the Council had not had that information, the meeting should stand adjourned until full information was supplied. This was carried, and the meeting adjourned.

At the monthly meeting of the Corporation last week, it was decided to dismiss the consultants, and the Electricity Committee resigned in a body, thus "giving the Council the opportunity of appointing a committee that would more effectively carry on the work." Sir Joseph Davidson said that the time had come when the critics of the committee should arise and do the work themselves. Several other matters were before the Council: A motion to increase the price of electricity by 20 per cent., another to ask consent for an application to the Electricity Commissioners for leave to borrow £550,000 for the completion of the new power station, and a third for sanction to pay £708 fees to the consultants. The increase in the price of energy was passed, and the other two motions were referred back to the committee. Subsequently a movement to upset the decision of the Corporation relative to the consultants—which was carried by a majority of only two—was set aside.

At a special meeting of the City Council on the 10th inst., called by requisition of thirty members, the resolution passed at the last monthly meeting, dispensing with the services of the Electricity Committee's consultants, was rescinded by a vote of 23 to 19. The whole of the work in connection with the construction of the new power station was brought to a standstill by the dismissal of the consultants, and would have continued to be held up indefinitely until other consultants had been appointed. Even if it had gone to this, the delay in the placing of contracts for the machinery of the power station would have been very bad business, for it would have loaded the undertaking with a mass of dead charges and probably with two sets of consultants' fees. The only way of relief from the serious financial position in which the electricity undertaking now finds itself is by the completion of the new power station. Sir James Johnston, in moving a resolution to rescind the dismissal, said that he understood that three points of objection were put forward by Councillor Alexander: that Sir John Snell blundered in ordering the 5,000 kW machine; that it had some imperfections; and that a new filter had to be ordered for it. Sir John was not responsible for that. The Corporation was in great need of one of those machines. One was offered, and the Committee bought it. Sir John Snell was not responsible for the specification. The only commission he got on that was on the new filter, which cost about £400 or £500. That machine had not been scrapped; it was working still. As to the shipyard agreement, he (Sir James) admitted it was a pity, but he was sure it had been done for the best at the time; but he understood Sir John Snell was paid no commission for that. He thought that the Committee asked his advice, and he said he was prepared to help the Committee as far as possible. Councillor Jameson, in seconding the resolution, said that if the decision of the Corporation at its previous meeting was not altered it would mean irretrievable financial loss. Councillor McConnell referred to the original agreement between the Corporation and Sir John Snell; there was not a word in that agreement which would lead anyone to infer that Sir John was to give them expert financial advice.

LIGHTING AND POWER NOTES.

Australia.—SYDNEY.—A statement of the requirements of the Electricity Department up to the end of 1926 was recently placed before the City Council. The total is estimated at £3,414,000, made up as follows: Commitments up to July 15th, 1921, £580,000; estimated expenditure upon capital account to December 31st, 1923, £984,000; preliminary expenditure in connection with new station, £100,000; further expenditure on new station and trunk mains up to December

Bexley.—**STRIKE.**—Owing to a dispute which has arisen between the Linton District Council and 200 of its employees the men have ceased work. The streets are unlighted, and consumers are receiving only a limited supply of electricity.

Blackburn.—**NEW SUB-STATION.**—The Electricity Committee proposes to erect an electricity sub-station at Mill Hill for the supply of electricity to the district.

Bradford.—**LOAN.**—The Electricity Committee has applied to the Electricity Commissioners for sanction to the borrowing of £250,000 for mains, transformers, transformer chambers, and equipment.

Burton.—**LOAN.**—Application has been made to the Electricity Commissioners for sanction to a loan of £20,000 for electric mains, services, and transformers.

Dundalk.—**INCREASED CHARGES.**—The Electricity Committee has increased the electricity charges for power and heating by 3d. per unit, and to kinemas by 1d. per unit.

Doncaster.—**LOAN.**—The Town Council has decided to apply for a loan of £1,712, to meet the cost of supplying electricity to 113 houses, to be erected on the Wheatley Hill estate by private enterprise.

Glasgow.—**ELECTRIC COOKERS.**—Owing to the increased demand for electric cookers, the Corporation has decided to supply a further 100, on hire, to consumers.

Kircudbright.—**ELECTRICITY SUPPLY.**—A committee has been appointed to consider the question of supplying the town with electricity.

Knaresborough.—**ELECTRIC LIGHTING ORDER.**—The Ministry of Health has sanctioned the extension of the Electric Lighting Order of 1915 to March 1st, 1922.

Leeds.—**CABLES IN RIVER AIRE.**—To meet prospective demands for electricity the Corporation Electricity Department is shortly commencing the laying of mains along the bed of the Aire from Whitehall Road to Victoria Bridge. The cables, which will be capable of transmitting a load of 50,000 h.p., will be laid in a dredged trench and covered in with broken ballast. A small dam will be constructed at the Bondman Weir through which the mains will pass.

Mirfield (Yorks.).—**ELECTRICITY CHARGES.**—From October 1st, the Urban Council has increased the price of electricity for power and heating by 25 per cent., and reduced the discounts previously allowed by 50 per cent.

Oswestry.—**PROPOSED SALE OF UNDERTAKING.**—At a meeting of the Town Council, last week, a letter was received from the secretary of the Oswestry Electric Light Company, asking the Council whether it would make an offer for the undertaking.

Perth.—**FIRE CLAIM.**—Alleging that a fire was caused by a fault in a municipal cable, the London & Scottish Assurance Corporation claims repayment of £30 which the Corporation allowed Perth Town Council in respect of damage caused by a fire. The Council declines to accept any liability.

Peterborough.—**LOAN SANCTIONED.**—The City Council has received the sanction of the Electricity Commissioners to the borrowing of £74,187, being part of the sum required for electricity purposes.

Redditch.—**LOSS ON UNDERTAKING.**—Provision has to be made to meet an estimated further loss of £6,750, equalling a 2s. 6d. rate, on the electricity undertaking in the ensuing half-year.

Sheffield.—**ELECTRIC FURNACES.**—According to the F.B.I. Bulletin, the Corporation has reduced the charges for energy for electric-furnace work, with the result that many furnaces have been put into operation.

Southwick (Sussex).—**ELECTRICITY SUPPLY.**—The Urban Council has decided to approach the promoter of the Shoreham electric lighting scheme with a view to his giving a supply to the town, the Council having found it impossible to fix up satisfactory terms with the Gas Co. to lay services to the Council houses.

Swansea.—**MONEY SHORTAGE REMEDIES.**—The necessity for an immediate working balance for the Electricity Department has led the Electricity Committee to consider schemes for securing this. There were four available methods: Increasing the charges; quicker collection of revenue; insistence upon deposits; and accumulating profits and charging all capital expenditure to loans. The borough treasurer considered that there was no justification for a price increase, but the institution of monthly instead of quarterly accounts was worthy of consideration; these would help business men to a quicker calculation of costs. The extension of deposits was not recommended. As regarded the fourth method, the borough treasurer thought that all capital expenditure should be defrayed by loans, and also that until the department had a balance of £40,000 no funds should be contributed to rate relief. As far as possible the borough treasurer's recommendations are to be followed.

Teignmouth.—**ELECTRICITY SUPPLY.**—The Urban Council has sealed a supplementary agreement with Messrs. Purves, of Exeter, for a supply of electricity to the town.

Worcester.—**LOAN.**—The Electricity Committee has applied to the Electricity Commissioners for sanction to a loan of £5,898 for coal and ash handling equipment, and an automatic weigher and totaliser.

Worthing.—**LOAN.**—The Electricity Committee has applied to the Electricity Commissioners for sanction to the loan of £4,500 for mains and services.

York.—**HYDRO-ELECTRIC SCHEME.**—The chairman of the Electricity Committee drew attention to assertions which had recently been made in the city that the new hydro-electric generating plant which was being constructed on the Ouse at Linton Lock was likely to end in disaster, and to involve the city in a loss of nearly £80,000. He strongly refuted the allegations, which he described as a tissue of misstatements. There was not the slightest suggestion that the scheme would end in failure. The only serious complaint was the slow progress of the work, and the inadequate dams made to fulfil the temporary purpose of protecting the lower level work.—*Yorkshire Post.*

TRAMWAY AND RAILWAY NOTES.

Australia.—**PERTH.**—The Railway Commissioners' report on the Perth tramway system for 1920-21 shows the earnings as £224,892, an increase on the previous year of £37,000. The working expenses were £203,459, an increase of £55,000. After paying interest a deficit of £9,334 resulted, against the previous year's surplus of £10,106. The number of passengers carried was 25,753,113, an increase of over 6,500,000.—*Daily Telegraph* (Sydney).

Barrow.—**LOAN SANCTIONED.**—The Ministry of Transport has sanctioned the borrowing by the Corporation of £16,000 for car shed accommodation.

Bexley.—**STRIKE.**—As the result of the cessation of work of 200 employees of the Urban District Council, the tramway service between Crayford and Woolwich has been entirely suspended.

Bolton.—**TRAMWAY EXTENSIONS.**—The Corporation is promoting a Parliamentary Bill providing for the extension of the tramway system.

Bradford.—**LOAN.**—Application is to be made for power to borrow £8,573 for track renewals.

Burnley.—**PRICE OF ENERGY.**—The Electricity Committee recently informed the Tramways Committee that as soon as the Electricity Department had made good the losses occasioned by the excessive price paid for coal during the coal dispute, the price of power supplied to the tramways would be reduced.

Continental.—**SPAIN.**—A number of companies are contending for the contract for the construction of electric underground railways in Barcelona, some holding concessions and others applying for them. The most forward of these up to the present, mainly because it has secured a concession, is the Banco de Vizcaya; but the execution of the works which it would like to undertake is controlled by certain conditions which may force it to modify the course originally outlined. Besides the Town Council of Barcelona, the Compañía Ferrocarril Metropolitana de Barcelona, S.A., formed in February, 1921, is the possessor of the rights for the electric underground railway styled the S.O.-N.E. This railway has a character quite unlike the others, as it aims to link the principal lines between Saragossa and Barcelona and Tarragona and Barcelona, joining with the former at La Bordeta and with the latter at El Clot. There is no essential incompatibility between the two schemes, provided account is taken of article 14 of the concession, which prescribes agreement with other lines, sanctioned or applied for, as to the crossing of each other's tracks. It is here that the difficulty arises, for the S.O.-N.O. is to be built as a main line, with suitable curves and gradients for general traffic, whereas the Banco de Vizcaya line is planned as a civic line, with moderate gauge, small curves, and steep gradients.

Halifax.—**YEAR'S WORKING.**—The annual report of the Tramways Committee for the year ended March 31st last shows a total income of £230,302, as compared with £189,186 in the previous year. Working expenses amounted to £208,190, as against £162,892, leaving a gross profit of £22,111. After the deduction of capital charges, &c., there was a net loss of £618.

Keighley.—**RAILLESS SERVICE.**—The service between Cross Roads and Oxenhope has been restricted to two days at the week-ends. The system has lost about £10,000 in five years. The loss on the last financial year was £5,322, as against a loss on the railless tramway service of £3,400. At a Town Council meeting last week it was pointed out that the position now was probably considerably worse than at the end of the year, to which the report referred. Notice was given that at the next meeting of the Council a resolution would be put forward for the closing of all railless routes that did not pay, and the entire service is necessary.

Liverpool.—**TRAMWAY RECEIPTS.**—The receipts of the tramway undertaking show a falling-off of about £37,000. No less than 36,000,000 fewer passengers were carried.

London.—**DISTRICT RAILWAY.**—A number of new 2,250-h.p. eight-car trains are being run between the City and East Ham and Barking in place of the previous six-car trains.

DROP IN TRAMWAY TRAFFIC.—The drop of a million per week in the number of passengers carried in the London County Council tramcars, as compared with last year, was the subject of discussion at a meeting of the Council on October 11th.

Dr. Scott-Lidgett asked for some explanation as to the cause, and whether any means could be employed to check the drop in traffic, and Mr. Gilbert suggested that cheap midday penny fares might prove a remedy for this decrease. Mr. W. J. Squires, chairman of the Highways Committee, pointed out that during the period July 13th to September 28th, the receipts showed an increase of £129,141. The London tramways were in the same plight as other undertakings throughout the country, such as Liverpool and Manchester, a condition which might be attributed to the shortage of money. He doubted whether cheap midday fares would make up the loss, and particularly penny tickets. The question was to be raised at the Committee's meeting on October 13th.—*Morning Post*.

Newcastle-on-Tyne.—**YEAR'S WORKING.**—The annual report of the engineer and general manager of the tramway system (Mr. E. Hatton) shows a total revenue of £580,269; working expenses totalled £498,966, leaving a gross profit of £81,302. After the deduction of capital charges, &c., there was a net profit of £4,037.

Paisley.—**TRAMWAY CONTROL.**—The Glasgow Corporation Tramways Committee has under consideration a proposal for the acquisition of the Paisley tramway system.

Statutory Charges.—The Ministry of Transport announces that the Government has decided, unless the question is otherwise dealt with by Parliament, to take steps to extend the operation of the Tramways (Temporary Increase of Charges) Act, 1920, until February 15th, 1924.

Stoke-on-Trent.—**EXTENSION OF LEASE REFUSED.**—The Town Council had before it, last week, an application by the Potteries Electric Traction Co., Ltd., for a reconsideration of the terms of its lease from the Corporation in connection with the tramways, with a view to its extension. The Council decided not to entertain the application.

United States.—**NEW YORK.**—The State Transit Commission appointed to investigate the tangled finances of the New York City tramways, and elevated and underground railways, recommends municipal ownership.

This recommendation is interesting in view of the opposition of the present city government to increased fares, for which the companies have been long contending, declaring that otherwise receiverships would become necessary.—*Reuter*.

York.—**EXTENSION REQUIRED.**—The City Council has received a petition from Micklegate residents praying for an extension of the tramways to the Poppleton Road boundary of the City.

TELEGRAPH AND TELEPHONE NOTES.

Bradford.—**NEW SWITCHBOARD.**—The Bradford Watch Committee recommends that a private telephone switchboard be installed in the police department, with direct extension lines to the several district police stations, in place of the present telephone arrangements, at an additional annual cost to the Corporation of £34.

Czecho-Slovakia.—**TELEPHONES.**—In less than two years the Republic has increased its telephone lines by no less than 6,250 miles. At the moment of the proclamation of Czecho-Slovak independence in October, 1918, there did not exist in the whole country even six miles' length of copper wire with which to start new constructions, and yet, since then, the Republic has constructed new telephone lines equivalent to all that was constructed by Austria-Hungary through several decades: This is a noteworthy achievement, especially when one considers the difficulties under which the Republic has laboured, the scarcity of material, the enormous cost of the same and of labour, to say nothing of the necessary financial means.

How necessary it was to take energetic steps in this matter may be judged from the fact that between Prague and Brno there was only a single line, while the west of the Republic, Bohemia and Moravia, was not directly connected at all by telephone with the east, with Slovakia. This state of affairs was the result of the Austrian policy of centralisation, which demanded that all roads should lead to Vienna or Budapest. To-day there exists direct communication between Prague and all the principal towns of the Republic, and also between the latter, one with another. Further, direct communication has been established with Austria and Germany, with Jugoslavia

(Lublana), Laibach (Agram), Trieste, and with Hungary (Bratislava (Presburg) to Budapest. Negotiations are proceeding for communication with Poland and with Switzerland. The Czecho-Slovak Telephone Administration is constructing a new line to connect Prague with Nuremberg, and this line will also serve for communication with Switzerland and France.

Latvia.—**RIGA.**—A group of English business men have entered into negotiation with the Latvian Government with regard to the erection of a large radio station. This station is to be provided with all the latest appliances, in order to facilitate communications with the whole of Europe.—*Reuter's Trade Service* (Riga).

Japan.—**YAP CONTROVERSY SETTLED.**—The Japanese Government, it is announced, has approved the plan worked out by the Washington Administration for a settlement of the Yap mandate and Pacific cable question. The plan for the settlement of this problem has been agreed upon informally in principle by Secretary of State Hughes and Baron Shidehara, the Japanese Ambassador. The main terms of the agreement are understood to be: (1) That Japan recognises the right of the United States and other nations to use Yap as a cable landing station and for other cable purposes, while the American Government drops its objections to the allocation of Yap to the mandate of Japan. (2) That the former German cables in the far Pacific be distributed so that the United States will have the line from Yap to Guam, Japan that from Yap to Shanghai, the Chinese end of which was diverted to Japan, and that the Netherlands' interests in the line from Yap to Menado, in the Dutch East Indies, be recognised.—*T. & T. Age*.

New Zealand.—The Postmaster-General of New Zealand reports that 16,000 telephones have been installed during the last two years, and it is anticipated that the demand this year will be greater than in previous years. The number of telephones in use and on order is now approaching 1,000,000.

South Africa.—**BELGIAN CONGO.**—The Belgian Government is going to construct a big wireless station near Elizabethville, Katanga (Congo). Through this station, which, it is expected, will be finished in 1923, direct communication with Belgium will be possible.—*The Times*.

Sino-American Wireless Agreement.—The American Minister in Peking has notified the State Department of the signing of a supplementary agreement between the Federal Wireless Co. and the Chinese Government. The agreement relates to the issue of bonds for financing the project.—*Reuter*.

The Telephone Service.—**SPEEDING UP.**—The London Toll Telephone Exchange, since its opening in September, has been a conspicuous success. It has not only obviated the wait for calls within a 25-mile radius of London, but also has relieved the pressure on the main trunk lines and junctions throughout the country. A recent calculation shows that a trunk call from London to Leeds, instead of taking 15 minutes, now takes, on an average, seven minutes. A correspondent ringing up *The Daily Mail* from the Isle of Wight recently got through in two minutes, as compared with ten minutes before the Toll Exchange opened.

NEW LONDON SOCIETY.—A society has been formed by members of the London Post Office telephone system for the purpose of discussing difficulties and problems connected with their work. Already the membership exceeds one thousand. The first meeting of the new session was held on October 5th.

Mr. Pink, superintendent of traffic, prophesied that the number of exchange lines in London would be nearly trebled in 15 years, and that it would be necessary to build a large number of new exchanges in addition to rebuilding some of those which exist. He claimed that the new "Toll" exchange had fully justified itself. About 95 per cent. of the calls passed to the exchange could now be connected immediately upon demand. Referring to the trunk lines, he emphasised the importance of the development of telephone "repeaters" in securing satisfactory transmission over long distances. It might be possible to apply wireless methods to the ordinary telephone service for the purpose of increasing the number of simultaneous conversations carried by one pair of wires.—*Morning Post*.

United States.—**ABSORPTION OF COMPANY.**—The Radio Corporation of America has purchased the assets of the International Radio Telegraph Co. Details of the transaction were announced recently by the Westinghouse Electric & Manufacturing Co. in a statement reading in part as follows: "The Radio Corporation of America has acquired from the International Radio Telegraph Co. a group of patents relating to wireless telegraphy which the Radio Corporation found it necessary to make use of to enable it to give the public proper and efficient service."

"The International Co. had not embarked upon commercial work to any great extent and was confronted with important patents owned by the Radio Corporation, so that neither company was able to give to the public satisfactory service without infringing upon the patents of the other. Under the circumstances it was found essential that the right to use the several groups of patents should be acquired by one corporation."—*T. & T. Age*.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Argentina.—October 21st. State Railways. Twelve months' supply of electrical stores.*

November. State Railways. One year's supply of railway signal material, including telephone and telegraph materials, &c.*

Australia.—MELBOURNE.—Victorian Government Railways. October 26th. D.C. arc welding plant (Cont. No. 34,377). November 9th. Armature banding machine with electric motor and starting gear (Cont. 34,378).

November 2nd. Electric storage battery complete for automatic telephone exchange (Cont. 34,223).*

January 4th. 150 electric train stops operated by a single-phase induction motor. One set of electrical pyrometer equipment for measuring temperatures of from 350 to 2,000 degrees Fahrenheit.—*Reuter's Trade Service* (Melbourne).

NEWCASTLE (N.S.W.).—December 22nd. City Council. One 25-kW motor generator set. Electrical engineer and manager, Watt Street, Newcastle (N.S.W.).

Belgium.—October 26th. Municipal authorities of Lokeren. Principal transformer cabin in connection with the local electricity supply. Particulars (15 fr.) from the Directeur des Services de Gaz et d'Electricité, Lokeren.

November 16th. Supply of electrical energy for lighting and power purposes in the town. Particulars and plans can be inspected at the offices of the Secretariat Commune, and tenders are to be sent to the Bourgmestre, Maison Commune, Haccourt (Visé), Belgium.

Edinburgh.—October 18th. Electricity Supply Department. Four 10-15-ton hand-operated overhead travelling cranes, electric and steam-driven feed pumps. (October 7th.)

France.—October 25th. Municipal Authorities of Lille. Transformer box, switchboard, electric motors with accessories. Particulars from La Mairie, Lille.

November 15th. French State Railway Authorities, 83, Rue de Rome, Paris. L.p. switchboards, h.p. apparatus, and l.p. and h.p. mains, &c., connecting the switchboards with the different machines and apparatus connected with the testing platform at the railway electric material repairing shops at Le Garenne. Particulars may be obtained from La Service Electrique, 88, Rue de Rome, Paris.

French Post and Telegraph Authorities in Paris. A 60-cell battery of accumulators of a capacity of 900 amp.-hours at the wireless telegraphy station at Saintes-Maries-de-la-Mer (Bouches du Rhone). Particulars may be had from Le Directeur de la Télégraphie Sans Fil, Service Technique, 5, Rue Froidevaux, Paris.

October 29th. French Post and Telegraph Authorities, 75, Boulevard Brune, Paris. Metal filament incandescent electric lamps required during a period of twelve months.

Greece.—ATHENS. November 14th. A new telephone installation at Athens, central battery type, and of an approximate capacity of 5,000 local lines, 40 inter-urban lines, and at least 50 special lines connecting Athens with the Piraeus.*

India.—CALCUTTA.—November 9th. Calcutta Electric Supply Corporation, Ltd. One 15,000-kW turbo-alternator and condensing plant. Two water-tube boilers with an evaporation of 60,000 lb. per hour. (October 7th.)

October 19th.—East Indian Railway Co. Insulated cables. (October 7th.)

London.—L.C.C.—October 24th. Electric goods lift (capacity 30 cwt.) at the Stamford Hill Stores Depot. (October 7th.)

H.M. Office of Works. October 24th. Electric lamps. (See this issue.)

New Zealand.—WELLINGTON.—November 21st. Post and Telegraph Department. 750 red and 750 white switchboard cords, 3 conductor (spec. No. 87).*

South Africa.—JOHANNESBURG.—November 7th. Rand Water Board. Two 350-kW steam-driven electrical generating sets, complete with switchboards and all accessories.*

HUMANSBORG, Cape Province. November 30th. Corporation. One water turbine and dynamo, switchboard with connections, battery of accumulators, and accessories, supply main and public lighting, aerial distributing lines, street lamps, fittings and accessories, section boxes, service cut-outs, meters, &c., ferro-concrete pipe line, reinforced concrete tank, buildings, and foundations. Forms, &c. (6s.) from the town clerk, Humansborg, Cape Province.

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CLOSED.

Doncaster.—Electricity Committee.

Waterway and pump in connection with plant extension at the Electricity Works. Sprakes & Sons. £1064.

Edinburgh.—Tramways Committee. Accepted.

Tramway poles under the electrification scheme, £7,390.—M. P. Galloway, Ltd.

With regard to a recommendation by the Corporation Electricity Committee concerning tenders for steel for sub-stations and for the pump house at Portobello power station, it was pointed out to the Corporation that it had not accepted the lowest offers as it could not send this large amount of work out of the country at a time when unemployment was so great. The offers were accepted subject to contractors' guaranteeing that nothing but British steel would be used.

Glascow.—Corporation. Accepted.

Three passenger lifts, £3,131, for new municipal buildings.—Express Lift Co., Ltd.

Mavor & Coulson, for main electric cable at the Dalmarnock gasworks.

Tramways Committee. Accepted.

Globe strain insulators.—Fleming, Birkby & Goodall, Ltd.

Ozone-proof cable and double cotton-covered wire. British Insulated and Helsby Cables, Ltd.

Electric lighting installation at the wharf, £1,947.—Altan & McGowan.

London.—L.C.C. Highways Committee. 8,000-kW turbo-alternator for Greenwich power station. With further reference to our note on page 188 of August 5th, the following particulars were submitted to the Council at its meeting on Tuesday last:—

Tenderer.	Original tender.	Without restriction as to obtaining materials.	
		(a)	(b)
Athers de Construction Oerlikon	1,009,493 Swiss fr.	£45,886	
	22 fr. to £1		
Brown, Boveri & Co. Ltd.	1,010,160 Swiss fr.	£45,916	
	22 fr. to £1		
Ditto (alternative offer) (including £500 in respect of special works)	£15,939	(irrespective of variations in rate of exchange)	
† Escher Wyss & Co., S.A.	£52,484		
Daniel Adamson & Co., Ltd.	£6,104	£50,800	
English Electric Co., Ltd.	£517,8	£52,340	
† C. A. Parsons & Co., Ltd.	£52,639	£53,110	
British Thomson-Houston Co., Ltd.	£52,719	£53,308	
Richardsons, Westgarth & Co., Ltd.	£52,760	£53,280	
Belusa & Moreau, Ltd.	£53,311	£54,290	
† Metro-Vickers Electrical Co., Ltd.	£53,387	£50,725	
Jas. Howden & Co., Ltd.	£54,954	£47,410	
Fraser & Chalmers Engineering Works	£54,954	(incomplete)	
		£5,050	

† These firms also submitted alternative offers.

The first three tenders, which were submitted by foreign firms, are subject to any import duties which may be imposed at a later date. As the result of inquiries, all the English firms who submitted tenders offered a reduction on the prices quoted by them provided that they were given a free hand to buy foreign material. The revised amounts are shown in column (b).

The difference between the lowest satisfactory foreign tender and the lowest acceptable English tender amounts to nearly £8,000, or 16 per cent. on the total amount involved, even allowing for the sub-letting of materials abroad. In all the circumstances, and after very careful consideration, the Committee decided, with the concurrence of the Finance and the General Purposes Committees, to accept the alternative offer of Brown, Boveri & Co., Ltd., amounting to £45,939.

L.C.C. Education Committee. Accepted.

Electric lighting installation at Allfarthing Lane, Wandsworth, school. £677. F. G. Minter.

Establishment Committee. Accepted sub-contracts.

Additional lifts for the new County Hall; one passenger lift, £1,354; one ditto, £1,855; two book lifts, £1,080.—Express Lift Co., Ltd.

Three passenger lifts, £6,150.—Waygood Oris, Ltd.

Main and circuit cables at the New County Hall:—

Pirelli-General Cable Works, Ltd.	... ..	accepted	£2,724
W. T. Glover & Co., Ltd.	... ..		£3,075
W. T. Henley's Telegraph Works Co., Ltd.	... ..		£3,360
British Insulated & Helsby Cables, Ltd.	... ..		£3,373
Callenders Cable & Construction Co., Ltd.	... ..		£3,434
Siemens Bros. & Co.	... ..		£3,508
Additional main lighting switchboards, £1,500.—Dorman & Smith,			

Installation of synchronised clocks throughout the new County Hall.

Gillet & Johnson	... ..	accepted	£2,566
Synchrotime Co., Ltd.	... ..		£2,703
Silent Electric Clock Co., Ltd.	... ..		£4,194
Standard Time Co., Ltd.	... ..		£4,498
Magna Time Co., Ltd.	... ..		£5,722

The building contractors were instructed to obtain from the Pirelli-General Cable Works, Ltd., additional main and circuit cables required at an extra cost not exceeding £3,100.

FULHAM.—Electricity Committee. Recommended.

Circulating pumping plant for the generating station.—Mather & Platt, £1,548.

Seventeen tenders were received varying from £1,382 to £2,084.

Rotherham.—Corporation.

Housing scheme electric installation (third contract for 100 houses).—Lillicker Bros.

Stourbridge.—Town Council. Accepted.

Installing the electric light at the Town Hall Offices, Market Hall, and Corn Exchange, £429.—Woodrow General Mechanical & Electrical Engineering Co., Ltd.

Worcester.—Town Council. Accepted.

Telpher plant for handling coal and ashes for the electricity works, at £4,000.—Heenan & Froude.

FORTHCOMING EVENTS.

Edinburgh Electrical Society.—Friday, October 14th. At the Philosophical Institute. At 8 p.m. Paper on "Electro Chemistry," by Mr. R. W. J. Stark.

Electro-Harmonic Society.—Friday, October 14th. At the Grand Hall, Cannon Street, E.C. At 8 p.m. First smoking concert of the 1921-22 season.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, October 14th. At Bolbe Hall, Newcastle-on-Tyne. Presidential address by Sir W. J. Noble, Bart.

Junior Institution of Engineers.—Friday, October 14th. At Caxton Hall, Westminster. At 8 p.m. Paper on "Electric Cranes," by Mr. C. H. Woodfield.

Friday, October 21st. At 8 p.m. Lecture, "Pyrometry for Boilers: Some Questions Pertinent and Impertinent," by Mr. C. E. Foster.

Commercial Motor Exhibition.—Friday, October 14th, to Saturday, October 22nd. At Olympia, W.

The Batti-Wallahs Society.—Monday, October 17th. At the Holborn Restaurant. At 1 p.m. Luncheon and address on "Marine Motoring," by Mr. L. M. Waterhouse.

Institution of Rubber Industry.—Wednesday, October 19th. At the Society of Arts. At 7 p.m. Inaugural meeting.

Industrial League and Council.—Wednesday, October 19th. At the Caxton Hall, Westminster, S.W. At 7.30 p.m. Lecture on "Economic Axioms of Industry," by Mr. E. W. Pether.

Société des Ingénieurs Civils de France (British Section).—Wednesday, October 19th. At 8 p.m. At the Institution of Mechanical Engineers, Storey's Gate, S.W.1. Paper on "Tanks and Chain-track Artillery," by Mr. L. A. Legros.

Chemical Society.—Thursday, October 20th. At Burlington House, W. At 8 p.m. Ordinary scientific meeting.

British Electrical and Allied Manufacturers' Association.—Thursday, October 20th. At the Savoy Hotel. 7 for 7.30 p.m.

Electricity Supply Commercial Association (Greater London Division).—Friday, October 21st. At 7.45 p.m. At Anderson's Hotel, Fleet Street, E.C. First annual Bohemian concert.

Institution of Mechanical Engineers.—Friday, October 21st. At the Institution, Storey's Gate, St. James's Park, S.W. At 6 p.m. Eleventh report to the Alloys Research Committee on "Some Alloys of Aluminium," by Dr. W. Rosenhain, F.R.S., Mr. S. L. Archbutt and Dr. D. Hanson.

Birmingham and District Electric Club.—Saturday, October 22nd. At the Grand Hotel. At 6.30 p.m. Annual ladies' night.

NOTES.

The Institution of Rubber Industry.—The Council of this Institution invites any of our readers to the inaugural meeting on October 19th at the Society of Arts, when Sir Henry Wickham will relate his experiences in connection with rubber plantation. Mr. J. H. C. Brooking, M.I.E.E., will deliver the presidential address the same evening. The secretary (Mr. W. Tyson, Charing Cross House, London, W.C.2) will send invitation cards on request.

Freemasonry.—The Kelvin Lodge of Mark Masters, No. 742, will be consecrated on Wednesday, October 26th, at Mark Masons Hall at 5.30 p.m. Any qualified brother who may wish to attend is requested to communicate with Mr. E. J. Willock, 6, Grovelands Road, Palmers Green, N. 13.

Appointments Vacant.—One assistant resident power-station engineer, four power-station shift engineers, for the Birmingham Corporation electricity department; meter superintendent (1,000 Rs. per month), for the Bombay Electric Supply and Tramways Co., Ltd.; superintendent of telephones (£250+£36+£60), for the Government of Antigua; chief engineer and manager (£500), for the Long Eaton Urban District Council Electricity Department. (See advertisements in this issue.)

Air Torpedo Post.—M. Louis Breguet, the French air pioneer, whose expresses fly daily on the Continental airways, speaking at Rouen, said he foresaw the time when urgent letters in London or Paris, placed in the evening in wirelessly controlled "televations" or aerial torpedoes, would be delivered next morning in New York.

Small, pilotless air machines, as M. Breguet sees their development, will really be winged projectiles with a motor and air-screw adapted to function automatically at high altitudes. Launched by special mechanism, the torpedoes will rush through the upper air at a speed almost equalling that of an artillery shell, crossing the Atlantic in a few hours. They will be guided by directional wireless. In France already small planes without pilots have been sent up and brought down and controlled in manoeuvres while in the air by wireless stations on the ground. One inventor, M. Detables, claims to have so controlled such a machine while it travelled more than 100 miles.—*Daily Mail*.

Educational.—The UNIVERSITY OF BIRMINGHAM celebrated its majority on October 7th. Over 900 guests, representative of all branches of science and industry, took part in the function. The guests were received by the Vice-Chancellor, Sir Gilbert Barling, Bart., accompanied by the Principal (Mr. C. Grant Robertson) and the Deans of the various faculties. The municipality was represented by the Lord Mayor (Ald. W. A. Cadbury) and the Lady Mayoress. Demonstrations of wireless apparatus were carried out for the benefit of the visitors, and a number of beautiful lighting effects were obtained by means of searchlights lent for the occasion by the British Thomson-Houston Co.

The Board of Education announces the following successes, *inter alia*, in the 1921 competition for Royal Scholarships and Free Studentships (science): Group A. (mechanics), A. Dean, W. Fogg, and E. N. Rowe (Royal Scholarships). Group B. (physics), W. A. Rowe, A. R. Lee, and E. A. Baggett (Royal Scholarships); Elizabeth N. Hora and C. R. Ensor (Free Studentships).

110-kV Transmission Line Poles.—The accompanying illustration is taken from a recent issue of the *Electrical World*. It depicts one of a large number of wooden poles erected by the San Joaquin Power Co. to carry 110,000-V transmission lines. These poles are 60 ft. in height and are about 20 in. in diameter at the base. Wooden poles were employed, as



measure of economy, in lieu of steel standards. A steel standard of the required dimensions costs \$148.60 (July, 1920). A cross-topped wood pole costs only \$69.50, showing an initial saving of \$79.10 per pole. Taking capital charges at 7 per cent. into account, the saving per pole will amount to \$306.12 at the end of 20 years, which is the average life of a wooden pole.

High-Voltage Transmission.—Dr. Charles P. Steinmetz, chief consulting engineer of the General Electric Co., U.S.A., says that in the course of the experiments carried out by the company recently many valuable data were gathered indicating the feasibility of considerably higher transmission voltages; the gap spacings for sphere and needle spark gaps were carefully checked, and the prolongation of existing curves (750,000 volts and under) was found correct up to 1,000,000 volts. Arc-over tests were made on strings of standard 10-in. suspension insulators up to 1,000,000 volts. The laws of corona were checked at similar pressures and found to hold good. A short transmission line was tested for corona conditions, and the results indicated that a line using 4-in. diam. conductors or larger would be necessary at 1,000,000 volts.—*Reuter's Trade Service* (Pittsfield, Mass.).

From the *Electrical World* we learn that one of the experimenters, Mr. F. W. Peek, Jr., said:—

"Tests up to about 1,100 kV were made on the various elements entering a transmission line, as follows: (a) The spark-over curve between points showed no discontinuity. The spark-over at 1,000 kV was found to be about 105 in. (b) The spark-over curve between 75-cm. spheres showed no great deviation from calculated values. (c) Tests were made on strings of line insulators and the spark-over voltages were as expected; for instance, a string of eighteen standard suspension insulators arced over at about 900 kV, while a string of twenty-two insulators did not arc over at more than 1,000 kV. (d) Visual corona tests were made on 3½-in. diameter brass-tube lines operating single phase. The corona starting voltage (about 900 kV) checked with the calculated value."

Regular Inspection Saves Time.—The value of systematic motor inspection is illustrated by an example recently given by the *Electrical World*. The Acme Wire Co., of New Haven, Conn., lost on account of motor repairs in a section of the factory, 5,250 spindle-hours per week. The electrical equipment consisted of 100 d.c. 4-h.p. motors, running at 1,700 r.p.m., and 240 V. During a week-end in September, 1920, about 25 per cent. of the motors were taken out, overhauled, and restored to service. In one week the lost time fell to 2,400 spindle-hours. During the next week-end another 25 per cent. were taken out, and a further saving of time was apparent. Now the motors are subjected to a maintenance inspection every six months. The programme followed is to take the machines apart, wash the field coils with petrol, shellac the outside of the coils, examine bearings, and look for stuck rings, micrometer worn shafts, wash and shellac the armature, turn down commutator bars, and undercut the mica, test resistance between segments, and test for incipient "earths" between segments, winding, and frame. This system of inspection has cut down the lost time by 80 per cent.

Radiography.—A school of instruction in radiography, radiotherapy, and electrotherapy has been opened at King's College Hospital under the supervision of Dr. Knox and Dr. Colwell. The course includes general elementary physics, electricity, anatomy, and photography, and will prepare for the examination of the Radiographers' Society. The fee is 35 guineas.—*The Times*.

Explosion-proof Mining Switchgear.—A description has already been given (*Electrician*, Sept. 26th, 1921, p. 457) of the construction of the relief bolts introduced by the Electrical Apparatus Co., Ltd., which, when used for the purpose of securing the cover of a suitably constructed switchgear enclosure, convert the cover into a large relief valve, and effectively protect the apparatus from damage in the event of an internal explosion, and prevent the ignition of inflammable gases in the mine. The system has been tested in various ways, but the following particulars of tests made by an independent authority are interesting. The Mining regulations specify that apparatus used in hery mines should be safe for use in an atmosphere containing methane in any explosive proportion, and in order to make the tests as severe as possible, the box was filled with a 9.5 per cent. methane-air mixture, which has the maximum explosive effect, and arrangements were made to explode this with an electric spark. This was done with entirely satisfactory results, i.e., the pressure due to the explosion did not rise above 12 lb. per square inch, and did not last longer than about 0.1 sec. The final test was to repeat the previous experiment, but with an explosive atmosphere surrounding the enclosure in addition to the charge inside. The object of this test was to determine whether an explosion inside the switchgear enclosure would ignite the gas outside. For the outside atmosphere, an 8 per cent. methane mixture was adopted—this being the most readily ignited. On exploding the charge as before, the pressure developed did not exceed 12 lb. per square inch, and its duration was less than 0.2 sec. No flame passed out at the flange, nor of course was the outside atmosphere ignited. There was no distortion of flanges or damage of any kind to the enclosure. The cover was held on to the box by eight relief bolts set to allow the cover to lift 1/32 in. on explosion.

Electric Lifting Magnets for Salvage Operations.—During the discharge of bulk cargoes from ships in harbour, accidents sometimes occur, and the load becomes detached and drops into the water. In many instances the salvaging is not justified, as the expense incurred in recovering single loads by means of divers, drags, or grabs would be prohibitive.

If, however, as in the case of unloading pig iron, scrap iron, and the like, these accidents occur so frequently that, in addition to the loss of the load, the possibility of choking the dock has to be considered, then the question of recovering the material assumes greater importance. This was the position in which some London dock owners found themselves and, after trying various mechanical means without success, they consulted the Witten-Kramer Electric Tool and Hoist Works with a view to dealing with the problem by means of lifting-magnets. For the purpose a 36-in. diameter magnet was employed. This was attached to a crane mounted on a barge, the current supply being obtained by trailing cables from the shore. The magnet weighed 10 cwt., its consumption was 18 amperes at 220 volts, and it lifted on an average 5 cwt. of scrap per lift. Operating in water 20 feet deep, it cleared the dock in five days, recovering over 100 tons of metal. It must be remembered that, whilst a magnet of this size will lift a load of six tons of solid plate, heavy sections or ingots, which have a flat surface and present a good contact face to the magnet, when the material is nondescript in size and shape and very light in proportion to the space it occupies, the lifting capacity is naturally very considerably reduced. Further, whilst it is not very difficult, with a little "sweeping," to recover a heavy load such as a number of joists bolted together, which is known to have been dropped within a certain area, the recovery of a widely scattered light load is a much more difficult problem. In the case under review the scrap consisted of horse-shoes, pieces of pig, and very rough light scrap, which were embedded in the mud and encrusted with rust, and the results in tons recovered really represent quite a high efficiency of operation.

When considering the comparative capacities of lifting-magnets, it is sometimes difficult to appreciate that, whilst a heavy magnet with a comparatively high power consumption may be overshadowed by a lighter one with a lower consumption when handling steel plates and similar heavy loads, comparative results would be entirely reversed if the load was light scrap, pig iron, and the miscellaneous scrap which has to be dealt with in a steel works. Different types of magnets are built for each purpose, and when comparing weights and capacities this must be taken into consideration.

Similar operations were also successfully carried out in a dock, where a large quantity of pig iron was sunk in 30 feet of water, its cargo being recovered with a Witten-Kramer 43-in. magnet. The magnet weighed 17 cwt., and consumed 21 amperes at 220 volts.

The Electrical Equipment of Motor Cars.—Discussing the "Desirable Motor" in the *Morning Post* of October 1st, Mr. H.

Another important point arises in connection with the electrical equipment for lighting cars and starting engines. Builders, alike of the highest repute and those not so well thought of, understand that a car which is free from trouble and which is not a source of trouble in the production of an assembly, is held in high esteem by the public; whereas one in which carelessness is exhibited, especially in fitting the auxiliary equipment, will soon earn for itself a bad name. Not the least fruitful source of trouble in many cars to-day arises from poorly laid-out and carelessly executed wiring for

the electrical units. Grounds, short circuit, and loose connections occur at some time in the best of jobs, but they are much more frequent in installations done indifferently. In general, wiring should be enclosed, but still left as accessible as possible. In every case it should be supported well to prevent abrasions from vibration, and it should be so located as to be protected from oil, or other substances, which tend to cause the installation to deteriorate. The average mechanic is not an adept in locating electrical troubles. Some of these often puzzle the best-qualified electricians. An intermittent ground, or short, may not be located for several hours. Meantime the owner, who naturally cares nothing about electrical apparatus, grows impatient and disgusted. As one American put it aptly, the things owners think, and often say, about the given manufacturer in such circumstances are hardly to be considered as good advertising matter. Most such difficulties, however, can be overcome by seeing that the wiring lay-out, and the materials used, are the best possible under the conditions imposed by the price, and so on; that the workmanship in any case is first-class; and that rigid inspection and check tests are applied before each car is sent out. The performance of the modern vehicle depends so much on the functioning of the electrical equipment that care in seeing that it is well selected and installed will pay the car builder handsomely.

Fitters and Motor Drivers for the R.A.F.—The Air Ministry announces that a certain number of vacancies exist at present for skilled fitters and motor drivers. In view of the present trade depression it is thought that many men would be interested in this opportunity to obtain regular employment in their trade, and at the same time to receive every encouragement to improve their efficiency.

The commencing rate of pay varies from 3s. 6d. to 5s. 6d. per day, according to the degree of proficiency on entry, and, with promotion, may rise to 18s. per day. In addition, food, quarters and clothing are provided, and married men over 26 are eligible for marriage allowance on a sliding scale according to the size of family.

Applicants, who must be physically fit for service at home or abroad, must be between the ages of 18 and 28, but ex-Servicemen may be accepted up to 38. Further details may be obtained from Officer Commanding, R.A.F. Recruiting Depot, 4, Henrietta Street, Covent Garden, London, W.C.2, or 298, Bath Street, Glasgow.

The Batti-Wallahs.—At the Batti-Wallah luncheon on Monday next, October 17th, at the Holborn Restaurant, at 1 o'clock, Mr. L. M. Waterhouse, past-president of the Batti-Wallahs' Society, will speak on "Marine Motoring."

Earl Grey on Trade as the Remedy for Unemployment.—In the course of his speech, delivered at Berwick-on-Tweed on Monday night on his return to political life, Viscount Grey of Faldoen said:—"The only permanent remedy for unemployment is trade. . . I do not believe nationalisation of industries is going to improve matters at all. In our present state I do not believe you are going to get better work under nationalisation. It is not the case that people work better for the community than they do for private enterprise. They do not work better for the State, they do not work better for the municipalities, than they do for private enterprise. When the mines were under Government control, and, therefore, all the extra profit was going to the State, I think I am putting it mildly in saying that the production of the mines, the amount of work done in the mines, did not go up. As a matter of fact, I believe it went down, and, therefore, you are not going to get better work under nationalisation, and you are certainly going to get worse management. Then how is that going to benefit the country? What is wanted to benefit Labour such as nothing else will is that industry shall be carried on at a profit, and production be as good as possible. To get that you want good management, and you want good work."

"As human nature is to-day, it is individual profit, individual advantage, which really secures good management and good work. Labour works for good wages, good conditions; employers provide good management in order that they may get more dividends. Dividends and wages come out of the same thing, the profits of the industry, and what I fear to-day is this, that, as long as you have the two classes of employers and employed, each of them thinking how they can get the greatest share of the profit at the expense of the other, not co-operating, but each thinking that the way to help its own interests is to get the better of the other side—as long as you have that, what will happen will be that profit will become less and less, until eventually there will be none for anybody. What you have got to get to, and this I believe is the only remedy for industrial difficulties, is that both classes should realise that wages and dividends come out of the same thing, the profits of the industry, and that they should come to an agreement as to how profit is to be divided. Not merely should they have an agreement about profits, but labour should have its share in management. I know there are all sorts of difficulties in working that out, but I believe it can be worked out perfectly if the great organisations of employers and trade unions really come together for that end."

Railway Electrification.—The recently-issued report of the Advisory Committee on Railway Electrification suggested that the Ministry of Transport should issue regulations to the

railway companies requiring them generally, and with such exceptions as might be approved, to adopt the recommendations of the committee as to standardisation of electrical equipment in all future electrification work. The *Railway Gazette* understands that there is no present intention on the part of the Ministry to issue any such regulations, such a course being regarded as premature and perhaps in the long run unnecessary. The Ministry will await the views of the railway companies who, it may be presumed, will be able to agree on standardisation arrangements. Considering the present financial position, little can be done in the way of new electrification work meanwhile, so that there is plenty of time to settle plans. It is worth while pointing out, however, that in the ultimate resort, though the war-time "control" of railways has ceased, the Minister of Transport has under the Railways Act, 1921, authority to require the companies gradually to conform to a standardisation of way, plant, and so forth, including electric equipment and type and pressure of electric current employed. The same journal goes on to point out that it has been generally assumed by railway engineers everywhere outside Italy, that the choice of system for railway electrification lies between d.c. and single-phase, because the three-phase system is out of the running, both on account of cost and complication. "It is, therefore, very interesting to find Dr. William McDonald, a well-known agricultural expert in South Africa, forwarding, a little rashly, a claim for the adoption of the three-phase system in South Africa. Dr. McDonald does not pose as an electrical expert, but, according to an interview in the *Cape Argus*, he consulted two experts in Italy, Commendatore Alfred Donati, a leading official on the Italian State railways, and Signor Pontecorvo, a gentleman, we believe, interested in three-phase locomotive construction.

Dr. Donati is responsible for getting round many of the difficulties in this system; but neither he nor any representative of State railways in Italy has ever been induced to publish any convincing figures as to the cost of the system, in spite of numerous requests. Such figures as have been published by other well-known engineers in Italy have gone to prove that the three-phase system to-day costs, apart from rolling-stock, about 50 per cent. more than d.c., even under the special conditions obtaining in that country. So striking were the figures that the Italian authorities have decided to consider the electrification of one of the Italian lines on the 3,000-volt d.c. system, and the plans are now, we believe, being prepared. The principal reason why the Italian authorities continue to install the three-phase system on other of their lines is largely a military one, uniformity of system over certain of the northern lines being considered essential for strategic reasons."

The Proposed Engineers' Club for Birmingham.—The difficulties in the way of consummating the plans made for the establishment of an Engineers' Club in Birmingham were referred to at a luncheon held on Friday last at the Midland Hotel. Mr. R. A. Chattock took the chair, in the absence of Sir Hallowell Rogers.

The Lord Mayor (Ald. W. A. Cadbury) gave the toast of the club, and said, in view of the prominent position occupied by engineers in the city, and the large contribution made by Birmingham to the science of engineering, it was, perhaps, strange that no club had been established for engineers up to the present. Their project for a club was a great step towards uniting the engineers of the city, and he wished it success.

Mr. R. A. Chattock, responding, said it was only possible at present to congratulate the members upon a half-formed club. That condition was unfortunate, but it was one imposed upon them owing to the difficulties of the times. The idea was first mooted during the war; a lot of spade work was done in the early days, and a committee was appointed. The committee had done a great deal of hard work, and eventually, after the holding of a public meeting, it was decided to proceed with the formation of a club, coupled with the determination to have a minimum membership of 500. It was estimated that it would be necessary to raise £10,000 to get the premises and equip them. Plenty of engineers were ready to come forward as members, and in the first six months they got 330. Unfortunately, the money did not come in so quickly as the members, and they found that in the time available it was possible to raise only about £3,000. They now had £4,500, including subscriptions. They could only express regret at being hit by the trade depression. The committee obtained an option on suitable premises in the centre of the city, but had reluctantly come to the conclusion that it would be courting disaster to go on without the necessary funds, and the idea of forming the club at the present moment had to be given up. They must keep the idea alive until better times came. The committee was able to get out of its commitment with regard to the premises in a satisfactory manner, and it could be said that they were in as good a position now as they were at the commencement. They hoped that the time would come when the cost of furnishing and other equipment would have fallen so that they could manage on a smaller capital than that originally anticipated. In any case, they would all make up their minds that the idea of the club must not be allowed to fall through.

Dr. Garrard proposed the toast of "The Visitors," which was responded to by Mr. E. Manville, M.P. (president of the London Engineers' Club), and Mr. J. S. Webb (president of the Manchester Engineers' Club).

INSTITUTION NOTES.

Finsbury Technical College Old Students' Association.—The tenth annual dinner of this Association was held at the Engineers' Club, Coventry Street, on Saturday, November 12th, when the chair will be taken by Prof. G. T. Morgan, O.B.E., D.Sc., F.R.S. Old students of the College may obtain tickets (price 10s. 6d. each) from the hon. secretary, Mr. H. P. Guy, 26, Northampton Park, Tottenham, N.7.

Birmingham and District Electric Club.—A lecture was given on October 8th by Mr. G. C. Friday upon "The Commercial Efficiency of the Telephone." Mr. Findlay commenced his paper with a short reference to the historic development of telephony, and then gave an exceedingly lucid, and so far as time allowed, a very detailed description of the technical equipment of the modern telephone exchange, giving some account of the many devices at present being developed to increase the load capacity of cables. The lecturer agreed that the automatic exchange was in process of successful development, but he feared economic reasons would delay universal adoption. The paper also dealt with the administrative side of the business, and in passing pointed out that the war had depleted the staff to such an extent as to make recovery to normal a slow process.

Institution of Electrical Engineers.—On Saturday, October 29th, there will be a visit of London students of the Institution of Electrical Engineers to the works of The British Electric Transformer Co., Ltd., at Hayes, Middlesex. Students who wish to attend are asked to notify Mr. H. J. Howard, 115, Queen's Road, S.W. 19, before 19th inst.

Oldham Technical and Old Students' Union.—On October 8th an interesting lecture was given to a large attendance by Mr. F. Clegg, A.M.I.E.E., A.M.I.M.E. (Messrs. Ferguson, Fainlin, Ltd., Manchester) on the subject of "Distribution of Electrical Energy, Switchgear Control." The lecturer gave brief historical notes, and dealt with the essential characteristics of three-phase transmission and distribution systems.

Glasgow and District Radio Club.—The annual general meeting was held on September 28th. The hon. secretary presented the annual report and financial statement. The former showed a record of 23 ordinary meetings, and one outdoor meeting, held during the session just closed, while the latter disclosed, after meeting all expenses, a substantial balance. The following officers were elected for the ensuing session: President, Mr. Eric Snodgrass; hon. secretary and treasurer, Mr. Robert Carlisle, 40, Walton Street, Shawlands, Glasgow (re-elected). Before vacating the chair, Mr. Dewar paid a handsome tribute to the retiring president, Mr. Robert Watson, Jr., for his past services to the Club, and expressed the regret and disappointment of the members that business arrangements prevented Mr. Watson from offering himself for re-election. The forthcoming trans-Atlantic amateur tests were under consideration, but as it was felt that participation in these tests would be prejudicial to the best interests of the Club it was decided not to enter.

The Optical Society.—The provisional programme for the new session, which opened yesterday with the "Thomas Young Oration" by Dr. Charles Sheard, provides for 12 meetings or other functions, for several of which papers and lectures have been arranged for. In January the Society will co-operate with the Physical Society and the Science Masters' Association in the exhibition of scientific instruments at the Imperial College.

Institution of Post Office Electrical Engineers.—The Council announces that the Postmaster-General has awarded Lieut.-Col. A. C. Booth, M.I.E.E., the sum of £100 "in recognition of his invention and services in connection with improvements in telegraph working." This applies more particularly to the development of the Booth-Baudot duplex giving 6, 8, 10, or 12 channels per circuit in place of the 3, 4, 5, and 6 channels of the ordinary Baudot as used in France for some 40 years.

Lieut.-Col. Booth has handed over this sum (£100) to be utilised at the discretion of the Council in annual awards for the best improvement in telegraph land-line apparatus or systems.

An annual award of £5 (to be known as "The Booth-Baudot Duplex Award") is therefore offered for the best improvement in telegraph land-line apparatus or systems, to be governed by the following conditions:—

1. British subjects only, employed by public telegraph administrations throughout the world, will be eligible to compete for the award.
2. Applications for the award to be received between January 1st and March 31st of any year, such applications referring to improvements made, or suggested, during the twelve months prior to January 1st referred to above.
3. At the discretion of the Council of the Institution of Post Office Electrical Engineers an award may be withheld in any year if, in the opinion of the adjudicators appointed by the Council, after full consideration of the application received, no award is warranted.
4. Applications for the award, accompanied by full details of the improvement, should be addressed to the secretary, Institution of Post Office Electrical Engineers, G.P.O. West, London, E.C.

Our congratulations are tendered to Lieut.-Col. Booth on this official recognition of his exceptional services in the cause of telegraphic progress. In a commercial sphere the honorarium would probably have been larger by a hundredfold, and we regard it rather "in the spirit in which it is given" than

as being in any way commensurate with the value of the service rendered, while the admirable use that Lieut.-Col. Booth has made of it affords further evidence of his zeal in promoting the advancement of British telegraphic science.

Junior Institution of Engineers.—A local section of the Institution was successfully inaugurated at Loughborough on October 1st. The President, the Right Hon. the Lord Weir of Listerdale, P.C., took the chair at the inaugural meeting (held at Loughborough Town Hall); the chairman of the Institution, Mr. B. E. Dunbar Kilburn, M.A., and other officers from headquarters were present. The resolution that the section be established was put by the Chairman and carried unanimously. Lord Weir then inducted Mr. H. Schofield, M.B.E. (Principal of Loughborough Technical College) as its first chairman. The new section will have its headquarters at the College, a meeting room and equipment having generously been provided by the governors. The local hon. secretary is Mr. G. Mavor, the College, Loughborough, Leicester.

Paisley Association of Electrical Engineers.—The third session of the Association was opened on October 5th, when Mr. W. R. Scott, the new president, spoke on "Engineering and Imagination." He said an engineer should have the power of imagining a thing and then achieving it. The engineer should first of all be a craftsman, skilled in the use of tools, and with a trained knowledge of accurate measurement. He should, secondly, be conversant with the existing and ever-growing records of scientific research. After these fundamentals had been attained, the principal factor in producing efficiency was imagination.

The Association of Engineers-in-Charge.—On Saturday last the annual dinner of the Association was held at the Holborn Restaurant. The president, Mr. W. H. Patchell, M.Inst.C.E., was chairman, and the chairman of the Association, Mr. J. E. Watkins, vice-chairman.

After the loyal toasts, Dr. H. S. Hele-Shaw, F.R.S., proposed "The United Services," remarking that not a fraction of what our heroic sailors and soldiers had endured would ever be known. He was proud to know that the engineer had been recognised in the Navy for what he was; in Admiral Goodwin they saw the engineer-in-charge of the greatest Navy of all time. Responding, Engineer Vice-Admiral Sir George G. Goodwin, K.C.B., told humorous anecdotes, and paid a tribute to the Old Army, which not only "did its bit" but also trained five million young soldiers and imbued them with its cherished traditions. He did not like to hear the war called an engineers' war; it was won by all-round co-operation. The meetings and discussions of the engineers-in-charge were of the greatest value; many suggestions emanating from shore engineers had been embodied in naval practice.

Proposing "The Association," Lt.-Col. C. E. P. Sankey, D.S.O., R.E. (ret.), referred to the value of the work of the Association, and said that during the war engineers played an enormous part; they were put in positions quite foreign to all their previous training, and he had found them thoroughly competent. They must all pull together if the country was to make progress.

Mr. W. H. Patchell replied to the toast, pointing out that the engineers-in-charge stood midway between employers and employed, and a serious duty was imposed upon them. In 1919, 35 million days' work were lost through strikes; in 1920, 27 million, and this year no fewer than 84 million days, in this country alone. It was a crying shame, and it was up to the engineers-in-charge to tell the men the truth about it. The Labour leaders would not and could not do that. They, who were disinterested parties, must teach the workmen, and show them that high wages did them no good unless output was high.

Mr. W. C. Clifford Smith, C.B.E., proposed "Our Guests and Friends," and referred to the great strides that the Association had made since he was its first engineer president, as evidenced by the array of distinguished guests present at the dinner.

Brig.-General Magnus Mowat, C.B.E., responded; referring to the predominant part played by the rank and file in the war, he pointed out the responsibilities thrown on the rank and file in industry, and said that no Association had a better right to exercise influence with the men with a view to counteracting unwise policy. He was especially interested in technical education, and stated that facilities would soon be provided for young men to acquire training that would enable them to rise in their profession.

Mr. J. E. Watkins proposed the health of the president, one of many very eminent presidents who had immensely helped the Association. They owed a debt of gratitude to Mr. Patchell, who had been president both in 1907-8 and during the past year; he was the "big brother" of the engineer-in-charge. The Association had hoped to secure incorporation during his year of office, but difficulties they met with had caused delay. Capt. Penn cordially supported the toast, and expressed the hope that Mr. Patchell would preside again 10 years hence. In his reply, the president expressed the enjoyment he had felt in attending their meetings, and his appreciation of the great assistance received from the officials of the Association.

The proceedings were continued by an entertainment under the direction of Mr. George Hardy, whose orchestra also played a selection of musical pieces during the dinner.

The new president, who took office this week, is Capt. H. Riall Sankey, C.B., R.E. (retired).

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Mr. A. G. STEPHENS, manager of the Brisbane Tramways Co., was to go on extended leave of absence at the end of August as a preliminary to his permanent retirement from the company's service. This course, says the *Brisbane Courier*, was taken on the advice of his medical attendant. Mr. Stephens has been associated with the Brisbane Tramways since 1891. During his absence he will be replaced by Mr. W. M. Nelson in the capacity of acting manager. Mr. Nelson is at present chief engineer of the company.

The recent accident to Mr. D. H. DAVIES, borough electrical engineer, and Mr. Thomas Hadfield, an assistant, who were burned whilst testing a meter at the Heywood electricity works was fortunately less serious than was at first thought. Mr. Davies has so far recovered as to be able to return home, and Mr. Hadfield was expected also to leave the Bury Infirmary this week.

At Leeds, on October 4th, Mr. H. B. SUTCLIFFE, late manager of the West Yorkshire telephone district, was presented with an envelope card table and a silver tea service and Mrs. Sutcliffe was handed a case of sterling silver tea spoons and tongs. The presentations were made by Mr. T. Rodgers (traffic superintendent) on behalf of the staff.

Mr. LEONARD THORNTON has resigned the position of general manager of the Electrical Supplies Co., of Tottenham Court Road, W.1.

After nine years' service as chief engineer and manager of the Hampstead municipal electricity undertaking, Mr. WILLIAM WYLD has resigned his appointment in order to join a commercial concern.

Mr. L. WILDE, for 15 years commercial assistant in the Ilford Urban District Council Electricity Department, has joined the Ajax Electrical Co., of Ilford.

Mr. EDGAR MOXON, borough electrical engineer of South Shields, has been appointed borough electrical engineer of Southport, at a salary of £900 a year, in succession to Mr. A. Black, who has succeeded Mr. Ayton at Ipswich. There were over 140 applications for the post.

Mr. T. K. EVANS, B.Sc., A.M.I.E.E., district manager in charge of the Manchester branch of the Electrical Apparatus Co., Ltd., has been transferred to London to take charge of the London district sales organisation. Mr. H. H. Pollard, until recently Glasgow branch manager to the Harland Engineering Co., has been appointed district manager at the E.A.C. Manchester office.

Mr. T. A. KNIGHT SIMPSON has resigned his position as chief draughtsman and tool engineer with Messrs. Dictograph Telephone, Ltd., Croydon. His new address is 92, Victoria Street, S.W. 1.

Mr. W. A. BOOTH has taken up an appointment as assistant engineer at the city office of Messrs. Johnson & Phillips, Ltd. (12, Union Court, Old Broad Street, E.C. 2). He was for several years assistant engineer in the switchgear, transformer, and junction box departments at the company's works, and he will specialise in these branches.

Mr. T. D. SPARK, chief electrical engineer of the Whitehaven Colliery Co., Ltd., was married on September 14th to Miss M. F. Bell, only daughter of Mr. T. S. Bell, A.M.I.E.E., of Whitehaven.

Obituary.—We reproduce the following notice from the "Deaths" column of *The Times* :—

"FEATHERSTONE-SMITH.—On October 7th, Edith Featherstone-Smith, for 25 years the trusted and devoted personal secretary to the chairman and managing director of W. T. Henley's Telegraph Works Co., Ltd."

Will.—The late Mr. RICHARD RIGG, a director of the Windermere & District Electric Supply Co., Ltd., left £32,023.

NEW COMPANIES REGISTERED.

Lloyd & Ramsden, Ltd. (177,109).—Private company. Registered October 4th. Capital, £3,000 in £1 shares. To take over the business of manufacturers of cinematograph projectors and general electricians carried on at 17 & 19, St. Michael's Street, Nottingham, as Lloyd & Ramsden, and to carry on the business of manufacturers of cameras and parts thereof, film manufacturers and renters, photographers, &c. The first directors are: E. G. Lloyd (permanent managing director), 4, Friar Yard, Nottingham; Capt. O. W. Redgate, Inglenook, East Leake, Notts.; C. E. Ramsden, 10, Wilford Grove, Nottingham. Qualification, £100. Remuneration of managing director, £900 per annum; of other directors, as fixed by the company. Registered office: 17, St. Michael's Street, Nottingham.

British Standard Centrifugal Pump Co., Ltd. (177,086).—Private company. Registered October 3rd. Capital, £3,000 in £1 shares. To carry on the business of manufacturers of pumps, mechanical, hydraulic, pneumatic, motor, electrical, and general engineers, &c. The first directors are: J. B. Weir, Hargreave Colliery, Kidsgrove, Stoke-on-Trent, mining engineer; A. H. Thompson, 7, Howenden Road, Cricklewood, N.W., engineer. Secretary: G. L. Moxton. Registered office: Kent Green, Scholar Green, Stoke-on-Trent.

Industrial League and Council.—The Industrial League and Council has been registered as an association limited by guarantee, without share capital, to promote British, Home and Overseas Dominions and foreign trade and commerce, and the manufactures of the United Kingdom, in the interests of employers and employed; to assist in establishing harmonious relations between employers and employed in all industries; to assist in the promotion of efforts, whether by the Government or otherwise, to bring together representatives of capital and labour for the advancement of trade, &c. The management is vested in a Council, the first members of which are: Lord Burnham, 135, Fleet Street, E.C.; George H. Roberts, M.P., 6, Buckingham Street, W.C.; Sir William J. Peckemason, Bart., Compton Castle, Compton Pannocot, Somerset; Hugh S. Hirst, Magnet House, Gungway, W.C. (chairman, General Electric Co., Ltd.); Robert Young, M.P., 215, Garry Road, S.E. 22; Harry Scholey, 56, Victoria Street, S.W.; G. Lothian, 25, Euston Road, N.W. 1, trade union secretary. Upon election, each member shall be placed by the Council in one of the following categories: (a) Individuals who are, or represent, employers of labour, (b) companies or associations composed of employers, and representatives of any such association which is unincorporated, (c) individuals who are, or represent, employees, and (d) companies or associations composed of employees, and representatives of any such association which is unincorporated. Solicitors: Kimber, Bull, Howland, Clappe & Co., 6, Old Jewry, E.C. The registered office is at 82, Victoria Street, Westminster. The file number is 177,161.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Associated Equipment Co.—A trust deed dated September 19th, 1921, to secure £500,000 debenture stock created by the Associated Equipment Co., Ltd., has been registered. The deed constitutes a specific mortgage on certain freehold lands, tenements, hereditaments, and premises in Blackhorse Lane and elsewhere in Walthamstow, and a floating charge on the company's undertaking and property, present and future, including uncalled capital (if any). The trustees for the debenture stock holders are the Rio Claro Railway & Investment Co., Ltd., Friars House, New Broad Street, E.C.

Peterborough Electric Traction Co., Ltd. (74,562).—Return dated May 23rd, 1921. Capital, £200,000 in £5 shares, 6,000 preference and 6,000 ordinary; 4,400 preference and 4,000 ordinary shares taken up. £42,000 paid. Mortgages and charges, £221,000.

Kalgoorlie Electric Tramways, Ltd. (73,127).—Return dated August 11th, 1921. Capital, £250,000 in £1 shares. All shares taken up and paid for in full. Mortgages and charges, £143,820.

CITY NOTES.

The Victoria Falls and Transvaal Power Co., Ltd.

The Marquess of Winchester presided over the annual meeting, held last Friday, and in proposing the re-election of the report, said it was again his privilege to submit a record of satisfactory progress, the year's trading having enabled the company to maintain the same dividends as formerly. Having gone through the balance sheet in some detail, he referred to the profit and loss account and said that the revenue amounted to £308,419, compared with £229,470 last year. The amount paid for the service of debentures in the shape of interest and premium amounted to £183,892, being some £25,268 less than last year. Depreciation and amounts written off and provision for British taxation amounted to £409,940. The amount written off for plant and machinery was in accordance with their adopted scale calculated to reduce the value of plant and machinery to a reasonable residual value during its useful life. The net result for the year, after making provision for all taxation, was a profit of £173,161. Adding that to the amount brought forward from the previous year made the total balance to the credit of that account £267,482. Dividends had already been paid to the preference and ordinary shareholders, absorbing £175,000, leaving a balance of £92,482, which had been carried forward. With regard to relief from British income tax in respect of Colonial taxation, they had advanced a step since he last addressed them, having received the amount of their claim in respect of the last two years, viz., the years ending April, 1917, and April, 1918. With regard to the two subsequent years ending April, 1919, and April, 1920, they had not yet reached a settlement, but were hopeful that their claims would be settled shortly. So far, the preference shareholders, although the company was subject to tax in South Africa, had received their dividend at the rate of 10 per cent., the maximum amount to which they could be entitled, and it seemed that the interpretation as it stood of the law given by the Courts on the subject was fair, namely, that preference shareholders who did not suffer Colonial taxation should pay the same income tax as other people. He had previously informed them that the first of their contracts for power had been renewed pursuant to the provisions of the contract for a further period of five years, and he could now report that all those contracts which were originally for a period of twelve years and expired at the end of this year, had now been similarly renewed for a further period of five years. At past meetings he had referred to the position of the low grade mines, which took their share of their power supply, and emphasised the importance to the company of the continuance of mining operations by those consumers. It was a matter of satisfaction that for the most part those mines were still at work, and where mines had closed, they had found an increase in demand by other consumers who had been able to absorb the displaced native labour. With regard to the working of the present year, the results apart from the dislocation of the business caused by the strike on the mines in the early months, showed that the business was well maintained; in

fact the power demanded had in some months exceeded the corresponding demands of last year. In February the effect of the strike was to shut down the mining industry which took time to resuscitate, and resulted in very seriously reducing their earnings during the early part of the year. The second quarter, however, showed a recovery to their old position with a tendency to improve, which improvement was still being maintained, and he was hopeful that the results of the latter part of the year might make up for the dislocation caused by the strike. During the year the South African Government appointed a drafting committee to frame a new Electric Power Bill applicable throughout the Union. At present the Act under which their licences were granted applied only to the Transvaal Province, while less concise and older legislation held in other parts of the Union. Their company and other interested parties were heard by the committee, and with regard to themselves the Draft Bill would leave them generally in the same position as at present. New enterprises would, however, be brought under similar regulations, and the Bill would enable the South African Government to vote money for the establishment of Government-owned stations for supplying Government departments and the public. The Bill had not yet been dealt with by the South African Parliament. The management in South Africa remained under the capable direction of Major the Hon. Walter L. Bagot, the company's general manager in South Africa, and Mr. Bernard Price, their chief engineer. In closing, the chairman referred to the board's appreciation of the services rendered by these gentlemen and by the whole of the staff in South Africa and London. Mr. A. E. Hadley, C.B.E., seconded the motion, which was unanimously agreed to.

The accounts of the *Wolfram Lampen A.G.*, of Augsburg, show that the debit balance of 506,000 marks in 1919-20 was increased to 679,000 marks in the past financial year on a share capital of 5,000,000 marks.

The *Kabelwerke Rheydtt A.G.*, of Rheydtt, proposes to pay a dividend at the rate of 30 per cent. on capital of 24,000,000 marks for 1920-21, contrasting with 40 per cent. on 14,000,000 marks in the previous year.

The directors of the *Wotan Werke A.G.*, of Leipzig, propose to pay a dividend at the rate of 40 per cent. for 1920-21, being the same as in the previous year. At the same time the share capital is to be increased from 7,500,000 to 15,000,000 marks.

The report of *Garbe, Lahmeyer & Co.*, of Aix-la-Chapelle, states that as contrasted with the extraordinary demand in 1919-20, the orders received in the past financial year were inconsiderable. Nevertheless the results were satisfactory, thanks to the clearing off of the orders brought over from the previous year. After writing off 2,264,000 marks, as against 569,000 marks in 1919-20, the net profits amounted to 3,182,000 marks, as compared with 1,679,000 marks, and the dividend is at the rate of 10 per cent., or 2 per cent. more than in the preceding year.

New Issue.—The *Mersey Power Co.*'s new issue of £300,000 debenture stock (7½ per cent.) was very largely oversubscribed. The list was only open for about an hour.

Stock Exchange Notices.—The Committee has ordered the following to be officially quoted:—

County of Southland Electric Power Board.—Scrip, fully paid, for £750,000 six per cent. debentures (guaranteed by New Zealand Government).

Dealings in the following securities have been specially allowed by the Committee under Rule 148a:—

Mersey Power Co.—£300,000 7½ per cent. mortgage debenture stock, issued at 97 per cent., £35 paid and fully paid, after issue of letters of acceptance.

Tottenham District Light, Heat & Power.—£50,000 6 per cent. registered redeemable mortgages in amounts of £50, £100, £200, and £500; and £91,650 7½ per cent. registered redeemable mortgages in various amounts from £50 to £23,000. For numbers see share and loan department.

Application has been made to the Committee to allow the following to be officially quoted:—

Westinghouse Brake and Saxby Signal Co.—1,015,032 ordinary shares of £1 each, fully paid (Nos. 1 to 1,015,032).

The Charleroi Electric Construction Works.—The directors of the *Ateliers de Constructions Electriques* de Charleroi, Belgium, have decided to rearrange the capital so as to bring the assets into line with their present value. In the first place, the deferred shares are to be converted into new ordinary shares, two new gratis shares will be allotted for every three ordinary shares, and a further issue of 30,000 shares for 250 fr. will be made. The effect of these changes will be to increase the share capital to 80,000,000 fr.

Direct United States Cable Co., Ltd.—Interim dividend of 4s. per share, less tax (at the rate of 4 per cent. per annum), is announced for the half-year ended September.

Oriental Telephone & Electric Co., Ltd.—Interim dividends of 3 per cent. on the 6 per cent. cumulative preference shares, less tax, and of 4 per cent. on the ordinary shares, free of tax, have been declared.

Rangoon Electric Tramway & Supply Co., Ltd.—According to the financial Press, an interim dividend of 8 annas per share on the ordinary shares is payable in Rangoon on October 31st.

STOCKS AND SHARES.

TUESDAY EVENING.

ELECTRICITY shares can hardly lay claim to being amongst the most popular of those which are being offered to the public at the present time. The County of London Electric 7 per cent. debenture stock was over-subscribed more than ten times in less than three hours. The Mersey Power Co.'s debenture stock was quickly over-subscribed, and the premiums on the previously-issued stocks of the North Metropolitan Electric and the Metropolitan Electric Companies, although lower than they have been standing lately, are still 7 points above the figure at which they were offered. The Clyde Valley preference shares were left in the hands of the underwriters to the tune of about 30 per cent. In this case, the advertisement of the prospectus in the London papers was on somewhat modest lines. It was expected, of course, that Glasgow and Scotland would take up the bulk of the shares. At the outset the price started about 7s. 6d. discount. Considering the security, it is reasonable to assume that when the shares become firmly placed in the hands of permanent investors, the price will recover to the neighbourhood of £10, the par value. The new Mersey Power debenture is 1 premium, and Lancashire Power debenture, after being 2, rallied to 2½ premium.

A good deal of dissatisfaction became vocal in the matter of the County of London Electric Co.'s new debenture issue. It might be scarcely worth while referring to were it not that there may be other companies coming along in the near future with similar offers, and in the case of which, if similar conditions prevail, the same kind of agitation will be raised. Possibly the critics hardly realise the difficulties with which issuing houses are faced in the matter of a new stock for which there is an immediate demand. Priority in allotment is due to shareholders and employees. The stag division deserves full discrimination, but to distinguish between the stags and the real investor is no easy matter. Speed is considered to be the essence of the business, and the allotment has to be done literally in a rush. That some genuine investors should be cut out when they deserve an allotment, and that stags creep in where only shareholders should be allowed to tread, is inevitable. If we may put forward a suggestion ourselves, we would propose that where a new issue is being made on attractive terms by a well-established company, that issue should in the first place be offered to the shareholders, who, if they declined it, would certainly have no cause for complaint against their directors for not giving them every opportunity to obtain the stock or shares.

The electricity supply market is steady, showing no great changes on the week. Westminster is 2s. 6d. down; City Lights 1/16d. easier. It cannot be said that there is much business going on, but one of the features continues to be the scarcity of floating supply. It has been humorously suggested in the Stock Exchange that the warmth of the second edition of the summer is quite sufficient to distract attention from such heating shares as those of the electric and gas companies. Where so many new attractions are being offered in the shape of fresh issues, it is obvious that claims of the seniors are apt to be overlooked.

Electric manufacturing shares are depressed. English Electrics have dropped to 9s. 6d. General Electrics are weak at 17s. 6d. A certain amount of anxiety has developed by reason of the heaviness in the last-named. It may be suggested that there is nothing very surprising in the probability that the General Electric must perforce suffer, in like manner with all industrial undertakings, from the trouble in the coal trade, the shipping, textile, and other branches of industry, all of which contribute to the success of a company doing such a business as the General Electric. People have lost money in shares of companies founded on less solid foundations than those of the G.E.C., and, because of their experiences in the former, they are apt to become nervous of their holding in the latter. It is more than likely that the company feels the effects of such influences as those just indicated; but, when the tide turns and trade becomes more normal, the company will be amongst the first to feel the benefit of E.P.D. abolition, economies in working introduced in these days of depression, and the strength of the position upon which the company is based.

Between the 10th and last week to a considerable extent of Anglo-Argentine Tramways first preference shares on offer in the market at a price which made a strong appeal to the speculative investor. It may now be added that this block (of 50,000 shares) has been taken, and the price has recovered from 50s. 9d. to 52s. 6d. The Mexican bonds and shares hold their advances. Mexico is declared, for the nth time, to be on the eve of recognition by the United States, and this serves to

keep prices rising at a time when other utility issues are inclined to waver. British Columbia Electric stocks are better. A private letter from Vancouver states that the province has declared that no doles will be given in respect of the considerable body of unemployment in Vancouver. The Premier flatly told Labour, to its face, that it had not been giving 50 per cent. efficiency on the work the Government provided. Labour retorted that it did not consider the Government had given 25 per cent. efficiency, and made a homethrust. There the matter rests, a little plainer for the plain-speaking.

The Underground Electric Railway stocks make a better showing, there being rises of a point in Central London Assented ordinary, Metropolitan and Underground incomes. Extension of facilities this month on the tubes is certainly having a beneficial effect upon the crowds during the rush hours, and this appears to have attracted a moderate amount of attention to the stocks.

Marconi has gone back to 1½, and United River Plate Telephones are easier at 5 15/16. Cuba Submarines at 7½ are 5s. lower. The general run of cable securities is well maintained, and Eastern ordinary changed hands as high as 167 this week. There is no change worth mentioning in the shares of the telegraph manufacturing companies. The rubber market is also very quiet, awaiting those developments which it is hoped may lead to a wide extension of the uses to which the material may be applied. The iron, coal and steel market is passive, pending the important conference between the Prime Minister and the Labour Party on the question of unemployment. Victoria Falls and Transvaal Power shares remain firm. At the meeting the other day it was stated that the South African Government contemplated an Electric Power Bill which would apply to all parts of the Union. In which proposal there lurks a hint of possible competition at some future date.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend		Price Oct. 11, 1921.	Rise or fall.	Yield. p. c.
	1919.	1920.			
Brompton Ordinary	12	12	62	—	29 8 2
Charing Cross Ordinary ..	7	8	44	—	9 8 4
do. do. 4½ Pref.	4½	4½	34	—	7 4 4
Chelsea	4	6	32	—	9 4 8
City of London	13	14	11	—	10 13 4
do. do. 6 per cent. Pref. ..	6	6	17 6	—	6 17 2
County of London	8	8	9	—	8 17 10
do. do. 5 per cent. Pref. ..	6	6	8	—	7 10 0
Kensington Ordinary	7	9	43	—	10 0 0
London Electric	2½	2½	1	—	7 10 0
do. do. 5 per cent. Pref. ..	6	6	32	—	10 9 0
Metropolitan	6	7	4	—	8 15 0
do. 4½ per cent. Pref. ..	4½	4½	21	—	7 13 2
St. James' and Paul Mall ..	12	12	63	—	9 1 4
South London	6	7	22	—	10 13 2
South Metropolitan Pref. ..	7	7	159 9	—	8 17 10
Westminster Ordinary	10	10	52	—	8 13 10

TELEGRAPHS AND TELEPHONES.

	Dividend	Price	Rise or fall.	Yield.
Anglo-Am. Tel. Pref.	6	87	—	8 18 0
do. Def.	1½	17½	—	8 11 2
Chile Telephone	6	64	—	5 14 3
Cuba Sub. Ord.	7	72	—	9 13 2
Eastern Extension	10	10	—	9 14 0
Eastern Tel. Ord.	10	10	—	8 10 0
Globe Tel. and T. Ord. ..	10	10	—	6 3 1
do. do. Pref.	6	6	—	8 9 9
Great Northern Tel.	22	24½	—	9 14 0
Indo-European	10	10	—	8 8 8
Marconi	25	16	—	9 4 7
Oriental Telephone Ord. ..	12	12	—	*6 16
United R. Plate Tel.	8	8	—	*6 16 9
West India and Panama ..	Nil	Nil	—	Nil.
Western Telegraph	10	10	—	*6 1 2

HOME RAILS.

	Dividend	Price	Rise or fall.	Yield.
Central London Ord. Assented ..	4	4	—	8 1 8
Metropolitan	12	12	—	6 2 5
do. Districts	Nil	Nil	—	Nil
Underground Electric Ordinary ..	Nil	Nil	—	Nil
do. do. "A"	Nil	Nil	—	Nil
do. do. Income	4	2	—	*4 0 8

FOREIGN TRAMS, &c.

	Dividend	Price	Rise or fall.	Yield.
Anglo-Arg. Trams, First Pref. ..	5½	12½	—	10 9 6
do. do. 2nd Pref.	Nil	64	—	10 9 6
do. do. 5½ Deb.	5	5	—	7 17 0
Brazil Tramways	Nil	Nil	—	Nil
British Columbia Elec. Ry. P. Sec.	5	60	—	8 6 8
do. do. Preferred	5	93½	—	*8 14 2
do. do. Deferred	5	134½	—	*11 8 6
do. do. Deb.	4½	4½	—	7 1 8
Mexico Trams 5 per cent. Bonds ..	Nil	Nil	—	Nil
do. do. 6 per cent. Bonds ..	Nil	Nil	—	Nil
Mexican Light Common	Nil	Nil	—	Nil
do. do. Pref.	Nil	Nil	—	Nil
do. do. 1st Bonds	Nil	5	—	9 0 0

MANUFACTURING COMPANIES.

	Dividend	Price	Rise or fall.	Yield.
Babcock & Wilcox	15	16½	—	8 11 2
British Aluminium Ord.	10	10	—	0
British Insulated Ord.	15	15	—	10 0 0
Callenders	15	15	—	11 8 8
do. 6½ Pref.	6½	6½	—	10 18 8
Crompton Ord.	10	10	—	13 15 10
Edison-Swan	10	10	—	9 7 1
do. do. 5 per cent. Deb. ..	5	5	—	16 17 0
Electric Construction	10	10	—	15 4 10
English Electric	8	8	—	8 11 6
do. Pref.	6	6	—	11 8 6
Gen. Elec. Pref.	6½	6½	—	11 8 6
do. Ord.	10	10	—	10 5 0
Henley	15	15	—	6 18 6
do. 4½ Pref.	4½	4½	—	8 16 8
India Rubber	8	8	—	9 8 2
West. Vickers Pref.	8	8	—	11 9 2
Siemens Ord.	10	10	—	11 9 2
Telegraph Con.	20	20	—	11 9 2

* Dividends paid free of Income Tax.

THE MUNICIPAL TRAMWAYS ASSOCIATION (INC.).—II.

THE ANNUAL CONFERENCE AT SALFORD.

Some Phases of Tramway Developments in the Past, and the Outlook.

By J. M. McElroy (General Manager, Manchester Corporation Tramways).
(Abstract.)

There is every evidence, speaking broadly, that the tramway has not merely met the constantly growing traffic demands, but has, by the facilities it has provided, greatly stimulated that growth, which continues at a great rate. This rapid growth brings with it many fresh problems for those engaged in the passenger transport business.

With the object of studying certain phases of some of the problems we have been (and are still) confronted with, I have obtained certain statistics from the tramway managers in Glasgow, Liverpool, Leeds, Sheffield, Nottingham and Bradford, to which I have added the Manchester statistics.

Taking the year 1904 as a datum line—that being the year when most of the undertakings were fairly well established—the information shows the developments and changes each year since 1904. In an appendix the information is given in detail, together with a number of charts, of which an example is reproduced in fig. 1.

The results are included within the following ranges:

	At 1914, compared with 1904.	At 1921, compared with 1904.
Fare per passenger ..	15% dec. to 18% inc.	32 to 66% inc.
Revenue per head ..	23 to 47% inc.	141 to 272% inc.
Operating costs ..	3 to 34% inc.	176 to 222% inc.
Journeys per head ..	16 to 55% inc.	72 to 122% inc.
Passengers per car mile ..	2 to 24% inc.	19 to 66% inc.

The rapid increase in fares generally commenced in 1918.

These statistics show that before the war there was:—

- (1) A general tendency towards reduced fares.
- (2) A general tendency towards increased operation costs.
- (3) A gradual growth in the journeys and revenue per head.

All these factors illustrate the soundness of the policy of cheap fares which resulted in increased travel and greater revenue, which more than met the increasing operation costs.

After the war started there was, almost from the start, an accelerated growth:—

- (1) In the journeys and revenue per head.
- (2) In the passengers per car mile.
- (3) In the operation costs.

The increases in the fare per passenger lagged behind until the war was practically over.

One important fact emerges, namely, that the percentage increase in the average fare per passenger in all the cities is a long way below the percentage increase in the operation costs.

The urban passenger transport business is a small-coin cash business, and the unit in the past (with a few notable exceptions) was the penny fare. In most other businesses it has not been a difficult matter to pass on in easy stages to the consumer the increased costs of production. In our business it has not been possible easily to do this. If we had had a decimal coinage system, such as has been recently advocated with considerable force, it might have been possible to in-

31 undertakings which charge a minimum fare of 1½d., the distance which passengers can travel at this fare varying from 1 mile 1,130 yards to 987 yards. Eleven undertakings have a minimum fare of 2d., and the distances which can be travelled at this fare vary from 3 miles to 1 mile 140 yards.

Some believe that the wisest policy is to charge a high initial fare and a comparatively low long-distance fare, thus tending to induce the spread of the population over a wider area. Others think it is unwise to increase the minimum penny fare, especially as the next higher fare which the coinage permits, namely, 1½d., involves the use of two coins, and further it is feared that a minimum charge of 1½d. might tend to stop a lot of short-distance travelling.

Now, what of the future? The present high cost of permanent-way construction will put strict limits to tramway extensions, and must necessarily lead to the increased use of the

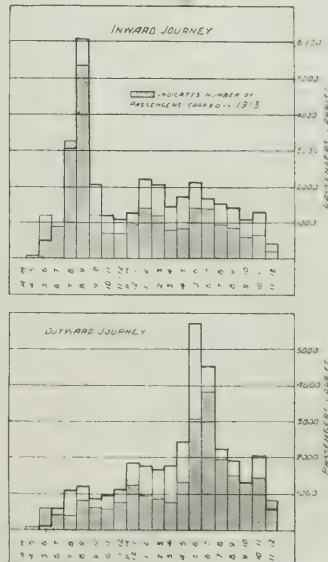


FIG. 2.—MANCHESTER CORPORATION TRAMWAYS. PASSENGERS CARRIED PER HOUR ON ONE ROUTE ON A TYPICAL DAY, JULY 1, 1921.

motor 'bus and the trolley 'bus, and in many instances where tramway tracks require reconstructing, the question whether motor or trolley 'buses should be substituted for tramways must be considered.

If I were to say that the passenger transport business in a city or town should be regarded as a monopoly run or controlled by the local authority in the public interests, I imagine I should at once raise an outcry against any such proposal. The very word monopoly rouses opposition, and it is claimed that competition is bound to be beneficial. But is it?

It is clearly a city's duty to see that its citizens are provided with suitable and adequate means of passenger transport at all times and in all directions, just as it provides other public services necessary for the public health and welfare. Its greatest task is to make full provision for the great tide of passenger traffic into the city centre in the mornings and out to the suburbs in the evenings—the peak loads. It has to decide how best to do this. The problem is a changing one, and the position has to be reviewed from time to time.

It is admitted by all who are qualified to judge that the modern tramcar is the most efficient vehicle for handling heavy peak loads traffic up to a certain traffic density. When the traffic passes beyond that density it has ultimately to be carried underground.

The provision of a tramcar service of adequate capacity to meet the peak loads involves the provision of a large amount of plant which is used for a few hours only each day. It calls for a large number of "part-day" cars which are in service during the rush hours only. These have to be housed and maintained, and adequate power plant has to be provided at the generating stations.

Appended to this report is a diagram showing the heavy peak on a typical route in Manchester. The diagram also indicates the growth of traffic since the year 1913 (fig. 2).

In Manchester we double the service of cars to meet these peaks, and the "part-day" cars we put into service at the rush hours are only on the roads for a comparatively short

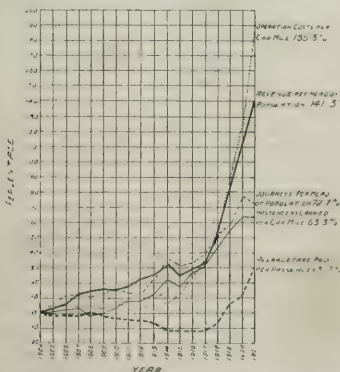


FIG. 1.—MANCHESTER CORPORATION TRAMWAYS, 1904-1921. PROGRESS CURVES.

crease our fares by easier stages than we have done, and correspondingly it would be easier to reduce the fares when the time was ripe for this to be done.

At the present time there are 45 municipal undertakings charging a minimum penny fare, and the average distance which can be travelled for this fare varies in the different undertakings from 1½ miles to 636 yards. Some of these undertakings still carry workpeople at cheaper rates. There are

time each day—less than one-third the time the "all-day" cars are in service, and some cars at the morning "rush" are run for a few minutes only—a costly business for any undertaking.

When the tramways on arterial routes near the city centres, reach the "saturation" point at the hours of peak load, and are still unable of satisfactorily coping with the traffic, then:

- (a) parallel tramway routes must, if possible, be provided;
- (b) motor "buses" must be run to supplement the tramcars or
- (c) underground railways must be provided.

The running of motor "buses" to supplement the tramcars at the peak would introduce considerable difficulties by adding to the street congestion unless the streets were exceptionally wide—a state of things which is not common in our cities.

It has been suggested that private enterprise should be allowed to come in and run motor "buses" to supplement the tramways to help with the peak-load difficulties. It has even been suggested that during the slack hours of the day motor "buses" alone should be run. This proposition has only to be stated to show its absurdity.

The provision and operation of tramways to meet the peak at reasonably low fares can only be done if the undertaking is carried on as a business concern, and the plant is run as nearly as possible at its maximum efficiency.

A tramway undertaking operated by a municipality has not only the obligations imposed upon it by Parliament, namely, (1) that it must maintain the paving between the rails and 18 inches outside them, and (2) that it must pay the local rates in respect of the rails laid in the streets, but the municipality has a tacit obligation to run cars at all times and in practically all directions, to run night services as well as day services, to run services along "thin" routes as well as good paying routes, to run costly "part-day" cars at the "peaks" for a few journeys only—in short, to meet all the legitimate demands of the public for passenger transport at such reasonably low fares as enable practically every citizen to use the facilities provided. In many cities and towns the tramway undertakings are called upon to pay large sums towards street improvements, and the provision of new streets, &c.

All these obligations are imposed legally or impliedly as conditions attaching to a public service which is or should be regarded as a monopoly.

If private enterprise is to be allowed to come in and run unrestrictedly without obligations such as those imposed upon tramways, it will follow that the services and advantages which the tramways have been able to give to the citizens will tend to diminish, because however effective the tramways have been in meeting the requirements of a city, they may not be able to give all the advantages they have done in the past if they have to compete with a rival system which is free from all the onerous obligations placed upon the tramways.

DISCUSSION.

Mr. J. DALRYMPLE (general manager, Glasgow), dealing with coinage, suggested that the Executive Council should be asked to go fully into the question, and make some recommendation to the Association on the subject. There was no doubt that it was a mistake to have an initial fare paid by two coins; what was wanted was a coin which would purchase something more than the present penny would purchase, and something less than three halfpence. He was of the opinion that the proposal put forward by Mr. Alcock, namely, to make the shilling into 10 pence, was the simplest proposition that had yet been made.

Mr. A. BAKER (general manager, Birmingham) said that the author's figures showing the increase of operating costs and fares due to the war were particularly interesting to him, because he had read a paper in 1915 before the Association on the question of financial problems as affecting tramways in war time. In it he had mentioned the fact that in order to meet the extra operating costs in Birmingham it had become necessary to increase the fares in the city. That was at a time when expenses had only gone up by 10, 15 or 20 per cent., but it would be seen that to-day the costs had increased by something like 200 per cent. all over the country. He had said that fares would have to go up all over the country, and his prophecy had come fairly true. He was particularly impressed with the author's reference to motor-omnibus competition with tramways. The unfairness of suggesting that omnibuses should come out during the heavy periods of the day to compete with tramways spoke for itself.

Mr. J. B. HAMILTON, C.B.E. (general manager, Leeds), said the tone of Mr. Baker's paper in 1915 was that plenty of money was going about, and the tramway people in Birmingham, too, they had better have some of it. This, amongst other things, led to the great rise in the cost of living, and incidentally, very largely to a great deal of the trouble from which they were suffering to-day. Nobody in the tramway industry should have had increased costs in 1915, except of a trifling character. As a matter of fact, in most well-managed towns, increased costs did not become general until 1918. As to the proposal to decimalise the shilling, he joined with Mr. Dalrymple with regard to sending the matter to the Executive Committee, but he thought that if they were going to take up this matter they ought to be able to co-opt some specialist on coinage, such as Mr. Alcock, so that they might come to some definite resolution to recommend to the members of the Association. The single coin would go a long way towards

settling, on a uniform basis, the difficulties portrayed by the author. It was a great pity that more uniformity had not been shown amongst municipal authorities throughout the country with regard to the alteration of fares.

Mr. H. MOZLEY (general manager, Burnley) said that at Burnley it was proposed to put into operation a minimum fare of 1½d., but they were told to reconsider the question. They accordingly separated the half-mile sections into an independent fare list—the penny fare stage only—keeping it entirely independent from the ordinary fare list, and it was working exceedingly well, without any difficulty to the conductors. That might help towards solving the problem of avoiding the 1½d. minimum fare.

Mr. J. BARNARD (general manager, Bolton) said that in Bolton they had returned the mile-and-a-half for a penny, and until April of this year they had never had occasion to alter that fare, and then they had only raised it by a halfpenny per stage. Therefore, they had a minimum fare of 1½d., and he was pleased to say that his Council was about to give concessions back to the travelling public. With regard to coinage, it was obvious that if they had had a coin of the value of 1½d. or 1½d., it would have carried them over their difficulties. As one of the Executive Council, he would do his utmost to further the introduction of some different coin, because he thought it was the only salvation for the tramways.

Mr. H. ALCOCK, at the invitation of the conference, briefly explained his proposition with regard to coinage. In doing so, he said that it must now be appreciated that the growing poverty of the tramway passenger would mean that he would have no alternative but to walk. On the other side, there would immediately arise a demand for the restoration of the penny fare, and so far as could be judged, the finances of the various undertakings would not permit of a return to the penny fare, because of the permanently higher cost of labour. Therefore, there was a good opportunity for tramway men to advocate, not a new system of coinage, but simply an adjustment of the existing coin values to bring them more into harmony with present-day requirements. Previous attempts to decimalise coinage in this country had failed chiefly because they had been of too ambitious a character, but his proposal was simply to make the existing penny coin worth more; no other coin need be altered. A penny would simply be worth a tenth of a shilling instead of a twelfth. The passenger would consider it a substantial concession to have the penny fare back, and the manager would appreciate that every penny fare would bring in 20 per cent. more revenue.

In the afternoon the discussion was resumed.

Mr. W. MURRAY (general manager, Walthamstow) said that were they to increase the fares further they would not only lose more passengers, but probably lose in revenue also. The only alternative was to reduce the costs. Much could be done towards increasing efficiency by education of the men and closer supervision; then increased revenue and decreased costs would naturally follow. With regard to motormen, it would mean increased effort towards economy in energy consumption and increased effort to avoid accidents. In the case of conductors, it would encourage a greater desire towards the effective collection of fares, and more courtesy towards the travelling public. If tramways were going to continue indefinitely making an annual loss, perhaps a growing loss, tramways were doomed, and the result would be that many men would find themselves on the human scrap-heap.

Alderman W. WALKER (Sunderland) also urged the importance of educating the tramway staffs. It ought to be possible to get the men together and give lectures with a view to increased efficiency in the handling of passengers and cars. He also urged that if they were all at one in the matter of the decimalisation of the shilling, they should go forward with a resolution. They must not sit down, or they would go bankrupt; if they could not get fares up to 1½d., they must put them up to 1d.

Alderman W. C. SHIPLEY (York) hoped that the conference would not go forward with the coinage revision proposal without giving it due consideration. To consider that it was possible to induce the powers that be to alter the currency to accommodate the tramway systems of the country appeared to be ridiculous.

Mr. A. T. EARDLEY (general manager, Stockport) pointed out that in the Sheffield case the increase of 66 per cent. in the fare per passenger in 1921 as compared with 1904 was higher than in any other of the five towns mentioned, and the increase of 272 per cent. in the revenue per head was also higher than in any other of the five towns, which showed that an increase of fares did not necessarily result in a decrease in revenue.

Mr. A. R. FRYMLEY (general manager, Sheffield) said the point was that the fares in Sheffield were the lowest coins which could be used—the halfpenny and the penny. The distances were half a mile for a halfpenny and three miles for a penny. That large increase in fare of 66 per cent. was not really the result of an increase, seeing that in doubling the halfpenny fare the distance was also doubled. He would not admit that they employed many men who were inefficient. It was up to the men to give every possible inducement to the public to use the tramways to the same extent as they did before. The number of journeys per head of population, which had increased by 122 per cent. since 1904, was only beaten by Glasgow, and not reached by any other undertaking in England.

Mr. R. H. WILKINSON (general manager, Bradford) pointed out that the increase in journeys per head of population in Bradford, namely, 96 per cent., was the highest increase of all the selected towns, with the exception of Sheffield. He mentioned that because he had advocated the 2d. fare twelve months ago, and it had been a great success. The increase in income in the first week following the increase was 32 per cent., and the average for the twelve months' working on October 1st next would be about 25 per cent. gain upon the revenue earned at the time the 1½d. fare was taken off. That fact, coupled with the increase in the number of journeys per head, proved that so far as Bradford was concerned the two-penny fare was the right fare to adopt.

Permanent Way (Public Road) Maintenance.

By W. CHAMBERLAIN (General Manager of Tramways, Oldham).

(Abstract.)

THE subject has frequently been discussed of the action to be taken by those responsible for operating tramway undertakings in order to obtain a measure of justice in respect of the unfair burden placed upon them by the Tramways Act of 1870, by virtue of which they are charged with the responsibility for maintaining a large portion of the roadway on which their tramways are laid, and of which they are only partial users.

After a period of 50 years, the question of road construction and maintenance has arrested the attention of Parliament. The subject is, without doubt, one of first importance. The evidence of it is found in the fact that legislation has been enacted to deal with the new methods of transport.

Tramway authorities were in high hopes that the unequal financial burden they had been called upon to carry would be corrected, but it would appear that the Government department concerned has not been actuated by any lofty sense of justice in dealing with the subject, but was content to operate in the field of legislation for the most insistent and clamant—the usual plan.

If tramway authorities do not bestir themselves and become so importunate that they cannot be denied, they will make no progress with an admittedly just claim. The chief object in presenting this paper is to obtain the feeling of tramway authorities, and, if possible, to secure concerted effort in putting forward our claim for redress.

In 1870 the House of Commons first gave permission to tramway authorities to use public roads, and enacted that they should maintain that portion of the road which they used. At that time every vehicle on the road was horse driven, and they were necessarily of light construction. The tramway track was, in fact, materially worn by horses used for tramway purposes. No form of road transport has experienced such a radical change as tramways, and it is certain that Parliament did not then foresee the use of mechanically-propelled vehicles, with the result that the intentions of Parliament are not being carried out to-day.

The conditions of the 1870 Act have been imposed by every private Act since that date right up to the numerous Acts of last year, but it is not pretended that these conditions are any longer founded upon any sort of principle.

The recent court of inquiry concerning the dispute in the tramway industry pointed out the recommendation contained in the report of the Select Committee of the House of Commons on Transport, dated July 25th, 1919:—

"Your committee further consider that it is essential that there should be equal financial treatment of all surface means of locomotion which exist by an appeal to passenger traffic. They regard the rating of the tramways, and their contribution towards the maintenance of the surface of the roads, as compared with the immunity of omnibuses from both these charges, as indefensible, and there are, in their opinion, no counterbalancing considerations of sufficient magnitude to induce them to modify this view. At the same time, they do not propound any specific means of dealing with this problem, which would be one of the duties entrusted to the suggested traffic authority for recommendation to Parliament."

The court of inquiry added: "No doubt the Minister of Transport has considered the subject of providing some contribution towards the additional cost of road maintenance caused by heavy vehicular traffic, which may pass through districts that derive no advantage from it, causing damage to the tramway track, the full cost of which is at present borne by the tramway undertaking."

Sir Eric Geddes, speaking on the Roads Bill in the House of Commons in December last, did not attempt to oppose the claim of tramway authorities on principle. He said:—

"It is the statutory obligation of the tramway companies to maintain the roads. If it is a wrong one, let them come to the House. I have a great deal of sympathy for the tramways. There may be a case at a later date for revising the Tramway Statutes, but this is not a Bill for revising the statutory charges imposed on the tramways and other undertakings such as gas, electricity, and water undertakings."

It is well known that when roads are disturbed by any undertaking, they are under a statutory obligation to reinstate the road, but there can be no analogy between this obligation and the one imposed on tramway authorities whereby they are called upon to maintain the road. Our claim is that new conditions demand new treatment.

A recent traffic census taken in an industrial town showed that over a period of seven days the amount of traffic carried over the tramway system was as follows:—

Tramcars, 9,503; other vehicles, 41,363; percentage of tramcars to other vehicles, 21 per cent.

Municipalities, particularly those which operate tramways on main inter-town roads, are placed in a very serious position. Where the roadway has not been constructed on modern lines the bulk of the traffic is carried on that portion of the roadway maintained by the tramway authority. It is also frequently found that the concrete foundation is cracked or otherwise defective, and to meet the needs which spring from the introduction of heavier road transport a thicker concrete foundation has to be substituted.

Defects in the roadway, largely caused by heavy traffic other than tramcars, have now to be made good by tramway authorities, and the repaired roadways are used in common by all road users.

The principle for which we contend is recognised in the Finance Act, 1920, which imposes a graded system of excise upon all mechanically driven road vehicles by way of an attempt to assess the burden in accordance with the measure of the user of the road; that is all the tramway authorities ask for.

In the Lancashire and Cheshire area the amount paid in local rates by the tramway authorities in 1920-21 was £260,235.

In addition to this expenditure, the amount incurred by the tramway authorities in this area during the same period on permanent-way maintenance was £584,081, to which must be added the sum of £627,051 on permanent-way reconstruction, making a total expenditure for one year on permanent-way works of £1,007,135. In the borough I represent the amount paid in local rates for the year 1920-21 was £6,881; of this sum £5,361 was in respect of permanent-way. The percentage of permanent-way costs to traffic revenue was 21 per cent.

Although we are the minor users of the roads, as every traffic census shows, we are the major contributors to their cost.

Would the withdrawal of the tramways cause any less wear and tear to the road? On the contrary, it is certain that a very large additional cost would have to be borne by the Roads Fund.

It has been argued that tramways do not contribute to the Roads Fund by means of taxation. The cost of an excise licence for a tramcar is 15s. If it were thought desirable that tramways should contribute to the Roads Fund in addition to being rated on account of their tramways, I think there would be little objection if an equitable graded system was adopted.

The equities of the case, and the conditions governing the rating and taxing of other forms of mechanically-propelled vehicles, whether for passengers or merchandise, demand a considerable transference of the burden of road maintenance.

Some ask: "To whom would the burden be transferred?" Would it be to another department of the same authority? The answer to this question is twofold. First, tramways are a commercial enterprise. They should, therefore, depend upon their own earning power, and should not be required to carry a burden directly imposed by other road users, in some instances by their own competitors. Secondly, road maintenance—at any rate, of first-class and other graded roads—is no longer borne by local taxation, and therefore it is not a case of transference from one pocket to the other. It is now in part spread over the actual users of the road through the medium of excise licences, and these licences should be extended to embrace all users of the roads.

Annual Report.

The annual report of the Executive Council shows that the total membership numbers 94 local authorities, 95 general managers, and 20 associate members. The total number of local authorities owning and working tramways is 102.

The outstanding feature of the year was the establishment of a Court of Inquiry into the condition of the industry, by the Ministry of Labour, under the Industrial Courts Act, 1919. An exhaustive investigation made during October and November, 1920, by the General Secretary and Mr. Cliff (the last-named representing the Employers' Trade Unions), into the financial position of municipal tramway undertakings disclosed an alarming adverse condition of affairs, which was unrelieved by any tendency towards improvement. In their report it was shown that the all-in operating costs during September and October, 1920, exceeded the traffic revenue by over 45 per cent. of the aggregate earnings. It was under such financial conditions that an application was made on October 15th, 1920, for a further increase of wages of twelve shillings per week. The National Council found itself quite unable to accede to it, and the Court of Inquiry arose out of the *impasse* thus created.

The total amount of war bonuses granted to tramway employees has been as follows: (a) 42 per week upon pre-war wages, and (b) a maximum of 3s. per week upon basic rates.

The first reduction of war bonuses by three shillings per week under the scheme adopted by the National Council on June 16th, 1921, took effect at the beginning of August, 1921.

Attention is directed to the fact that in most cases the published balance sheets of municipal tramway authorities do not make any provision for renewals not actually effected

before arriving at the balance, either deficit or surplus. Only five undertakings succeeded in earning sufficient revenue to enable them to make provision for the renewal of the permanent way at the rate which is generally recognised as being now necessary, viz., 2½d. per ear mile.

The result is stated as follows:

Amount required for renewals at 2½d.
per mile on the approximate car
mileage run, viz.:—244,000,000 ... £2,541,666

Aggregate amount of surpluses, with-
out any provision for renewals ... £1,029,706
Deduct: Aggregate amount of deficits ... 841,392

Net aggregate surpluses ... 188,314

Net aggregate deficits for the year ... £2,356,552

During the passing of the Roads Act, 1920, through Parliament, strenuous efforts were made to secure to tramway authorities some share of the proceeds of the excise duty imposed by the Finance Act, 1920, upon mechanically propelled road vehicles. The proposals made on behalf of the Association were opposed by the Minister of Transport and defeated. During the holding of the recent Court of Inquiry, strong emphasis was laid upon this aspect of tramway finance, and the Court directed attention to it in the report.

Notwithstanding the cardinal change in the conditions of road user by tramways and other forms of road transport that has taken place since horse-traction days, the Minister of Transport seems to be of opinion that the original obligation placed upon tramway authorities for road maintenance should remain unchanged.

The Association informed the Minister of Transport that it dissented from the proposed requirement that in the case of new cars designed for exit or entrance at the leading end on the near side, the steps used for the purpose must be of folding type, but the Minister would not give way. It was agreed that a pull of 50 lb. should be the minimum necessary to lift a lifeguard tray off the ground.

At July 13th, 1921, 33 municipal applications for orders to increase statutory fares under the Act of 1920 had been granted, and eight refused.

The Board of Inland Revenue has agreed to continue for five years the present scale of annual allowances of 20 per cent. on the written-down value of motor 'buses in respect of depreciation due to wear and tear.

Sub-committees are considering the types of trolley collector gear in use, the relative merits of British and foreign rails, the standardisation of gear cases, and the division of duties of electricians, wiremen, &c., and the British Engineering Standards Association is to hold a conference on the standardisation of ball and roller bearings.

The receipts for 1920-21 amounted to £5,321, and the expenditure to £5,068. The cost of preparing and submitting the case for the Association to the Court of Inquiry was £1,616, which was met by a special levy.

An appendix gives the final report of the Rail Corrugation Committee, which indicates that after five years' observation of the effect of running of trams on all the rails under observation, the summary of conclusions given in the report of the committee of October 12th, 1914, is generally confirmed. It is held "that corrugation of steel rails is inseparable from the action of the heavily loaded wheels rolling along the surface of the tread of rails, and that this rolling originates the corrugation by giving rise to superficial stresses in the material of the rail tread which are in excess of the elastic limit and of the toughness of that material."

Another appendix shows that the sums contributed to the relief of rates in the current financial year amounted to £43,945, while the sums charged upon the rates amounted to £516,361, making a net charge of £472,416.

Annual Dinner.

The annual dinner of the Association was held at the Grand Hotel, Manchester, on Thursday evening, September 29th, the President, Mr. Holford, in the chair.

The loyal toasts having been duly honoured, Coun. J. Thomas, (Mayor of Portsmouth) proposed "The Ministry of Transport." In doing so, he assured them that the feeling towards the tramway industry of the Ministry was all that could be desired, and the Association could only hope that that feeling would be reciprocated by the Ministry. There was never a time when it was more imperative that these feelings should exist than to-day.

Mr. ARTHUR NEAL, M.P. (Parliamentary Secretary to the Ministry), responding, emphasised the supreme importance of transport. We in this country, he said, must realise that the cheap and easy transport of goods and people was absolutely essential to the restoration of the prosperity of the country. Dealing with the work of Sir Eric Geddes during his term of office as Minister of Transport, he said that the Railways Act was one of those great permanent measures which would make commerce easy and smooth the pathway of the trader. Dealing with unemployment, he said that it must not be forgotten that in this country there had been given to local bodies an increasing number of powers of

local self-government, and the national problem, though it were national, had to be solved very largely along the lines of local self-government. Both the national Government and local governments wanted to catch the same fish, i.e., those who had money. Therefore, when local governing bodies went to the central Government for grants they really had to go to the same public. A deputation from the Municipal Tramways Association and the Tramways and Light Railways Association had asked the Minister of Transport to take over the duty of fixing their charges for them. As everyone knew, a special Act was passed, and the Minister had been discharging those duties. He was in a position to say that the Government was prepared in the next session of Parliament to promote legislation to carry on for another twelve months at least the method of fixing charges which was at present in operation, and which would see the industry through, he believed, until February, 1924. That would enable municipalities and other transport people to avoid the necessity of spending their money, time, and energy in the promotion of private Bills.

Ald. W. C. FENTON (Sheffield) proposed "The Salford Corporation Tramways Committee and the Manchester City Tramways Committee," and thanked both bodies, on behalf of the Association, for the hospitality they had extended to the members of the Association.

Ald. BARRETT, J.P. (chairman of the Salford Corporation Tramways Committee) and Ald. J. BOWES, J.P. (chairman of the Manchester City Tramways Committee), responded. The latter gave some figures concerning the Manchester Tramways, on which the Corporation had spent £2,500,000; it was the third largest system in the kingdom. The revenue from the tramways last year was £1,802,280, but the expenses were also very great. In 1914 the salaries paid to the employees amounted to £371,192, but this year they were paying £1,142,064, which was an increase of 208 per cent. on the 1914 figure. Expenditure on material had also increased by 357 per cent. at the present time, compared with 1914.

The toast of "Our Visitors" was proposed by Mr. D. D. IRVING, M.P. (vice-chairman, Burnley), and responded to by Mr. G. H. ROBERTS, M.P. (late Minister of Labour and Food Controller). The latter expressed appreciation of Mr. Neal's courage in advising the members of the Association not to expect too much from the Government. At the same time, there were aspects of the tramway question which rightly demanded the consideration of the central Government.

Finally, a hearty vote of thanks was accorded the retiring president for his services.

ELECTRICAL NOTES FROM INDIA.

(FROM OUR BOMBAY CORRESPONDENT.)

YOUR correspondent has only recently arrived in India from the wilds of British East Africa (now Kenya Colony) after some few years' wandering off the beaten track, where electrical undertakings of any sort are few and far between; and it is a pleasing experience to return to civilisation once again, and to find oneself in a busy town, where trams (not so far for five years) pursue their way merrily along crowded streets; and matters electrical meet one on every corner.

It requires but a brief sojourn in India to imbue one with a spirit of pure optimism regarding the possibilities of electrical development in this country in the future. Industrially, the prosperity and greatness of any country depends primarily upon an abundant supply of cheap motive power. India is rich indeed in raw materials, but this fact alone would not make for industrial progress or supremacy. If there were to be a deficiency in cheap motive power supply, India's future would be continually handicapped; and in these days of dear coal and dear oil, India may be considered fortunate in being wonderfully endowed with a vein of wealth in the power necessary to satisfy the needs of the community. From all appearances, India will not lack such a supply, for on all sides one is met with activities towards the development of her wonderfully economic sources of power in watersheds of her mountain ranges.

The brief outline following is concerned with schemes on the Bombay side, the moving spirit in which schemes is Sir Dorabji Tata, the head of the great Indian industrial house of Tata. His activities are perhaps too well known to need any eulogy, more especially in the direction of engineering development in general, and hydro-electric schemes in particular.

The Tata Hydro-electric Power Supply Co., Ltd., is now supplying a large number of cotton mills in Bombay, through Messrs. Tata Sons, Ltd., who are developing the schemes under review. Their power station at Khopoli, about 43 miles from Bombay, has a capacity of 50,000 h.p., which can be delivered to Bombay for 3,600 hours each year, but, says *Industrial India* (from which excellently compiled publication these figures are excerpted), the outstanding fact of interest at the moment is the huge additional power which will soon be available for the inaugurating of large new industries, and the electrical operation of the suburban railways required to serve them.

Eventually some five power stations will be built to develop water power in the Western Ghats, the projected Ambaoli

power station being 131 miles from Bombay, and that at Kumbhari, 150 miles from Bombay; but it is anticipated that the bulk of the energy from this scheme will be consumed by industries as near as practicable to these power stations. The Andhra Valley Power Co. is building a station at Bhiopuri, of 65,000 e.h.p. capacity, and the Tata Power Co. a station of 150,000 e.h.p. at Bhira; and the above, together with the station in operation at Khopoli will render available some 915,000 e.h.p. for delivery to consumers.

Bombay is notoriously short of domestic water, the existing supply of which is estimated at 38 million gallons per day. The municipality has under consideration works to increase this at an early date to 95 million gallons.

The following table gives the supplies of fresh water which will become available from the tail races of these Western Ghats power stations:—

Power House.	Power for Consumers e.h.p.	Distance to Bombay.	Fresh water supply available from tail races, per day.
1. Bhiopuri	65,000	52	120,000,000 gal.
2. Khopoli	50,000	43	100,000,000 gal.
3. Bhira	150,000	77	300,000,000 gal.
4. Ambaoli	400,000	131	700,000,000 gal.
5. Kumbhari	250,000	150	450,000,000 gal.

Station (2) in operation.

Stations (1) and (3) under construction.

Stations (4) and (5) projected.

Bombay is one of the largest ports and cotton centres of the world, and it will therefore be seen that a supply of nearly a million h.p. will eventually be available at a cost (so says *Industrial India*) never exceeding 0.75d. per unit; and abundant fresh water supplies can be tapped.

The static head of water on any of the turbines will never be below 1,700 ft.; and it is presumed that arrangements will be made to operate the various stations in parallel should occasion arise.

Any preliminary description of these projects is necessarily sketchy and incomplete, but the bare outline given will serve to draw renewed attention to undertakings, which, in size, at any rate, will compare favourably with the Niagara business. Brief reference may be made to some of the chief industries which await the supply of abundant cheap motive power. The mineral bauxite may prove an asset of great value to India, inasmuch as the deposits of laterite in the Peninsula and in Burma have been proved to contain large quantities of alumina; and these deposits are, it is believed, in all essential respects identical with the substance known as bauxite, the chief uses of which are (1) as a raw material in the production of metallic aluminium, (2) in the manufacture of aluminium salts, (3) in the manufacture of bauxite bricks for furnace linings, (4) in the manufacture of alundum, aloxite, &c., for use as an abrasive.

A still more modern industry is the fixation of atmospheric nitrogen for the manufacture of various products, particularly in agriculture, and in the manufacture of explosives; and, generally, electricity will be adopted here in the iron and steel industry, both for smelting steel, and in the reduction of iron ore; its use is also extending to non-ferrous metals and for the manufacture of chemicals.

So much for the schemes taken in hand by the great Parsee house of Tata. The shareholders and the directors appear to be common to all the companies concerned.

The Bombay Electric Supply & Tramways Co., Ltd., are at present taking about 3,000 kW from the Tata Hydro-electric Supply Co., Ltd., to assist over the peak load in the evenings.

The British manufacturers are fairly well represented in India, such large firms as the Metropolitan-Vickers Co., the B.T.H. Co., and the G.E.C., having branch offices in the chief towns.

ELECTRIFICATION OF THE G.I.P. RAILWAY.

It is proposed to electrify the suburban lines of the Great Indian Peninsula Railway, and the Andhra Valley Power Co. (referred to above) will be asked to meet the demands for power required.

On first opening from the Victoria terminus in Bombay to Kurla it is anticipated that the hourly maximum demand will be 6,650 kW, which will be furnished from two substations, and the energy consumption for this section will reach about 17,000,000 units per annum.

On opening from Victoria terminus to Thana, the anticipated demand is 9,000 kW, with an additional sub-station of 3,500 kW capacity; annual consumption 29,000,000 units.

On the final opening to Kalyan the total hourly demand will be 11,600 kW.

According to the preliminary figures of the recent census, the population of the suburbs of Bombay has increased 50 per cent. in the last ten years; and it is estimated that an approximate train mileage of 2,000,000 will have to be worked on the first opening. This figure will rapidly increase as the development schemes of the Bombay Government come into being.

The Bombay-Kalyan section will thus operate a service equal in intensity to that of any electrified line in the world. Within ten years of the opening the hourly maximum demand

will reach 25,000 kW, with a total annual consumption of 87,000,000 units.

The Andhra Valley scheme will embrace transmission from the Bhiopuri station at 100,000 volts, and distribution in Bombay at 22,000.

HYDRO-ELECTRIC UNDERTAKINGS IN CEYLON.

The Director of Public Works in Ceylon (Mr. T. H. Chapman), in his annual report for 1920, says that the surveys and plan-work in connection with the Aberdeen-Laxapana hydro-electric scheme have been continued under the supervision of Mr. D. J. Wimalasuriya, district engineer, and have been sufficiently far advanced to enable a fairly accurate estimate to be made of the cost of the work up to and including the generating station.

The survey and location of the transmission lines has begun. Mr. J. W. Meares, M.I.C.E., M.I.E.E., of the Hydro-electric Survey in India, and the electrical adviser to the Indian Government, visited Ceylon in 1920, at the request of the Government, to advise on the scheme, and his report appears to have been entirely favourable.

The estimated cost of the Aberdeen-Laxapana scheme, and the cost of energy in the various stages proposed for its development are given in the report. The total capital cost, excluding transmission lines, is Rs. 8,435,000 in the first stage, Rs. 15,120,000 in the second, and Rs. 30,925,000 in the third stage.

Mr. F. Bolton, M.I.C.E., M.I.E.E., visited Ceylon in November, 1920, and furnished a report dealing mainly with the electrical production of cyanamide and nitrogenous manures. His figures indicate that cyanamide could be produced in Ceylon at about Rs. 60 per ton less than it can be obtained for now, and that 20,000 tons are now consumed annually, and consumption is likely to increase materially in the near future.

CIRCUIT BREAKERS OF LARGE CAPACITY.

A PAPER on "Modern Switching Equipment," by L. B. Chubb, engineer to the Canadian Westinghouse Co., was reproduced in a recent issue of the *Electrical News*. This paper describes, with illustrations, some recent developments in large capacity circuit breakers, and is a striking record of the progress made in this direction.

Among the gear treated upon is the 3,000-A, 15,000-V circuit breaker shown in fig. 1. This is stated to be the heaviest medium-voltage circuit breaker so far manufactured (? by

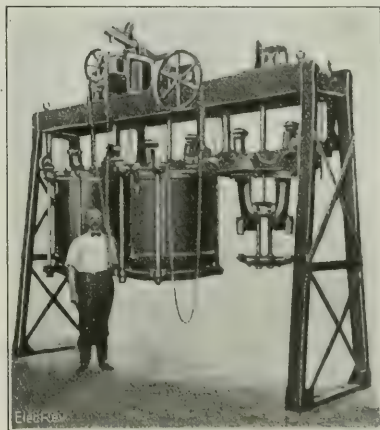


FIG. 1.—3,000-A, 15,000-V CIRCUIT BREAKER.

the Canadian Westinghouse Co.). The three poles together with all mechanism, are mounted as a rigid unit on two horizontal 10-in. channels. Tanks and covers are designed to withstand internal gas pressures of over 1,000 lb. per sq. in.; 80,000-V test condenser bushings are used. These being short, and of large diameter (6 in.), have high cantilever strength to withstand electromechanical forces. No porcelain or other brittle insulation is used. The main contacts are of the "reverse" brush type; both these and auxiliary contacts are designed to maintain contact under heavy short-circuit currents. The auxiliary contacts are necessarily large to successfully shunt the large rated current (60,000 A) from the main contacts on opening. High speed solenoid operation is used, though a removable worm gear device is furnished for hand operation when desired. A worm gear device is also used for lifting

or dropping the tanks. This device can also be used for replacing a complete tank unit, if necessary.

In contrast to the above medium voltage, high current breaker, it is interesting to compare the high voltage breaker described. In this case the possible abnormal voltages demand large tanks for insulation requirements. While the tank structures are not subjected to as high pressures in arc rupturing as the l.p. heavy current breakers, yet the h.p. tank structures must be of ample strength to withstand any explosion possible. The density of explosion of plain oil vapour is small, as this, when mixed with air, is explosive within very narrow limits, viz., from $1\frac{1}{2}$ to 6 per cent. of oil vapour to air. The explosion pressure also does not exceed about 75 lb. per sq. in. Arcing under oil breaks up the oil more or less into various hydro-carbons, oxygen, and hydrogen. Such mixtures are explosive when mixed with air through wide limits from 10 to 66 per cent. proportion to air, and may give violent explosions with pressures up to 120 lb. per sq. in. If the generation of gas is rapid enough to give $1\frac{1}{2}$ atmospheres compression before ignition, the explosion pressure is about 50 per cent. higher. Many failures of l.p. oil circuit breakers in the past have been traced to failures of the tanks under gas explosions. Each pole of the equipment is therefore fitted with four quick-break contacts in series. In these large-capacity high-voltage breakers the arcs tend to become long and "stringy." The current in this case (as compared with the l.p. breakers) is small, with slight magnetic blow-out effect, and multi quick-break contacts have proved very effective in interrupting such currents. The bushings furnished with these l.p. breakers are of the well-known "condenser" type, designed to give a uniform distribution of voltage stress over and through the insulation. These bushings are all given a 400,000-V. one-minute insulation test, and meet this test with entire absence of noise or any evidence of "static." This test is equivalent to a flash-over of 42 in. between needle points.

LEGAL.

FREDERICK SMITH & CO. BUILDERS, LTD., v. WOOLF.

In the Mayor's and City of London Court on October 7th, plaintiffs, electricians, 9, Bush Lane, Cannon Street, E.C., sued George S. Woolf, wholesale stationer, 155a, Upper Thames Street, E.C., for £10 6s. 3d. for repairing electric lights and other work done for him. Mr. WARNER, defendant's counsel, asked for an adjournment because the defendant was ill. Mr. PORTER, plaintiffs' counsel, opposed that, and said the defendant had raised a plea of infancy. There were three other actions pending against the same defendant, and he had raised the same defence. It was in the public interest that the sort of thing which the defendant was doing should be exposed in every possible manner. Defendant's mother said he was born on April 2nd, 1900, and was therefore under age when he entered into the present contract. Judge JACKSON said the defendant had no right to come into the City and trade there and then get out of his liabilities by setting up a plea of infancy. If he were an honest man he would say he could not pay and would offer instalments. Mr. WARNER said the defendant had started in business, and there was about £100 due to him from customers. If they paid he would be able to pay the plaintiffs. Judge JACKSON said he must find for the defendant, but it was not a creditable thing for such a state of things to be going on. If he could deprive the defendant of his costs he would do so, but without further consideration he was not prepared to decide definitely.

GIBBS v. METROPOLITAN ELECTRIC TRAMWAYS, LTD.

In an action tried in the King's Bench Division on October 6th by Mr. Justice McCardie, damages were claimed for Hannah Ellen Gibbs, of Shadwell, against the Metropolitan Electric Tramways, Ltd., for injury sustained by her as the result of a collision between two trams near Wood Green Station on April 5th of last year.

The case for the plaintiff, as stated by her counsel (Mr. Doughty), was that the passengers in the one car, when they and the other car descending upon them, fell to the exits, and the plaintiff, who was at the end of the frightened queue, had the misfortune to get her foot between the two cars at the moment of the impact, as a result of which she was badly injured. The structure of the foot collapsed, and, said counsel, the girl would in consequence be a cripple for life. She was 14 years of age at the time of the accident, had gained four scholarships, and was training for a teacher.

The Tramway Co. paid £350 into Court, but his Lordship, in giving judgment, said that although the sum paid in was substantial, it was not sufficient, having regard to the nature of the injury sustained. The girl, he said, must be compensated for her great suffering, for she had gone through pain and an experience which could not fail to leave a permanent effect on her physical, mental, and temperamental. Such effects were apt to be over-estimated. The plaintiff had lost what was sometimes called the great chance of self-im-

provement. She was a bright girl, but the career of a teacher was now closed to her. Bearing in mind that her future chances in life, whether in the greater field of industrial employment or the minor field of domestic employment, had been marred by the accident and the possibility of a future operation, he awarded her the sum of £425, of which £50 would go to her father.

Judgment was accordingly entered for the plaintiff for £425, including the £350 paid into Court, with costs.

MATE v. MORGAN.

In the King's Bench Division on October 7th, Mr. Justice Greer had before him an action in which Mr. Robert Mate, whose address was stated to be 150, Queen Street, claimed damages against Mr. Morgan, an agent, for failure to supply under a contract 2,000 Bosch magnetos.

Mr. Doughty appeared for plaintiff, and defendant was represented by Mr. Harold Morris, K.C.

Mr. DOUGHTY, in opening, said that there was no question as to quality, the only point being failure to deliver according to contract, and the only defence put forward was a statement that it was common knowledge when the contract was made that the magnetos were coming from Germany, and as defendant was unable to get them from Germany he was excused from his contract. The contract was made on August 11th, 1920, for the delivery of the magnetos (ZU4 and ZR 4) at the rate of 100 a week at £9 2s. 6d. each, free of all charges. The sum of £1,800 was to be paid as soon as the consent offer was accepted, and the payment of that amount was made on August 14th. Mr. Morgan was unable to obtain the magnetos in Germany, and on September 23rd he informed plaintiff of the fact.

His LORDSHIP: And there were none delivered at all?

Mr. DOUGHTY: Only one, and that was sent as a sample. At the end of last year there was a great demand for these magnetos, and there was still a demand for them.

His LORDSHIP: Notwithstanding the name?

Mr. DOUGHTY: Yes, my lord, notwithstanding the name. Continuing, counsel said that they were made of a peculiar kind of steel which would take a higher magnetisation than any other steel.

Mr. ROBERT MATE, the plaintiff, in the course of his examination, said that he was dealing in magnetos in the summer of last year, when he was introduced to Mr. Morgan, who entered into the contract for the purchase of the magnetos. The plaintiff paid £1,800. On September 22nd Mr. Morgan saw him and told him that he was unable to get the goods. He returned the cheque for £1,800 and offered £100 in addition. He (plaintiff) was unable to say what his loss was from the failure on the part of the defendant to carry out his contract.

In cross-examination, plaintiff said that the goods were to be delivered free on rail at Grimsby, but at the time he had no warehouse or place in which to store them. He had entered into other contracts to buy magnetos. One was with the Vulco Co. for two parcels of 250 each. The 2,000 from Morgan and the 500 from the Vulco Co. were the only two contracts. He had brought an action against the Vulco Co. for failure to deliver, and that was the only action which he had previously brought either by himself or through other people with whom he was connected.

Witness was further cross-examined as to the price of magnetos at the time of the contract and the persons with whom he had dealings with a view to showing the losses which he might have sustained, and trade witnesses were called in support of his statements that the prevailing prices for magnetos were then from £11 6s. wholesale to £18 retail.

At the close of the plaintiff's case a consultation took place between the parties, with the result that the record was withdrawn upon terms endorsed upon counsel's briefs—terms which did not transpire except that the £250 paid into Court should be paid out to the plaintiff.

A Diesel-electric Trawler.—The equipment of the Diesel-electric trawler *Mariner* was described in a recent issue of *Power*. The propelling equipment comprises two eight-cylinder four-cycle 350 r.p.m. Nelsco-Diesel engines, each directly connected to a 165-kW, 125-volt, G.E. d.c. generator. The two self-excited generators are normally connected in series and supply power to a 400-h.p., 250-volt, 200-r.p.m. motor, which is direct coupled to the propeller shaft.

The 400-h.p. propeller motor is located forward of the generating sets and has a normal full-load speed range of from 160 to 200 r.p.m. It is a compound-wound machine, and when taking energy from both generators, operates at 250 volts; but for slow cruising one engine can be shut down and the motor then receives power at 125 volts. Under these conditions it has a speed range of from 70 to 160 r.p.m.

The fishing operations are carried on by means of a 65-h.p. motor-driven main double-drum hoist, installed on the main deck forward of the engine room, which handles the haulage cables and ropes of the net as they pass through the hoist brackets fore and aft on either side. The unloading of the fish at the dock is accomplished by means of a 5-h.p. motor-driven whip hoist located near the forward mast.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Electric Pipe Lighter.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C. 2, has recently put a new electric pipe and cigarette lighter upon the market. This device, which appears at first to be merely a refinement of luxury, is claimed to be more economical than petrol lighters or matches. As will be seen

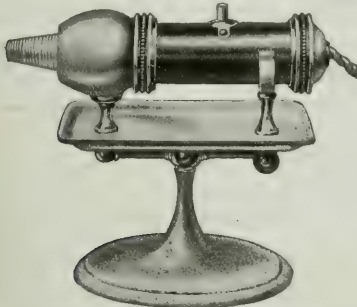


FIG. 1.—THE "MAGNET" ELECTRIC PIPE LIGHTER.

from the illustration (fig. 1) the lighter consists of a cylindrical body containing a push-button switch. The element is wound spirally upon a porcelain cone. The lighter can be supplied in a variety of finishes, and adapted for either table use or for mounting upon a wall.

Ornamental Electric Fires.

Hitherto electric fires have been somewhat light in construction and have generally been limited to some 2,000 watts. With the increasing use of electric heating came the demand for fires of more substantial construction, larger capacity, and handsomer appearance. The General Electric Co., LTD., has produced a series of fires expressly designed to meet this demand. The bodies of these fires are iron castings of substantial proportions and beautiful design. Several patterns of



FIG. 2.—A "MAGNET" ORNAMENTAL ELECTRIC FIRE.

single and double fires are available, and each can be obtained in various finishes. A typical fire of the double type is shown in the accompanying illustration (fig. 2), the block body being relieved by brass ornaments.

The standard fires are made in 2,000-watt and 4,000-watt sizes and are provided with high efficiency heating elements of the glowing wire coil pattern. A selection of cast iron fires can be seen at the company's showrooms at Magnet House, Kingsway, and at any of their provincial branches.

A Simple Form of Ammeter.

The ammeter, shown in the accompanying illustration, has been designed primarily to test dry cells. It is constructed so that contact may be made directly to the battery without

the use of a wire lead, but a terminal is provided so that a lead can be used if so desired.

A dry cell may be tested with this ammeter by placing the metal insertions on the back of the instrument on the terminals of the cell. A dry cell of ordinary commercial size when new should register approximately 28 amperes.

A one-piece aluminium punch-and serves as the coil for some

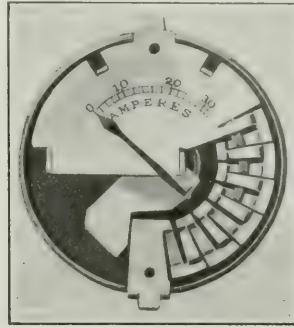


FIG. 3.—A SIMPLE AMMETER.

noid as well as the terminals, dial plates, the mounting for the armature, and the support for the glass. The entire collection thus formed is placed in a composition case, so as to form an ammeter of the most simple design and construction. This unique construction, it is claimed, eliminates soldering the screw connections common in other meters, making a more durable, dependable and accurate instrument. The meter is sealed so that it cannot be opened or tampered with. The stamped coil or solenoid is the feature of this invention.—*Scientific American*.

The Wheatcroft Soldering Iron.

Our illustration, fig. 4, shows one of a number of sizes and types of electric soldering iron that have been placed on the market by MESSRS. ELLIS & COE, 308, King Street, Hammer-smith, London, W.6, in which the bit is made in one piece so as to eliminate the screwed joint that is apt to give so much trouble. The bit can be taken out to shape the working end to suit the work in hand; it can be easily adjusted for wear, and repairs, when needed, are simple to make. The iron is

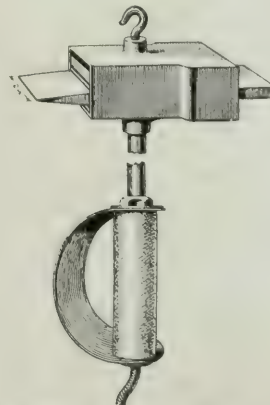


FIG. 4.—THE WHEATCROFT SOLDERING IRON.

provided with two heating elements, one above and the other below the copper bit, which are in no way connected to the latter, so that they can be easily replaced. The type "A" iron has been specially designed for armature work, the handle being protected by a fibre guard from falling solder; the grip is made of compressed cork. This size of iron has a copper bit 2 in. wide and $\frac{1}{2}$ in. thick, and it consumes about 400 watts.

(NOT YET PUBLISHED.)

2340s. Crossed by St. George's Engineers, Ltd., and
R. W. September 20th
2341s. W. H. Longworth. September 20th
2342s. Crossed by Grosvenor Conduits Co., Ltd., and F. I.
. September 20th

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

- 4,559. "Distant control of telescopes or cameras." J. B. Henderson.
March 28th, 1916. (168,918.)

1920.

- 7.849. "Wireless reception and particularly methods and means whereby the direction of the incoming waves can be determined." A. K. Macrae, R. Morris-Aire, and S. H. Long. March 16th, 1920. (108,925).
- 10.334. "Electric motor control." British Thomson-Houston Co., Ltd., and J. Shorthall. April 1st, 1920. (108,935).
- 10.951. "Dynamo-electric machines." H. A. Cope (E. Hoefely et Cie Akt.-Ges.). April 20th, 1920. (108,936).
- 12.868. "Secondary or storage batteries." R. C. Houston. May 10th, 1920. (108,944).
- 12.931. "Methods of and means for producing alternating currents." British Thomson-Houston Co., Ltd. (General Electric Co.). May 10th, 1920. (108,947).
- 12.937. "Electric heating apparatus for waving or curling the hair." Marcel's Permanent, Ltd., and F. Kerka. May 13th, 1920. (108,954).
- 13.277. "Resistance switches for controlling the intensity of electric currents." J. Watkinson, N. C. Francis, and A. E. Quennell. May 13th, 1920. (108,955).
- 13.396. "Mine signalling systems." Sterling Telephone & Electric Co., Ltd., and W. C. Dwyer. June 2nd, 1920. (108,962).
- 13.111. "Tool for electric cable stripping." E. H. Scholes, and E. A. Claremont. June 1920. (Addition to 138,730). (108,963).
- 15.316. "Method of signalling in systems generating high-frequency oscillations." Western Electric Co., Ltd. (Western Electric Co., Inc.). June 7th, 1920. (108,967).
- 15.648. "Reduction of metals and alloys for use in making thermo couples and for other thermo-electric purposes." W. C. Hirasco. June 9th, 1920. (Addition to 138,648). (108,977).
- 16.812. "Handle for electric arc welding." J. Dooly. June 11th, 1920. (108,982).
- 16.966. "System for the conversion of continuous or direct currents into alternating currents." F. Breisig. March 11th, 1919. (134,720).
- 16.005. "Metal vapour electric discharge apparatus." Siemens-Schuckert-Verlag. July 16th, 1918. (147,597).
- 16.177. "Transmitting circuits for wireless telegraphy and telephony." A. K. Macrae and G. Shearing. June 18th, 1920. (108,997).
- 16.186. "Process for obtaining an increase in light electric effect in light tubes." J. W. L. Smith. July 1920. (Addition to 138,930). (108,998).
- A. Sinding-Larsen. June 13th, 1920. (169,008).
- 17.047. "Telephone reception." Siemens & Halske Akt.-Ges. September 27th, 1918. (146,122).
- 17.068. "Submarine signal receivers." Submarine Signal Co. (June 27th, 1919. (146,150)).
- 17.470. "Automatic compressed-air brake controlled electrically and by compressed air, particularly for trains composed of several motor vehicles." P. K. Kuehn. June 1920. (Addition to 138,930). (109,002).
- 18.407. "Telephonographs." Telegraphon Ges. July 17th, 1919. (147,555).
- 18.913. "Telegraphic ciphering and deciphering mechanism." Western Electric Co., Ltd. December 9th, 1918. (Addition to 146,520). (146,991).
- 18.951. "Test device for including electric current transformers for use with measuring instruments." Compagnie Four La Fabrication des Compteurs et Mesures D'Electricite a Giv. June 30th, 1919. (147,604).
- 19.368. "Attachments for submarine cable recorders." R. S. Whitney. July 19th, 1920. (147,610).
- 19.534. "Signalling means for submarine boats." O. von Truppel. May 29th, 1917. (147,597).
- 19.540. "Electricity meters for indicating the wattless consumption in alternating current and three-phase current installations." Korting and Akt.-Ges. October 11th, 1918. (147,602).
- 19.687. "Wave telephone systems." Ges fur Drahtlose Telegraphie. January 17th, 1919. (147,609).
- 19.761. "Thermionic tube amplifying devices." M. Latour. December 4th, 1918. (Addition to 147,318). (147,608).
- 19.936. "Voltmeter electricity meters." Siemens-Schuckertwerke. March 11th, 1919. (Addition to 147,879). (147,884).
- 19.981. "Receiving device for sub-aqueous sound signals." Signal Ges. December 16th, 1918. (147,934).
- 19.994. "Submarine sound transmitting and receiving apparatus." Signal Ges. March 10th, 1917. (147,839).
- 19.997. "Submarine sound producer." Signal Ges. February 25th, 1918. (147,840).
- 19.998. "Device for preventing disturbing noises in polarised electro-magnetic sound apparatus." Signal Ges. May 4th, 1918. (147,943).
- 19.999. "Device for preventing disturbing noises in polarised electro-magnetic apparatus." Signal Ges. May 30th, 1918. (Addition to 147,943). (147,944).
- 20.003. "Arrangement for avoiding disturbing noises in listening devices caused by changing circuits associated therewith." Signal Ges. March 20th, 1918. (147,945).
- 20.031. "Means for obtaining unidirectional potential differences or current of constant value." British Thomson-Houston Co., Ltd. December 22nd, 1915. (108,122).
- 20.037. "Sound receivers." Signal Ges. November 27th, 1915. (148,421).
- 20.373. "Sound apparatus." Signal Ges. March 17th, 1916. (148,426).
- 20.374. "Sound signalling device for dense propagating mediums." Signal Ges. March 3rd, 1917. (148,427).
- 20.375. "Sound signalling device with two plates for dense mediums." Signal Ges. April 27th, 1917. (Addition to 148,427. (148,982)).
- 20.847. "Reception of submarine sound signals." Signal Ges. January 25th, 1917. (148,325).
- 20.849. "Submarine sound transmitter." Signal Ges. May 3rd, 1918. (148,987).
- 20.850. "Receiving device for submarine sound signals." Signal Ges. May 19th, 1917. (Addition to 1,905, 1913). (148,988).
- 21.076. "Burning of carbon electrodes in electric furnaces." S. E. Sicurin. July 1920. (169,069).
- 21.684. "Telephone repeating circuit." Western Electric Co., Ltd. July 31st, 1919. (149,351).
- 21.756. "Electrical apparatus for the electro-chemical treatment of hydrocarbon vapours." R. Berry. July 20th, 1920. (169,063).
- 22.440. "Electric lamp supports." A. C. Runkel. July 26th, 1920. (169,071).
- 22.673. "Electrical current plugs." W. de Renzi. July 30th, 1920. (169,073).
- 23.373. "Gas exits for galvanic batteries." O. Oldham, G. Oldham, and J. Oldham. August 9th, 1920. (169,082).
- 23.693. "Alternating current electro-magnetic engine." V. J. C. Payne. August 19th, 1920. (169,086).
- 25.466. "Time limit relays for use in electrical supply systems." Metropolitan-Vickers Electrical Co., Ltd. September 3rd, 1919. (150,790).
- 25.650. "Electric transforming systems or devices." H. B. Brooks. September 8th, 1919. (150,791).
- 27.461. "Electrically propelled boat." M. R. Lojza. September 27th, 1920. (169,105).
- 29.957. "Sending devices for radio telegraphic stations using a continuous series of waves generated by an arc." P. J. Laut. October 23rd, 1919. (152,970).
- 1921.**
- 4.807. "Arrangement of the high-tension insulators of electric propagating installations." Siemens-Schuckertwerke. January 11th, 1920. (154,913).
- 7.056. "Method and means for the electrical navigation of ships." Signal Ges. March 12th, 1921. (159,002).

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THE PRINCIPLES OF WAGES DETERMINATION.

THE cry for economy at any price is heard on all hands, and the first item of expenditure to be tackled, with a view to reduction, is almost invariably that of wages. Whether the remuneration to be examined be official salaries, national or municipal, or the wages of operatives, this item of direct expenditure, precisely because it is direct expenditure, is so situated in the industrial prospect as to attract the first attentions of the economist.

It is not our intention to deny that wages, like every other expense, must be constantly watched, with a view to obtaining the highest return for the expenditure laid out. That is only to make for business efficiency, the first aim of every true engineer. Our object is rather to draw attention to the true principles by which the reward of labour, whether of the head or of the hands, ought to be determined. That there are such principles must be clear to the minds of our readers, who are accustomed to think in engineering terms, and to deal with engineering problems; but to the lay mind, to the man in the street, who takes most of his views straight from the pages of his daily or weekly stunt-monger, the very existence of any principles at all tends to be obscured by the incoherent clamour of every ignoramus who stands on a stump and yells "Anti-waste," or anti-anything else, if that will help him to grind his own axe.

The presidential address delivered by Mr. W. L. Hichens before the Economic Science Section of the British Association on September 8th, is one among a number of efforts now being made by the great engineering employers to bring home to the workers an adequate knowledge of the facts of the industrial situation, and of the economic laws which govern it. Mr. Hichens is the chairman of Messrs. Cammell, Laird & Co., Ltd., the steelmaking, engineering, and shipbuilding firm, of Sheffield, Birkenhead, Penistone, &c., and he speaks with an authority and experience not to be gainsaid. Wages have to be paid out of the accumulated wealth of the community, and that accumulated wealth comes, and can only come, from the receipts of industry—in other words, from the sale of goods. The law of supply and demand operates to make the sum total of industry vary in a periodic fashion, the periodic times being more or less irregular. Since industry varies, wealth must vary, and consequently wages must vary. During the period of unexampled industrial activity brought about by the war, wages rose to unprecedented levels. The scarcity of labour was one reason, leading to a higher rate of real, or commodity, wages; the scarcity of provisions, bringing about higher expense, and increase generally in the cost of living, was another, leading to a higher rate of apparent, or money, wages. The present is a time of depression such as has not existed within the memory of most present-day workers, though many equally bad, and worse, crises have been recorded in the history of every country.

The natural operation of the law of supply and demand makes money wages low when goods are plentiful, and high when they are scarce. The real state of wages, represented by the purchasing value of money, may remain much the same in both cases. In times of plenty, and consequent cheapness, labour has a tendency to become scarce, because people start in business for

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themselves, and do not want to work for employers. This tendency must have been apparent to most of our readers, who will, without difficulty, be able to recollect numerous instances that occurred within their own circle of a mania during the boom years 1919 and 1920. The apparent prosperity of those years was, as nations and individuals are finding out to their sorrow to-day, largely a will-o'-the-wisp, and most of those who ran after it became engulfed in the difficulties of the situation. When prosperity wanes, those who have not been sufficiently successful on their own account, seek employment again, and this alternate scarcity and plenty of available assistance raises and diminishes wages, against the operation of the ordinary considerations of supply and demand.

The next principle is that of the living wage. All must agree that subsistence well above the poverty line is the due right of all who are willing to work for it. Views of what is a living wage must necessarily vary, and must generally advance, as the standard of living of the community varies. It is an ideal, however, and the realisation of ideals, however desirable, must necessarily be regulated by facts and circumstances as they exist from time to time. The subsistence expenses of a married man with a family must necessarily be greater than those of a single person, but the suggestion put forward by Miss E. F. Rathbone, that wives and children should be provided for from a fund contributed equally by single and married men would not afford a satisfactory solution. In his book,* recently reviewed in our columns, Mr. J. S. Hecht advocated the establishment of a living wage based upon the daily necessities of life of the average man with the average family; and in our view the wage paid to every full-time adult worker should be such as will permit him to marry and bring up a family. It is highly undesirable that a man should be obliged to notify his marriage or the birth of each child, as a ground of increase of remuneration. If private employers paid on such lines, who will doubt that single men would be employed in preference to those with family responsibilities? Private employers will not wish to undertake the administration of such a fund as Miss Rathbone suggests, and we have had enough of State administration for the present.

Mr. Hichens advocates, as his third principle, that of payment by results. This has much to recommend it, and the trader on his own account lives by the results he obtains. In great organisations, however, it is exceedingly difficult of application, and most large industrial firms in the electrical industry have passed through the phases of attempting to apply this system of payment and then abandoning it. The trade unions concerned bitterly oppose it; and if we could depend on everyone doing his utmost, and so endeavouring to deserve the best possible remuneration, we ought not to jump to the conclusion that they are completely mistaken in their opposition. Piecework is a form of payment by results, but it is largely modified by "canny." In discussing this question Mr. Hichens briefly touches upon women's wages, and reaches the conclusion that for a number of reasons they must be lower than men's. Experience seems to show that at present it is the exception to find women doing the same work as men. What may be the case in a generation's time one cannot prophesy now.

Mr. Hichens next mentions, under slightly different designations, the five principal circumstances governing inequalities in wages, viz., the agreeableness or disagreeableness of the employments themselves; the easiness and cheapness, or the difficulty and expense of learning them; the constancy or inconstancy of employment in them; the small or great trust which must be reposed in those who exercise them; and the probability or improbability of access in them—all of which are fully discussed in Part I, Chapter X, of Book I of Adam

Smith's "Wealth of Nations." Considering that this work was published in 1776, it is remarkable how much of it might, with equal aptness, have been written to-day.

Finally, he discusses profit-sharing, finding in it the defect we have so frequently pointed out, that the financial result to any individual worker is insignificant. Moreover, it does not tend to the efficient development of business enterprises that all profits should be distributed, whether as dividends or as additions to wages. The investment of profits in the improvement and extension of the business is one of the first cares of the enterprising individual trader, and this is one of the best means of increasing the amount of employment provided by the business.

The whole wages question is always with us. It is of almost primeval age, yet ever new. It is not to be expected that a permanent settlement will be reached, but all considerations seem to point to the fact that joint control of industries by employers and employed, or Whitleyism, is the most likely method of reaching satisfactory results, and periodically reviewing and adjusting those results, that has been suggested up to the present time.

"JAPAN was the first to break: will she be the first to mend?" This important question is discussed in an interesting report by H.M. Commercial

Counsellor at Tokio (Mr. E. F. Crowe) and the Acting Commercial Secretary (Mr. G. B. Sansom), which has been issued this week by the Department of Overseas Trade. The question is important from the point of view of the recovery both of Japan's purchasing power and of her capacity to export. Although the British Commercial Representatives naturally do not commit themselves to a definite answer to this question, they give some very plain and useful indications. From these certain deductions may be made which should give great satisfaction to the British trader. The report does not agree with the pessimists who believe that the worst is yet to come. It points out that importation is beginning to revive, accumulated merchandise to be cleared, and confidence to be restored. Japan acquired, during the war, infinitely more catholic tastes with regard to foreign goods, and still possesses the means with which to gratify them. The United Kingdom should have an excellent chance of catering for these new requirements, for she enjoys a splendid reputation in Far-Eastern markets. Japan appears, in fact, to be in the exceptional position of having recovered her purchasing power, whilst her export business still remains under a cloud. This brings us to an aspect of the situation which is of particular interest to the electrical trade, namely, Japan's capacity to manufacture for overseas markets. Much has been heard during the past few years of the flooding of China, Australia, India, and even South Africa and South America with low-priced goods produced by cheap Japanese labour in imitation of Western manufactures. Examples which our readers will readily recall are lighting fittings, wires, lamps, and other small electrical accessories. Cheap these were without doubt. Whether they were worth the exceedingly low price asked for them depended largely upon the amount of British raw material that entered into their manufacture. Mr. Crowe and Mr. Sansom, in their report, do not refer specifically to this class of goods. But in alluding to the fact that Japan's export trade is at a standstill, they state plainly that her present costs of production are too high. Furthermore, the high exchange value of the yen adds to the difficulties of finding markets for her goods in the impoverished countries of the world. Another weighty factor against Japanese competition abroad is, we know, the failure to maintain quality. Meanwhile, so long as the domestic demand is good and Japanese articles remain high in price, there will be opportunities for selling British products.

* "The Real Wealth of Nations, or A New Civilisation and its Economic Foundations." By John S. Hecht. *Elec. Rev.*, March 10th, 1921, p. 295 and *Elec. Rev.*, April 8th, 1921, pp. 442.

THE BLACKBURN (EAST) ELECTRICITY WORKS.

For some years before the war the need for an increased electrical power supply had been occupying the attention of the Blackburn Electricity Committee, and in 1912, Mr. P. P. Wheelwright, engineer and manager of the electricity department, submitted to the Town Council preliminary plans for a complete power station to contain two 5,000-kW turbo alternators, with the necessary boilers and accessory plant. These plans were sympathetically received by the Town Council, and after careful consideration a scheme based upon them was drawn up and submitted to the Board of Trade which in 1914 granted its sanction for the work to proceed. As a result of this the requisite land was bought, and it is upon this land that the present station is being erected. During the war the scheme was held in abeyance, and when in 1919 the Council returned to a reconsideration of the plans it was found that the wider experience of the advantages of the electrical drive obtained during the war, and the consequent increased popularity of this form of power, had increased the demand for electricity in the district so that it greatly exceeded that anticipated in 1914, and accordingly the original plans were

columns were up, in another two months the steel structure was complete, while before the end of the year the whole building, both boiler house and engine house, had reached its final stages. In the meantime the foundations for the cooling towers had been laid, well boring was progressing, the wharf was built and the canal dredged, cranes were erected both inside and outside the building, foundations were laid for the machinery, an electric locomotive was delivered, and all the various parallel works had been carried out.

Within one year of the laying of the foundation stone, the boilers, the economisers, the condensers, the feed pumps, the circulating pumps, the ash-handling plant, the soot blowers, the switchgear, the cranes, the coal conveying and mechanical stoking plant, the turbine and the alternator for the first half of the station were delivered, and to-day, when the opening ceremony takes place, finds the first half of the station in commission; it is expected that the station will be complete and in final running condition before the early spring of next year.

In designing the plant special care has been taken to



FIG. 1.—EXTERIOR OF BLACKBURN (EAST) POWER STATION.

redrafted to make provision for a station of double the original capacity. The present station will, therefore, contain two 10,000-kW turbo-alternators.

Tenders for the comprehensive carrying out of these plans were invited, and that of the English Electric Co. was accepted by the Council in August, 1919, and work was commenced immediately upon the first power station to be built under the auspices of the Electricity Commissioners. Sir John Snell, and the Electricity Commissioners under his chairmanship, have exhibited the warmest and most practical sympathy with the work.

Credit is due to Mr. F. G. Mitchell, of the Mitchell Conveyor Co., who prepared designs of the structure in such a way that steel work was ordered within the first month of the contract, and during the progress and erection of the job no radical alterations have been necessary, nor has delay been caused.

The ground forming the site of the station was waterlogged, and some form of artificial foundation had to be employed. In preference to erecting a building on piles, it was decided to build a concrete raft. Before building the raft a special line of broad-gauge railway, 1,000 yards long, was laid from the local gasworks siding to the site of the station to facilitate the bringing up of material. The raft was completed, and the foundation stone was laid on May 13th, 1920. After this the progress was rapid; two months later the steel

ensure that the supply of coal to the station shall be economically dealt with, and so arranged that the department is free to receive coal either by canal or rail.

The main 20-ton travelling crane represents the complete receiving, storing, reclaiming, and weighing plant for the station. The full wagon is lifted by the crane, weighed by the crane operator, discharged into the coal-hopper or on to a storage heap and the empty wagon weighed again before being replaced on the track, so that the net weight of coal is ascertained. The one crane operator discharges the wagon and weighs the coal, thus cutting out the weighbridge with capstans and attendants, and the shunting usually necessary. When the coal is not to be placed into stock it is discharged direct by the crane into the receiving hopper of a skip hoist. The skip hoist and belt conveyor work automatically, one ton of coal being fed by weight into the skip every time the skip is elevated. The operations are counted so that a correct record of the amount of coal passed up into the bunkers is kept. A maximum of 40 tons per hour can be dealt with in this way. In addition to lower power consumption the upkeep and general repair costs of a skip hoist are very light compared with any other form of elevating gear. A Mitchell belt conveyor distributes the coal to any portion of the bunker, and completes this plant, which, it is claimed, is the most efficient that could be devised.

When unloading from barges or reclaiming from store, an electric grab is attached to the 20-ton crane. This grab has only to be hooked on to the crane ropes. The power for closing the spades is provided by a motor inside the claw of the grab itself, which makes it possible for the same grab to be attached to any other crane that may be installed, and retain all the advantages of a double-rope grab.

For removing the ashes from the boiler house an electric battery locomotive is employed; this hauls a specially designed truck under the ash pit door, where it is filled. After loading, the locomotive takes the truck to a patent distributor outside, where the ashes are discharged on to a moving belt which distributes them over the surrounding ground. By the arrangement of the distributor a wide area of discharge is obtained, and the one man who drives the locomotive also attends to the



FIG. 2.—COAL-HANDLING APPARATUS AND CANAL.

distribution of the ashes on the ground which has to be made up. On the present site the amount of ground which has to be made up is considerable, so that a dump for ashes is provided for many years. A fixed-radius jib crane is also provided for use in the event of the 20-ton crane being out of commission. This is fixed in position near the canal wharf so that the path of the radius arm covers both the barges moored alongside and the underground hopper.

The boiler room plant comprises seven boiler units of the Babcock & Wilcox type, each having a steaming capacity of 50,000 lb. per hour as a normal duty. Each unit is fitted with a superheater and superimposed Green economiser of the horizontal tube type and three mechanical stokers of the Underfeed self-contained, forced-draught, travelling-grate type. Coal is fed to the stoker hoppers from the overhead bunkers through chutes fitted with control valves. The coal burnt by the stoker is measured as it passes into the furnace by Lea coal meters attached to each stoker. The ash and clinker from the stokers is dropped into special ash chutes built to the underside of the stokers and is emptied into trucks running on a special track fixed in the boiler room, whence it is conveyed to the distributor. Steam is generated at a pressure of 210 lb. per sq. in. and superheated to a total temperature of 600 deg. F.

Each boiler is provided with a polished enamelled slate panel carrying two steam-flow recorders and indicators; a CO₂ indicator; a dial draught gauge; a pressure recorder; and a six-way temperature indicator for registering the temperatures of the economiser inlet and outlet water, economiser inlet and outlet flue gases, and the steam temperature at the superheater box.

The boilers are operated on the balanced draught system. The stokers are provided with separate forced draught fans, and the chimneys are divided into two portions, at their lower sections and fitted with induced draught fans. These draw the gases of combustion down one section of the chimney from the outlet of the economisers and discharge them upwards through the other portion of the chimney. This arrangement ensures the maintenance of efficient combustion with fuels of varying heat values. Each boiler unit is fitted with

a soot cleaning equipment, consisting of a rotary device for directing steam at high velocity on to the tubes while the plant is in operation. These appliances are so situated that the whole tube area is covered by the rotary jets, which are periodically operated by hand. This is the first large power house in Britain to be equipped throughout with this plant. It abolishes the necessity for hand lancing, a costly and very often inefficient method of keeping the boilers clean, and, moreover, these equipments will effect a remarkable saving in fuel consumption.

The circulating water for the surface condensers, after passing through the condensers, is pumped into four cooling towers, where it is cooled down to a temperature of about 75 deg. F. A pond is constructed under each tower, from which the circulating pumps draw their supply. The only new water to be provided, therefore, after the initial starting up is that necessary to make up the losses caused by evaporation and wastage, which will be obtained from a well sunk near the cooling ponds. Condensing water can also be taken from the canal and afterwards returned.

The pipework between the pumps and towers is interconnected so that it is possible for either pump to draw water from or discharge it to any one or more of the four towers. An emergency supply tank is provided, situated upon the roof; this has a capacity of about 18,000 gallons. This tank will also be used for emergency water supply for any point of the station. In the turbine house a 60-ton overhead electric travelling crane is erected, fitted with an auxiliary hoist of 10 tons capacity.

Electricity is generated at 6,600 volts, and is controlled by an extra-high-pressure switchboard. The switchgear comprises separate cubicles for the e.h.p. gear, situated in a separate cell room, immediately below the control desk. The control board is of the desk type, and is mounted in the switch room, while the operating levers pass through the switchroom floor into the cubicle room below. The gear is designed to have a breaking capacity suitable for direct connection to bus-bars supplied by generating plant of much larger capacity.

The turbo-alternator plant consists of two 10,000-kW impulse turbines and 6,600-volt, 50-period, 3-phase alternators supplied with cool washed air from a patent air filter.

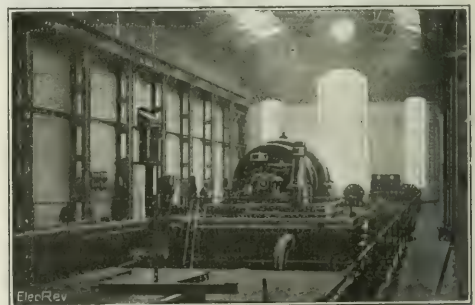


FIG. 3.—INTERIOR OF ENGINE ROOM.

Each set is complete with surface condenser, extraction pump, circulating water pumps, &c. The steam from the turbines after being condensed is passed through a "closed feed system." The condensed steam is fed direct to the suction of the turbine-driven boiler feed pumps, which feed the water directly to the inlet of the economiser, where it is heated during circulation by the combustion gases. The delivery into the boilers is regulated automatically by Copes feed regulators. There are three turbine-driven boiler feed pumps, each capable of supplying three boiler units, so that with the whole station in operation there is one spare feed pump.

For the auxiliary plant, alternating-current supply will be transformed down to 400 V by three 500-kW transformers, which are connected to the low-pressure a.c. switchboard. This board may also be supplied, if necessary, from the Jubilee Street station.

To provide a supply for the d.c. motors and station lighting there are three 320-kW rotary converters, which draw their incoming supply from the 400-volt a.c. board and supply d.c. to a 400-volt switchboard. These rotary converters are arranged so that in the event of the main generating sets not being in operation they can be operated by a supply from the Jubilee Street station.

Fig. 1 is a reproduction of a photograph conveying an idea of the size of the station; the skip hoist which takes the coal up to the distributing belt is seen (not very clearly) to the left of the background. Fig. 2 is another exterior view showing the coal-handling gear and the canal from which the feed water is taken. The interior of the engine-room is shown in fig. 3; the switch-room, offices, &c., are to the right. The first set is seen in position, and the foundations for the second set appear in the foreground. Two rotary converters are in an enclosure seen at the back of the picture, the third being hidden.

The welfare of the station employes has received close attention, there being ample accommodation for meals, a number of bathrooms, and lavatories. The station is well lighted by day and night, both boiler house and turbine room having glass roofs. The switchroom, mess-rooms, offices, &c., are finished off with glass tiles, and the floors are made up with "Dolomit." It is thus possible to clean out all the rooms by means of a hose pipe. One end of the switchroom has a blank wall, and upon this it is proposed to draw a diagram of the whole Blackburn system; this will be of great assistance to the engineers.

Taken as a whole, the station represents an excellent example of up-to-date practice, and Mr. Wheelwright and the English Electric Co., and its sub-contractors, are to be congratulated upon this valuable addition to the power system of the district.

INSTALLATION COSTS, AND THE DEVELOPMENT OF NEW FIELDS FOR ELECTRIC LIGHTING.

For the timely and suggestive notes which follow we are indebted to Mr. J. W. Beauchamp, director and secretary of the Electrical Development Association; we reproduce them practically in his own words, in the hope that they will help to stimulate enterprise in the direction of popularising the use of electricity:—

I think most people in the electrical industry are beginning to realise that within the past two years there has been a most notable increase in public approval of electricity and electrical methods. The Press deals with letters, articles and references, direct or indirect, on the advantages of electricity, and the immense benefit which must follow from its wider use. A very large section of the people are quite convinced that they wish to use electricity, and will do so as soon as they possibly can.

Although costs have risen so much, one hears of fewer complaints about the price of electricity or of electrical apparatus than one hears about the difficulty of getting connected and supplied. Nevertheless, I feel at the present time that the great check upon new electric lighting business lies in the difficulty which many people are experiencing in paying for installation work.

With regard to lighting, a few points must be kept clearly in mind:—

1. That we have obtained most of the business available from the fairly well-to-do and the rich, whilst in commerce and in industry electric lighting is adopted automatically for all extensions and new enterprises.

2. Therefore our great field of further lighting business lies with the middle class, and amongst the houses

inhabited or to be inhabited by working people in the ordinary sense of the term.

In securing further lighting business one achieves much more than at first sight appears. Electric lighting opens the door to all other forms of electrical application; with the exception perhaps of power, one seldom or never hears of any application for electricity supply without lighting—almost always it is the introduction to the use of electrical energy for heating, cooking, and mechanical purposes. Even in shops and factories where electricity is sometimes sought for mechanical power only, the electrical engineer knows by experience from the day it goes in that the gas or other lighting is doomed.

For these reasons I feel that one can never do too much to bring about the addition of new lighting installations, and that those who work towards that end perhaps in the first instance for their own immediate benefit are really assisting the whole of the industry—electric lighting is the spear-head of the business.

I have been tempted to present these remarks again at the present season of the year, although to many they must be platitudes, because it has been brought home to me that there are some places, perhaps a good many, where the price of electrical energy has not risen during recent years so rapidly as the price of gas, and consequently an admirable field for additional business exists if only something can be done to cheapen services, internal wiring, and fittings, that is to say, to cheapen the "all-in" cost of the installation to the landlords or tenants concerned.

Only recently I met a case where electricity had not gone beyond 8d., whilst gas had steadily climbed to 7s. per 1,000 ft. There was not any wide use of electricity amongst the houses of the town, one which has passed through a great deal of adversity and where money is not plentiful, but some of the people who were using electric lighting voluntarily explained the fact by saying that it was "so much cheaper than gas."

Although we are aware of the truth of this statement, it is not often that it is put to us so clearly.

It is perhaps worth while to look at this matter from the point of view which the E.D.A. has already adopted with regard to heating and cooking.

It will be remembered that figures have been prepared showing roughly the commercial relationship or competitive values of electricity and gas for domestic heating and cooking by means of arbitrary figures of merit relating the cost of a kilowatt-hour to the price of 1,000 ft. of gas.

Similar treatment with the rates in vogue for lighting leads to quite startling results in some cases. For example, we know that in many places 1s. is charged for electricity, whilst from 4s. 6d. to 5s. 6d. per 1,000 ft. for gas is not an uncommon figure; in these districts plenty of business can be done where the cost of installation is not too serious a factor.

Now, the lighting figure-of-merit in such a case may be called 5, produced by dividing electricity at 1s. into gas at 5s. Turn to another town where electricity is still standing at 8d. a unit and gas has risen to 7s.; the figure-of-merit is something of the order of 10, from which one may deduce that new business should be very easy in the latter district.

I would suggest that it is well worth while to consider these relative values for all applications of electricity: the results tend to direct one's efforts into the best channels for immediate effect, and although allowance must be made for the varying conditions of different people and districts, yet it does appear that there are still plenty of areas where a little assistance in propaganda towards cheaper wiring systems, or more particularly methods of assisting supply undertakings to provide installations on hire or hire purchase, should lead to a very considerable further development.

New lighting business to-day is worth a good deal more to the contractor than was the case a few years ago, because it is now possible to follow it up with many applications of electrical energy which were not freely available before the war.

NOTES CONCERNING CONTACT PYROMETERS.

By "ELECTRODE."

A PYROMETER has been jocularly described as an instrument whose use will, in the hands of different persons, produce either good results or bad language. That it is possible to achieve the former, renders it at once worthy of consideration, while its being the cause of the latter invites investigation.

Pyrometers may be divided into two distinct classes, and the purpose of the present article is to review the contact or tube-stem pyrometer (which is so familiar in engineering shops) rather than the radiation or optical type which requires more skilful manipulation. The thermo-electric pyrometer stands alone, as a device,

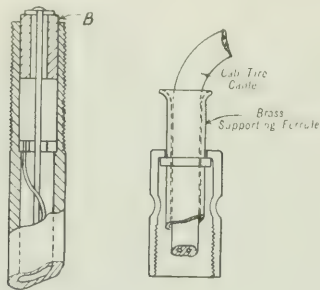


FIG. 1.—FIBRE INSULATING BUSH. FIG. 2.—CABLE-SUPPORTING FERRULE.

for the measurement of high temperatures with precision, but like all moving-element instruments it is not, nor is it intended to be, fool-proof.

The accurate measurement of temperatures is a question of supreme interest to electrical engineers to-day, just as it is the desideratum in the foundry and tool room. In certain avenues of the electrical industry, it would appear to be more satisfactory to train the manual and non-technical worker into the intelligent handling of the simple indicators and measuring instruments he has been selected to use, rather than rely upon a series of safeguarding devices which, while they may add robustness, usually impair the sensitivity of an instrument.

The former practice was adopted in connection with furnace attendants and tool-room operators, to whom the function and uses of thermo-electric pyrometers was simply explained, together with a few hints regarding careful handling and the importance of clean and firm contact.

The result, in a large works where something like a score of such portable pyrometers are in daily use, has been satisfactory, and its success demonstrated by the very infrequent calls upon the services of the electrical section to remedy any minor defects.

In the early days the tool-room mechanic and the foundry men viewed the introduction of pyrometers with scepticism, and used them with a tolerant attitude, but to-day, after a period of ten years, it can be recorded that the failure of an indicator to read off the zero is sufficient to induce a state of mental agitation in any of the attendants. Portable instruments are more prone to depart from the path of strict veracity than the wall or switchboard pattern, because they are subjected to innumerable shocks and stresses during handling and operation.

A pyrometer may be divided into three main components, viz.: (a) The indicator or galvanometer; (b) thermo-couple or tube stem, and (c) connecting leads and connector. It is a tribute to pyrometer manufacturers that, in so far as the writer's experience is concerned, only isolated cases of failures have been traceable under headings (a) or (b). The admission of dust

through the imperfect refitting of the hardwood casing of the indicator caused the moving element to stick in one instance. Regarding item (b) two distinct and separate failures are recorded. The fibre insulating bush (b, fig. 1) disintegrated after long service in a hot situation, short-circuiting the couple, while the remaining breakdown was simply due to the warping of the tube stem, this causing intermittent contact between the stem and the alloy rod.

At least 75 per cent. of the defects noted have been caused by the flexible connecting leads chafing and breaking away from the swivel connector to which they are attached, or, by indifferent contact, established when the latter has been screwed down.

To affix a robust brass connector to a length of flexible of similar grade to that in common use for ammeter shunt leads is inimical to long service in the works, although it may satisfactorily meet laboratory conditions. Repeated breakages of the indicator leads at the point of entry into the brass connector, led to the adoption of "workshop" and other protected flexible wire, with somewhat better results. Even this grade of cable would obviously not withstand the normal conditions to which portable pyrometers are subjected, and by contact with the floor, or not too gentle stowage, soon lapsed into a perished condition.

Finally, a cab-tire-sheathed cable was tried, after consideration, and, to lend additional support to this heavier cable, a long brass ferrule was fitted into the top screwed coupling (fig. 2).

This furnished the requisite mechanical strength; for the instrument to which this cable was attached has now been in service continuously for over two years and is the cherished companion of a certain foundry operator.

With regard to the reliability and accuracy of thermo-

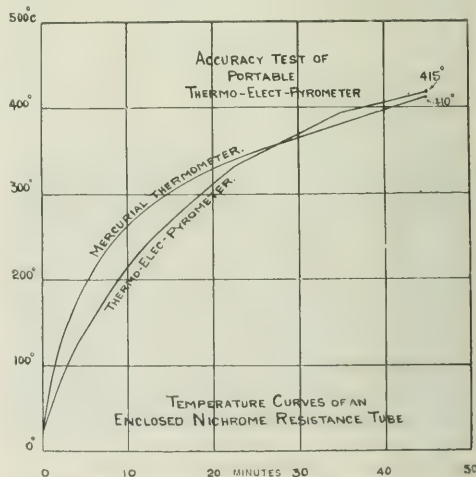


FIG. 3.—ACCURACY TEST OF PORTABLE THERMO-ELECTRIC PYROMETER.

electric pyrometers, the advisability of periodical verification is recommended, just as switchboard measuring instruments are (or should be) similarly calibrated. The wisdom of this course was demonstrated some time ago when, in connection with a steam generating plant, the reading of the indicator attached to a superheat steam couple was openly disputed by the boiler-house superintendent, who also added gratuitous opinions on thermo-electric pyrometry.

Reference to the "filing" cabinet revealed the fact that this particular pyrometer had emerged from a

recent check test remarkably well. But "as one man's word is no man's word," a spare thermo-couple together with its pyrometer were verified in a pure lead bath, and against a mercurial thermometer, by coincident immersion. This was substituted for the doubtful apparatus, and a comparatively similar reading was shown for the steam temperature. Thereupon the boiler was shut down, and finally a defect localised in the superheater system.

The thermo-couple which had been displaced was then inserted, together with a mercury thermometer, into a small metallurgical resistance furnace to ascertain its behaviour by direct comparison, and to obtain some idea of its "time constant." Simultaneous readings were taken every two minutes and the values, precisely as observed, plotted as shown in fig. 3. The result was gratifying, especially as this particular pyrometer had been in service for several years.

Too much care cannot be taken to establish perfect electrical contact at the junction of the indicator leads and the stem of the thermo-couple, as the following resistance values, which were obtained when testing out the pyrometer outfit under review, will testify:—

Resistance of galvanometer moving coil, 3.1 ohms.

Swamping coil (galvanometer) resistance, 2.0 ohms.

Flexible connecting leads, 0.15 ohm.

Thermo-couple (cold) complete, 0.31 ohm.

Thermo-couple (600 deg. C.) complete, 2.5 ohms.

The galvanometer or indicator was found to give a full-scale deflection of 1,200 deg. C. with 80 milli-volts so that when indicating 600 deg. C. the "drop" across the galvanometer would only be 0.04 volt (approximately). These tests were made solely in order to obtain useful information regarding pyrometers under practical conditions, and to ascertain the "reliability factor" of such instruments when compared with other temperature measuring devices and methods adopted in the realm of industrial engineering.

BOILER HOUSE TECHNIQUE.

(COMMUNICATED.)

PENDING the use of more modern plant and the achievement of coal saving due to linking-up, it may be worth while to consider if something can be done to get an immediate (even if small) improvement in the average steam-raising efficiency of public electricity works.

In most stations engine-room efficiency can only be raised by expenditure on plant. There are, however, but few power houses where some small saving cannot be made in the boiler house.

Some moderate increase in maintenance cost or more often the employment of additional and skilled supervision will in many cases enable the extra expenditure to be covered by savings in fuel burned.

Expenditure on testing appliances and refinement in fuel-saving apparatus has often failed to produce a continuous return because such capital expense has not been supported by proper maintenance and supervision. Steam-raising plant is subject to rapid deteriorating influences—it is operated by men who, whilst perhaps having as much knowledge of the principles underlying their work as those responsible for the engine room, are in the boiler house able to make or mar economical results more immediately than is the case with other portions of the plant.

The principles are known, as well as the remedy; it lies in sound equipment, ample maintenance and educated supervision. The difficulty with many of the smaller undertakings is to find suitable men, and persuade the employer body that it is worth while to keep supervisors who apparently have little to do and call for a fairly high scale of wages.

It may not be impossible to suggest a means whereby

action which is usual in large undertakings could to an extent be initiated in small ones in order to achieve an increase in average efficiency and reduce the amount of coal handled and destroyed, whilst waiting for the smaller plants to be superseded.

The collection of statistics of coal consumption per kWh in central stations, as carried out by the Coal Controller during the war, should be continued (possibly it is being continued); these statistics could be roughly sorted into classes, according to load and plant conditions, when for each class a fair (coal per kWh) value could be assessed; failure to reach that figure would become a condition undesirable to those in charge of works. Such a system of checking results should be accompanied by practical assistance in improving the efficiency of the staff employed and in supporting the responsible engineers in any application to their authorities for more assistance or expenditure on upkeep.

Instructions in steam practice might also be given to responsible members of the staffs of undertakings where results were deemed to be unsatisfactory.

This could best be carried out by selecting (with the agreement of the owners) a few medium-sized works in different parts of the country, such works to be notable for achieving good coal figures without undue expenditure on "methods" and with load conditions as normal in the smaller works.

These selected works would then be used as demonstration centres, men being sent to observe and assist in running and maintenance (boiler house only) for suitable periods; in this way the men from small stations might find a stimulus towards better results and learn that the secret of boiler-house efficiency lies in continuous supervision of the unskilled, and never-ending attention to the state of the plant, rather than in the possession of costly instruments and checks.

Some of the smaller stations are weak also on records; it is possible to find in the general offices statistics of flue gases and other check figures which seem highly improbable after an inspection of the plant.

The demonstration courses suggested would awaken many to the fact that test figures are of most interest when they reveal faults.

Briefly, the idea consists in admitting that many of those who actually supervise the burning of vast quantities of costly fuel are, by no fault of their own, of very limited training and experience in the technique of steam raising. The same reproach applies to the private manufacturer—he will often maintain a costly staff and laboratory to check the food or other product which he produces, whilst leaving his fuel bill to the mercy of men whose wages may amount to but a minute percentage of its value.

If it were possible for the Electricity Commissioners to initiate such a scheme as indicated they would do doubt have the assistance of the Coal Mines Department, and the work would be in a way complementary to that of the Fuel Research Board. Any instruction or experiences offered could be supplemented by experts in boiler design and the use of coke and special fuels.

During the war the Coal Controller had an advisory organisation in being, and did to some extent check the performances of public utility undertakings and manufacturers by inspections carried out and reports made, but possibly the converse method—i.e., getting the actual men engaged on the work to leave their plants for short periods and to act under guidance in other and somewhat better plants—would have a more lasting effect, and make them more useful, confident, and less apt to feel that nothing better can be done than they are at present doing.

It would be worth while to secure the friendly co-operation of the Electrical Power Engineers' Association in work of this kind; that body has, by collective bargaining, raised the scale of payment to its members, and probably realises that in some cases it may have succeeded in securing a wage which, whilst "right for the job," may not necessarily be right for the man now in it or for the way in which that job is now performed.

UNEMPLOYMENT INSURANCE AND ELECTRICAL ENGINEERS.

By JOS. J. H. STANSFIELD, F.C.I.S.

THE passing of the Unemployment Insurance Act, 1920, extended the provisions of the principal Act passed ten years ago to all employed persons with certain exceptions mentioned, the exceptions being similar to those which apply to National Health Insurance.

There were many engaged in trades or businesses who would have preferred to remain outside the new Act, and when it was recently decided by Mr. Justice Roche that engineers who looked after electric lighting plant were not insurable under the Act, they may have rejoiced.

The decision of his Lordship will, however, not affect a large number, but the grounds of the decision may be of interest to electrical engineers generally.

The exceptions referred to include "employment in domestic service except where the employed person is employed in any trade or business carried on for the purposes of gain."

The Junior Carlton Club employed a number of persons on the Club premises, including one who was an engineer whose duty it was to look after the electric light, and as the Club was not a trade or business carried on for purpose of gain, the Club authorities objected to pay, or call upon their employés to pay, the contributions required by the Act.

The Minister of Labour had decided that contributions were payable, and an appeal having been made against his decision, it was argued before Mr. Justice Roche on June 30th last, when the appeal was allowed. His Lordship stated that by the Act of 1920 domestic servants were not insurable, and after referring to a definition or description of "domestic servant" in *Pearce v. Lansdowne* (69 L.T. 316), he said he thought that domestic servants were persons whose function it was to be about their employers' persons or establishments for the purpose of administering to the needs or wants of such employers or of those constituting the members of such establishments or of those resorting thereto, including guests. That covered the case of club servants, who were, therefore, domestic servants and not within the Act.

The object of the Unemployment Acts is to insure against unemployment, and it may be that whilst some club servants will be relieved at the decision, others would have preferred to have the decision of the Minister of Labour confirmed, and it may be pointed out that Section 4 of the Act of 1920 allows the Minister to include any exempted employments, but subject to a draft of the Order being laid before each House of Parliament for not less than twenty days during which the House is sitting, and provided that no address by either House against the Order is presented to His Majesty.

But so far as regards electrical engineers generally, whatever their views of the Act may be, they, with their employers, are (within certain limits of age and remuneration), still liable to pay contributions to provide against unemployment.

Lighting Plants in Argentina.—In reporting on the large number of separate electric lighting installations which are to be found in Rosario, Santa Fé, the United States Consul there remarks that they should prove of interest to the exporter, as consumers of lubricating oil, belting, lamps, and accessories. Both British and Continental electric lamps are competing with American makes. The size of the various plants varies from 18,000 kW (Rosario) down to 15 kW in small outlying towns. Only eight are 3-phase a.c., four of which are at Cordoba. Three plants at Cordoba are 60 cycle, and the other five a.c. plants are 50 cycle. One of these 3-phase, 50-cycle plants is on the Lules river at Tucuman, and develops 3,750 kW.; another is the central plant at Rosario. Practically all the small enterprises are wood-burning plants with d.c. service.

LEGAL.

NEWBURY & THOMAS v. LEVINSKY.

At Southwark County Court on October 13th, an action was brought by plaintiffs, electrical engineers, of 66, Westminster Bridge Road, London, S.E., to recover £16 15s. from J. Levinsky, proprietor of the Electra Picture Palace, West Norwood. The defendant entered a counterclaim for £36 2s. 6d. Counsel explained that the claim was for repairs to an electrical apparatus used at the theatre for the production of kinema pictures. In August, 1920, the plaintiffs were asked to estimate for certain repairs. The work was completed, but after a time the defendant complained that it was not at all satisfactory, and that the apparatus was still defective. He had to call in the services of the Crypto Electrical Co., whose bill was the subject of the counterclaim.

Evidence having been heard, his Honour Sir THOMAS GRANGER gave judgment for the plaintiffs, whose evidence he accepted that there was no complaint until two months after they had done the work. In his opinion, the defendant wanted the machine "tinkered" instead of spending a proper sum to put it into thorough repair. The plaintiffs had done what they were engaged to do, and had done it thoroughly, and the work which had since arisen was due to the reason he had explained. He gave judgment for the plaintiffs for the amount claimed with costs, and the counterclaim was dismissed with costs.

THE ATTORNEY-GENERAL v. LIVERPOOL CORPORATION.

In the Chancery Division on October 12th, before Mr. Justice Russell, mention was made of a case concerning electrical fittings, in which the Attorney-General is opposed to the Mayor and Aldermen of Liverpool.

Mr. Cartwright Sharp, who made an application that his Lordship should fix a day for trial, explained that the case was one in which the Attorney-General in relation to certain taxpayers sought to restrain the Corporation from carrying on a retail business in electrical fittings. One of the defences, it was stated, was that the defendants had been incorporated and constituted a corporation by divers charters, which gave them the right concerning which the issue arose.

His Lordship fixed November 1st for the hearing of the case.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Small Water Powers.

With reference to the letter in your "Correspondence" column this week, from Mr. A. C. Burt, a copy of our booklet "Water Power and the Generation of Electricity" might be of interest to him.

I enclose two copies of the booklet in question, and we shall be pleased to send one to any people who have "water power running to waste."

P. SYLVESTER FOX,

Sales Manager,

Edmundson's Electricity Corporation, Ltd.

Westminster.

October 15th, 1921.

[The booklet referred to, which has previously been noticed in our columns, gives clear instructions as to methods of measuring the flow of water and the power available, and describes the apparatus used to generate electricity, together with particulars of typical installations carried out by the company.—EDS. ELEC. REV.]

A description of a small plant we fitted up last winter may be of interest, as it differs in several respects from any similar plant that we are acquainted with.

The plant was for a retired physician who had bought a small farm in the Heddon Valley, about half-way between Lynton and Ilfracombe. On the hill behind the house had been cut many years ago a small irrigation ditch; we found that 12 cu. ft. per minute could be depended upon, most of the year, and that we could get a head of 150 ft. with 170 yards of pipe. The owner stipulated that all the waterpower was to be made use of, no accumulators were to be used, and no complicated switchboard or governors were desired.

We laid a 3-in. Mannesmann steel tube from a catch-pit built into the irrigation ditch, down the hill to the outhouses of the farm. A very low-speed dynamo was at that time advertised in your second-hand machinery columns, and was secured; this enabled a direct drive to be arranged, and a

Pelton wheel was designed to run at the same speed as the dynamo, its shaft mounted on ring-oiled bearings for continuous running, and a spare pulley fixed to allow a circular saw to be used for cutting firewood.

The plant has an output of 1.1 kW. In the house there is a 50-gallon hot-water tank, heated with four electric heaters, two of 400 watts, and two of 150 watts; these are controlled by four switches in the kitchen, with a voltmeter over the switches, which constitute the only switchgear, apart from the individual lamp switches.

All through the day the four switches are on, except when the electric kettle or flat iron is in use, when one or two switches are turned off to bring the voltage back to normal, the plugs for these being close by the switches. In the evening, when lights are in use, it is also necessary to turn off some of the water-heating switches; this small amount of attention gives the servant very little trouble, and answers quite well.

The hot-water tank is lagged with about 3 in. of asbestos, and, with the spare electricity, gives all the hot water needed for two baths per day, as well as the hot water needed in the scullery and pantry.

The plant runs continuously, needs very little attention, and even this dry summer has only been "hung up" for want of water two weeks. The Pelton wheel is fitted with interchangeable nozzles so that a larger jet can be used when saving wood if the supply of water permits.

P. T. Kimmins.

Electricity Works, Lynmouth.

October 15th, 1921.

With regard to Mr. Burt's inquiry under the heading of "Small Waterpowers" in your issue of October 14th, the writer during holidays fixed up a small waterwheel, belt-driving a small dynamo for lighting six lamps in a small cottage. The stream running through the grounds was found to be 30 cu. ft. per minute with a 6-ft. fall. A 12-volt battery was used for storage, and the wheel left running all night. This wheel was not by any means the most efficient, as it was made up roughly from odds and ends lying about the place.

Mr. Burt does not mention the speed of his water; but if it would interest him, I shall be pleased to give him all details of the outfit gratis if he will apply to the Editors for my address.

E. Humphries.

Devon.

October 14th, 1921.

Cleaning Enamelled Slate.

With reference to your correspondent Mr. J. H. Robbards's inquiry in your last issue with regard to cleaning and polishing enamelled slate switchboards, I have found that the following method both cleans and polishes them.

Apply linoleum floor polish with a soft cloth, and polish off with another dry, soft cloth. The greasy streaks can afterwards be eliminated by a final polish with a soft chamois leather.

H. C.

London.

October 16th, 1921.

With reference to your correspondent's inquiry on the above subject, we have found that furniture cream ("Cobra" brand) gives very satisfactory results. The cream should be lightly rubbed over the slate with a clean cloth, and polished with a soft rag or chamois leather. If the cream is unobtainable, the "Cobra" brand black shoe polish makes a very good substitute.

William E. Fuller,

For The West Leeds Engineering Works.

Leeds.

October 15th, 1921.

I have found it necessary at times to do a little slate polishing, and find that a good grade of ordinary boot polish applied in a moist state with a soft cloth, and finished off with a piece of velvet, produces a glossy finish equally as good as any new slate.

Another good medium to use is furniture cream, but it is not as good as boot polish, because it is not so searching in its effects.

H. W.

Manchester.

October 16th, 1921.

The Durability of Lead-covered Wiring.

With reference to this subject in your issue of October 14th, 1921, I express the opinion that the practical electrician referred to by "W. T. J." either has considerable stocks of tubing or wood casing in hand which he is anxious to use up, or had very little practical experience with any of the C.M.A. wiring systems.

I would suggest to "W. T. J." ten minutes' practical thinking on the following details:—

1. Compo-lead piping has been used without question for gas lighting for years.

2. The G.P.O. uses plain lead-covered cable which is subjected to more severe conditions without deterioration than would occur in private house wiring.

3. Plain lead-covered e.h.p. mains at 11,000 volts working pressure are in use in this country, and as the least suggestion of moisture penetrating the cover of these cables would be fatal to the service, the conclusions of expert electrical engineers on this subject are obvious.

O. Skidmore.

Wombwell.

October 17th, 1921.

Coventry Corporation and E.P.E.A.

I should like to endorse the statement of "Fair Play," wherein he asked in your last issue if the Secretary of the E.P.E.A. could supply any particulars of the exact position taken up by the Association.

I consider the information is more essential now, as Mr. Jones states that the incident referred to might have culminated in a serious dispute.

As Mr. Jones's reply is distinctly vague and evasive, I can only assume that the dispute was settled in favour of the Coventry Corporation, and I consider it only reasonable that the main facts of the dispute and the decision of the National Joint Board should receive the same publicity as the disputes at Dover and Perth.

One Interested.

Repairing a.c. Rotors.

It is a fairly common experience for a repairer to have an a.c. motor sent in owing to the rotor having rubbed on the stator and so burnt out the windings. Now, assuming that a complete re-wind is called for, is there any method of determining whether or not it is necessary to open out the stator and reinsulate the laminations? Of course, if the air gap has been ground oval, a lot of the teeth knocked out, the vent spaces damaged or any other obvious injury is apparent, the question settles itself, but quite recently a case came to the writer's notice in which a rather large motor had to be rewound owing to its having pulled over. When it was put on load the temperature rise of the iron was so excessive that the motor could not be used, and as a result the stator will have to be rebuilt. The damage to the stampings did not appear to be excessive, at all events a competent firm of repairers did not think it necessary to do anything to them, and as other people may have been up against the same trouble, any information on the subject would be welcome.

Jaques.

London.

October 17th, 1921.

[An obvious plan is to spin the stripped rotor in a suitable magnetic field and see whether it heats excessively.—Eds. ELEC. REV.]

A Motor Problem.

With regard to the motor problem in this week's REVIEW, I doubt the possibility of the motors generating back on to the supply busbars when a "short" occurs on the traction side. In the first place, the motors, being on load, are more likely to slow up, on the voltage drop due to a "short," and it is probably due to that effect and the back e.m.f. set up by the "short" itself causing a rush of current to the motors that the fuses mentioned blew. I have experienced the same thing, and know that the back e.m.f. of a short, where traction is concerned, has no sympathy with motors in parallel with the traction supply source. The best way out of the difficulty is a separate supply for the auxiliary service.

The law of resonance is to be applied in this case where, strictly speaking, a pulsating current is being supplied and a "short" occurs.

P. E. Ford.

Hounslow.

October 17th, 1921.

[Apparently our correspondent refers to the effect of surges.—Eds. ELEC. REV.]

Accumulator Froth.

It seems to be generally acknowledged that this is mainly due to the action of certain chemicals contained in the celluloid. A very simple way out of the difficulty is to do what so many people have already done, that is, to use flexible ebonite containers.

As far as train lighting batteries are concerned, I believe I am right in saying that ebonite is used exclusively. Quite a number of makers of motor-car batteries have adopted ebonite; as far as I know, I am the first person to adopt ebonite for cells of miners' electric safety lamps, but I really don't see why I should be the last.

Theodore Stretton.

Cardiff.

October 14th, 1921.

The remarks contained in Mr. Hesketh's letter published in your current issue call for comment.

On reference to my statement as to transparency, he will find that it was made in answer to his suggestion of "painting with some sort of preparation as paraffin wax." He now amplifies this suggestion by mentioning transparent paints, the utilisation of which would raise questions of both practical and chemical importance. Mr. Hesketh being so confident as to the variety of methods for overcoming frothing, it naturally causes one to wonder why he did not put one of his "multiplicity of ways" into operation on his celluloid cases instead of abandoning them in favour of glass boxes. To make a suggestion is a simple matter, to put it into practice is an entirely different proposition.

From his remark that the chemistry of frothing should be properly investigated, I assume that this was written without the deliberation one would expect from an apparent authority on accumulators. Does he seriously mean to imply that the accumulator industry, with its facilities for analytical and research work, have not thoroughly and exhaustively investigated this question, and is he not aware that failing glass, ebonite or wood, lead-lined boxes are the alternatives?

His somewhat pointed remarks concerning a Rolls-Royce car call for reply in that so many of your readers will feel it is a matter affecting them personally.

The standard for car starting and lighting batteries is an assembly in ebonite, but should celluloid containers be specifically called for, these could be supplied, but only after advice had been tendered as to the suitability of ebonite cases. Small type cells are supplied in either ebonite or celluloid containers, but the demand is invariably for celluloid, simply because of its transparent qualities.

Ponders End.
October 10th, 1921.

W. C. Coates.

The letters appearing on this have added nothing to our knowledge of the subject. The very best makes of cells do this frothing, and surely if it were possible to employ some other grade of celluloid, no one would risk his trade or reputation. Whatever the cause may be, its elimination should be the job of chemists. Speaking with over 30 years' battery experience, testing and working, I have seen frothing only in cells where the container, envelope containing paste, or separators have been made of celluloid, and this the makers can minimise by leaving as large a space as possible between the top of the plates and the top of the container, with an intervening condensing or settling chamber well ventilated. I have seen plenty of gas bubbling from other types of cells, but no frothing. The effect of frothing is usually to eat away terminals, and on the road with car-lighting batteries this is a nuisance. In 1914 I devised a renewable terminal and tool for affixing it, which received commendation in your "New Devices" column at the time.

Oulton Broad.
October 4th, 1921.

B. Barber, A.M.I.E.E.

The Contractor's Future.

With reference to the above article in your issue of September 16th and subsequent correspondence under this head, this is really a question to be settled by facts, and if instead of using unkind names concerning each other, we were to get busy with the best way of handling our own business, we should accomplish much in the way of establishing the future.

It is a fact there is a market for various labour-saving devices, and there are many such articles of American manufacture carried in stock by large numbers of contractors in almost every large town in this country, and this being so, one would think these articles were purchased for business purposes and not for the sake of the proprietor's health.

Being in business, let us ascertain the best methods to carry on such business, and then get on with it.

Newcastle-on-Tyne.
October 10th, 1921.

C. N. Vernon.

Thunderstorm Phenomena.

During a recent thunderstorm at Alverstoke, Hants., the following phenomena were noted in one of the houses.

The telephone lightning discharger, which was fixed just above the lintel of the side entrance, was blown. The telephone instrument, which was about 6 ft. away across a passage, was not damaged. The occupier of the house, however, was in the open doorway at the time, and, though unhurt, heard a report like a shell burst. The flash was apparently a spark-across between the telephone lightning discharger and the electric light distribution box, which was fixed about 3 ft. above the telephone instrument, and some of the fuses were blown, though most were undamaged. Three or four of the metallic filaments in the incandescent lamps in various parts of the house broke. The main house fuses, which were close to the side entrance of the house, were quite unaffected.

The electric light supply is underground, 8-wire, d.c., 240 volts from outer to neutral, and the house wiring is all in screwed conduit. The telephone connection is overhead, the

nearest pole, a high one, being about 50 yards distant. The earth wire from the telephone lightning discharger was carried through at least 8 angles of from 90 deg. to 110 deg. as follows:—Round the lintel of the side entrance (2), along the wall (1), round a re-entrant angle in the house (1), then along the side of the house (1), round to the back (1), in through a hole near the lavatory window (2), and thence by a water pipe to earth.

The house is a low semi-detached building about 15 ft. clear of the next pair of houses. The nearest tree is about the same height as the house and in the garden of the next pair of houses quite 20 ft. away from the side entrance.

I wonder if you or any of the readers of your paper can offer an explanation and suggest how a repetition of the accident can be avoided, as the occupier of the house is anxious not to run such a narrow risk of death again unnecessarily.

E. O. Alabaster,
Bvt. Major, R.E., A.M.I.E.E.

School of Electric Lighting,
Stokes Bay, Gosport.
October 10th, 1921.

A Suction-gas Problem.

At a certain small power house in the Midlands we have recently installed a suction-gas plant, and have since had several complaints about the smell given off by it; the complaints seem to originate mostly from people living about 300 yards from the power house, and it is when the plant is idle that they notice it most; yet while the plant is running we who look after it find considerable odours of an objectionable nature from the overflow water from the scrubber, but none at all when the plant is idle.

The water from the scrubber runs through a drain about twelve yards long into an open ditch; but when we put the plant down we built a pit into the drain for deodorising purposes. I should be glad if any of your readers, having had similar trouble, could tell me what is the best deodoriser to use, and whether this method is likely to prove satisfactory with regard to the overflow water from the scrubber.

With regard to the odours arising when the plant is idle, they must come from the waste pipe from the producer, and as far as I can see there is no remedy unless a longer waste pipe would be effective; our present one is 13 ft. above the producer outlet.

October 14th, 1921.

O. N. E. Morequery.

Grinding v. Turning Commutators.

I have read with interest the recent articles in the ELECTRICAL REVIEW, on the subject of "Grinding v. Turning Commutators," and while I agree that there are certainly good points about each method, I feel I must criticise both the suggestions made.

One correspondent would have us believe that good commutators are manufactured solely by one firm, but of course, any manufacturer of repute can produce machines which give quite as good results as those quoted. This is apparent to users of other makes, who take it quite as an ordinary thing to be able to quote such performances. Indeed, some machines never get the great care that is admitted in this case, and yet give good results. Either method of truing is good, provided it is carried out properly, and it is only in cases where the operator is careless that troubles occur.

Any turner worthy of the name takes sufficient interest in his lathe to keep his "centres" in good condition; indeed it is upon the condition of the centres that all the work produced upon the machine depends. Personally, however, I should not be inclined to allow a "lad in his teens" to true up the shaft and turn the commutator, for the first is an important and not easy task, apart from the care necessary in placing the armature in the lathe.

Grinding is satisfactory provided the correct grade of wheel is used and that all chatter in the parts is eliminated.

The tendency for the copper to "drag" is more apparent when turning than when grinding, because of the difference in the amount taken off relatively by each cut. A grinding wheel will not stand up to a cut more than about 5 "thou" and produce a good finish, and as the finish is the sole reason for performing the operation, a fine cut is taken. The main trouble is the difference in peripheral speed caused by the reduced diameter of the wheel by wear, and therefore a wheel should not be used after its diameter has been considerably reduced.

A manufacturer or user will make use of the method which is best adapted to his plant, and as necessity is the mother of invention, it is quite probable that there are other methods in use. I agree that a good result is obtained by grinding while the armature revolves in its own bearings, but this is hardly practicable in small machines. Personal experience often leads one into a groove, and therefore unless one has proved, by experimenting with all methods, which is the best, one is apt to miss the good points of other methods by being biased.

October 15th, 1921.

Adam.

Supply Without Statutory Powers.

Should time permit and the Editor have space available in a future issue, I should be pleased to recount my experiences, faced with disadvantages unique and varied in their character. How I made a Provisional Order of the local Council a dead failure may interest "N.W." and others. Your correspondent "A.O.G." gives an interesting example, but although much in agreement with him, I cannot accept the efficiency of the £45 steam set as against a station supplying a million units per annum, or the barrowful of coal, unless it be a two-wheeled barrow. The price to be charged is controversial, but is always worth all costs of generation, and energy should never be sold at a loss to the undertakers. The price has never hindered the progress of electricity, but crass stupidity and "take it or leave it" and "we are the law" has much to answer for. How many supply authorities exercise tact in dealing with the irate and dissatisfied consumer, or employ anyone to create, educate, and keep a satisfied consumer? If there is any such authority it is a *rara avis*.

B. Barber, A.M.I.E.E.Oulton Broad,
October 4th, 1921.**Rearing Chickens Electrically.**

Readers of your note in last week's issue on the above subject might possibly conclude that a modern electrically heated incubator consumes a comparatively large amount of energy.

We should like to say that practically all existing types of oil or gas heated incubators of any egg capacity can be converted to electrical heating, the power consumption of a 50-egg size being only 220 watts, and that of a 300-egg incubator 530 watts.

It will be seen that such incubators would be well within the scope of a country house lighting plant.

Shortly after starting up, the current is switched "off" by the thermostat, and is usually "on" for only an average of 30 minutes out of each hour. The use of four 32-c.p. lamps as a heating medium suggested by Messrs. Cooper & Co. is not only expensive in first cost, but unless the light is well screened, will probably have a detrimental effect upon the later development of the birds. Whilst light is permitted in a hover or "mother," it is certainly to be avoided during the period of incubation.

E. P. Barfield,*Automatic and Electric Furnaces, Ltd.*London,
October 11th, 1921.**Rapid House-Wiring.**

We have noticed a claim made in your columns by Messrs. Jessop & Boydell regarding wiring work carried out on the Henley system.

The claim in question seems to have occasioned some criticism, but we really cannot see that this is called for. We are able to say from our own experience in the use of a similar system of more recent introduction (the J. & P. wiring system) that there is nothing unusual in the results said to have been secured; certainly nothing beyond what ought to be realisable by any properly organised contracting business.

We are at present working on housing schemes where two men and a boy are completing in one day the entire installation of a house containing nine lights. This includes the erection of all fittings and shades, which work was not included in the daily output claimed by Messrs. Jessop & Boydell.

We may add that owing to the very favourable results both as regards the costs and workmanship, which we have obtained with the system mentioned, we have completely abandoned the use of screwed conduit for any competitive work.

Henry H. Pearson, A.M.I.E.E.*Jones Brothers.*Blackpool,
October 13th, 1921.**A.C. Organ Blowers.**

Amongst the methods for varying the speeds of organ blowers run from constant-speed a.c. motors, one might consider the system used on motor cycles. This consists of a belt running between two disks which are slightly coned. When the disks are near together, the belt is forced to the outside where the diameter is great, whilst, when the disks are far apart, the belt comes near the centre where the diameter is small. There seems no reason why such an arrangement should not work for organ blowing, the position of the disks being adjusted by a lever running from the bellows. One wants to be sure that there would be no click when the belt joint ran over the pulley, and one also wants to be sure that the motor would not hum unduly. This variable speed arrangement would allow one to run the bellows at a low speed when necessary. Over-blowing could be prevented by arranging that the air valve is opened when the bellows are full. This

method would be much better than running the bellows at full speed the whole time, and preventing over-blowing by letting off the air. Such a method is wasteful, as the organ is only very rarely run at full power. It would be interesting to know if anybody has tried such an arrangement.

Organ Blower.

October 17th, 1921.

Lighting Bakers' Ovens.

With regard to the trouble experienced by "Electro" in the lighting of bakers' ovens, I would suggest the use of lamps with platinum loops and spring holders. These lamps would be unaffected by the high temperature. As they are still used in some situations where excessive vibration is experienced, such as gun turrets in battleships, I should imagine they could be obtained without much difficulty.

R. W. J. Stark.Edinburgh,
October 17th, 1921.

The condition of the equipment, reported by "Electro" in your issue of October 8th, reminds one of the man who returned from the war "minus a leg and an eye and an arm. Otherwise free from material harm."

I suggest that the problem should be tackled in consultation with manufacturers of watertight fittings, such a fitting to be provided with circulating water by connection to a cistern outside the oven with suitable flow and return pipes; the lamp to be permanently fixed inside the oven. Probable cost, from £5 to £7 per point.

C. A. B.

October 17th, 1921.

Wealth of U.S. Electrical Industry.—Wealth is always of interest and a compilation such as that recently made by Prof. David Friday of the national wealth for 1920 is particularly so. It portrays not only the wealth of the nation but indicates as well the chief sources of this wealth. The total as arrived at by Professor Friday reaches in round figures close to the fabulous sum of \$300,000,000,000, approximately half of which is represented by real property subject to taxation. Next in value, the wealth represented by the railroads and their equipment is placed at \$20,000,000,000. Segregating and combining certain of the other items as listed, the electrical industry is credited directly with a wealth of \$14,200,000,000, but this figure is very far from being complete. Many of the other items given include as wealth electrical equipment, as for example, in manufacturing where the value of electrical equipment employed is known to be some \$2,045,975,500. That portion of the wealth of other important industries represented by the value of the electrical equipment employed in each is substantially as follows:—

	\$
Agriculture	90,000,000
Electrified steam railroads	135,000,000
Electric railways	330,000,000
Isolated power plants	250,000,000
Fire alarm and signal systems	80,000,000
Contractor-dealers and merchandise	175,000,000
Electrical publishing	4,000,000
Miscellaneous	20,000,000
	\$1,085,000,000

Combining these further totals a partial aggregate of the wealth contributed by the electrical industry is \$17,330,975,000. Even this is far from being all, for no account is taken of the wealth represented by electricity in the marine field, the costly electrically propelled and operated naval vessels, or of the wealth entailed in the equipment for the domestic use of electricity. With approximately 7,000,000 homes wired in the United States, exclusive of Alaska and the islands, each one of which contains from \$50 to \$100 or much more electrical equipment, it is plain that the electrical industry is directly responsible for a proportion of the national wealth second only to the real property value subject to taxation. Even the value of this property has been materially enhanced by the electrical industry. And a quarter of a century ago there was virtually no electrical industry—at least none which contributed greatly to the national wealth.—*American Electrical Review.*

Electrification of the Polish Petroleum Basin.—The *Journée Industrielle* learns from Warsaw that a group of petroleum companies at Borslaw is to construct a great electric station in order to provide energy for the boring of soundings and working of pumps. The Minister of Industry and Commerce has promised the collaboration of his department for the purpose of erecting an electric system for the whole of the petroleum basin.—*Reuter's Trade Service (Paris).*

BUSINESS NOTES.

Bankruptcy Proceedings.—FREDERICK CHARLES NICHOLS, 19, South Street, Scarborough, trading in co-partnership with another, under the style of The Scarborough Motor and Accessories Supply Co., motor and electrical engineer.—The receiving order in this matter was made on September 24th on debtor's own petition. The statement of affairs shows liabilities of £372 and assets of £39, from which has to be deducted £12 for preferential claims, thus leaving a deficiency of £345. The debtor attributes his position to bad trade, lack of working capital, &c. In May, 1914, he started business at 24, Park Street, Scarborough, as an electrical engineer with a cash capital of £130. He carried on the business until May, 1916, when he joined the Army, but after being demobilised in January, 1918, he again opened out business at the same address, and also at Whipp's Yard and Falsgrave, all in Scarborough, when his capital was £150. About two years ago, whilst at Whipp's Yard, the debtor was financed by another, and in July last the business was transferred to South Street, Scarborough. He alleges he first became aware of his failure in November last, when trade was very bad, but it was not until last August that he realised his true position. The first meeting of creditors took place on October 14th at the offices of the Official Receiver.

A. E. BLOWER (Blower & Cooper), electrical engineers' merchant, 1 and 3, Paul's Bakehouse Court, E.C.—Receiving order made October 11th on debtor's own petition. First meeting, October 25th. Public examination, December 15th, both at Carey Street, W.C.

A. LORD, electrical contractor, 33, Westgate Burnley.—First and final dividend of 5½d. in the £, payable October 24th, at the Official Receiver's office, 13, Winkley Street, Preston.

C. H. STEEL, electrical engineer, 53, Queen Street, Cardiff, and 65, High Street, Merthyr Tydvil.—First and final dividend of 2s. in the £, payable at the Official Receiver's office, 34, Park Place, Cardiff.

A. E. DICKINSON (Crown Electrical Co.), electrical engineer and contractor, 157, Hunslet Road, Leeds.—First and final dividend of 1½d. in the £, payable October 25th at the Official Receiver's office, 24, Bond Street, Leeds.

ERNEST EDWARD MATHERS, electrical engineer, of 10, High Street, Doncaster, and residing at Allen Dale, Springwell Lane, Balby.—A receiving order has been made in this case. The statement of affairs shows liabilities expected to rank for dividend amounting to £581 and a deficiency of £498. The assets include a motor cycle and side-car. The cause of failure, as alleged by the debtor, are judgment obtained against him for damages and costs in consequence of a motor-riding accident, and also insufficient trade. The debtor, aged 36, states that he began business in April, 1921, with £150 capital borrowed from his mother, starting in Doncaster, where he was a stranger, because he was advised by a friend that it was a growing town and there was an opening for an electrical engineer. The debtor says he was unable to obtain orders. He purchased the motor cycle and side-car for £85, in order to canvass outside the town. The accident was on Whit-Monday, at Humphrey Bank, near Harrogate, when a Mr. Samuel Whitaker, of Leeds, was injured and subsequently obtained judgment against debtor for £72 10s. damages and £43 costs. The first meeting of creditors was held recently at the Official Receiver's Offices, Figtree Lane, Sheffield, and the matter was left in the hands of the Official Receiver as trustee.

V. B. WORTHINGTON, electrical and mechanical engineer, 33, Memorial Road, Walkden.—First meeting, October 25th, at the Official Receiver's Offices, Byrom Street, Manchester. Public examination, November 9th, at the Court House, Salford.

G. H. GEE, electrician, 10, Front Street, Adnfield Plain, Durham.—Last day for proofs for dividend November 8th. Trustee: Mr. C. Wollett, Official Receiver, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne.

Company Liquidations.—AMALGAMATED ELECTRIC WORKS, LTD.—By an order of the Court, Mr. T. J. Wilson, of 59-60, Old Bailey, E.C., has been appointed sole liquidator in the place of Mr. J. L. Mahon, retired.

MUTUAL ELECTRIC TRUST, LTD.—Meeting of members called for November 18th at Messrs. Allen West & Co.'s offices, Lewes Road, Brighton, to hear an account of the winding up from the liquidator, Mr. A. E. Wake.

MAXIM LAMP WORKS, LTD.—In the Company Winding Up Court, on October 18th, Mr. Justice Astbury, on the petition of Carl Quitmann, made a compulsory order for winding up this company. Counsel for the petitioner said he was a judgment creditor. No notice to oppose or support the petition had been received.

Dissolutions of Partnership.—CROSLAND & BATESON, electrical engineers, Bradford Road, Batley.—Mr. G. F. B. Crosland and Mr. H. D. Bateson have dissolved partnership. Mr. F. B. Crosland will attend to debts.

SMETHWICK ARC WELDING CO., electrical welders, Grove Works, Grove Lane, Smethwick.—Messrs. J. Horton, F. Parkin, G. Price, J. W. Parkin, F. Parkin and H. Jones have dissolved partnership.

KEY ELECTRICAL SUPPLIES Co., 109-111, Portland Crescent, Leeds.—Mr. J. L. Knowles and Mr. J. Ellison have dissolved partnership. Mr. J. Ellison will attend to debts and continue the business under the same style.

Trade Announcements.—MR. JOHN DAVIS states that he has ceased to be connected with the Freeman Electrical Accessories Co., and is commencing business as the Davis Electrical Co., Ltd. (which is being registered), at 6, Warwick Court, High Holborn, W.C.1.

Mr. F. S. J. HARDING announces that he has taken over the sole proprietorship of the Swan Electrical Works, Clewer, near Windsor.

Mr. J. W. RUSSELL, electrical engineer, of Loates Lane, Watford, has opened additional showrooms at 8, Queen's Road.

With reference to the notice in our issue of October 7th under the heading of "New Companies Registered," regarding the Baynes Electrical Co., Ltd., in case it may be gathered that the company has started business on the contracting side of the industry, we are asked to state that such is not the case. The company is actually a wholesale electrical supply firm.

The Canadian Electrical News (October 1st) contains an article regarding the formation of the English Electric Co., of Canada, Ltd., which is associated with and holds the exclusive manufacturing rights in Canada of the home company of similar title. The company has purchased the plant of the Canadian Crocker-Wheeler Co., of St. Catharines. Mr. R. A. Stinson remains as president and general manager of the new company, and Mr. Gordon F. Perry is chairman of the board.

THE NORTHWOOD ELECTRIC LIGHT & POWER CO., LTD., has removed to new offices at 2, Eastbury Road, Northwood, Middlesex. Telephone number unaltered (Northwood 38).

MESSRS. MARLEY & WHITE have removed to 17, Sandhill, Newcastle-on-Tyne, where they have an office, a showroom, and stores. Telephone number: 1261 Central.

MESSRS. T. TWIST & SON have removed to their new office and showroom at Britannia Chambers, George Street, St. Helens.

Catalogues and Lists.—MESSRS. LAWRENCE, REYNOLDS AND CO., 13, Crutched Friars, E.C.3.—A list of electric motors, fuses, charging boards, irons, &c., for which the firm are agents. Also a price list of 1-, 2-, and 3-phase motors ranging from 25 to 200 cycles and from .25 to 45 h.p.

MESSRS. BILL & BERRY, 18-26, Constitution Hill, Birmingham.—List No. S.R., 1922, an illustrated price list of shunt and speed regulators for generators and motors.

THE HART ACCUMULATOR CO., LTD., Stratford, E.15.—A showcard advertising "Hart" batteries for motor-car starting, lighting and ignition.

MESSRS. SUTCLIFFE BROS., 90 and 91, Queen Street, E.C.4.—A price list of v.i.r. cables, flexibles, bell wire, and conduit of various types and sizes.

MESSRS. RAYNER & HEALD, LTD., Duke Street, Derby.—Stock list of 2- and 3-phase induction motors ranging from 1 to 45 h.p.

MESSRS. DONOVAN & CO., 47, Cornwall Street, Birmingham.—A sheet giving illustrations and prices of numerous electrical accessories as lamp-holders, tumbler switches, bells, plugs, house service switches, &c. Also a list of reduced prices of "Mazda" lamps.

DUGGILL'S PATENTS, Failsworth, Manchester.—A card bearing numerous illustrations of jointed lighting fittings for walls, ceilings, and desks.

Mr. H. C. SLINGSBY, 142-146, Old Street, E.C.—List No. 151, dealing with several types of barrows.

MESSRS. HOGAN & WARDROP, 88, Golden Lane, E.C.1.—A well-illustrated price list of electric fans of numerous types—desk, bracket, ceiling, port-hole, &c. The list also deals with fractional h.p. motors, regulating resistances, and grinding and polishing machines.

MESSRS. SIEMENS BROS. & CO., LTD., Caxton House, Westminster, S.W.1.—Leaflets 2007 and 2009, the first giving a description and illustrations of the lighting of Covent Garden Markets, and the other a list of large residences in which the "Stannos" wiring system has been installed.

MESSRS. WATSON & SONS (ELECTRO-MEDICAL), LTD., Sunic House, Parker Street, Kingsway, W.C.2.—Bulletin 37s, describing the "Canny Ryall" portable diathermy apparatus; priced. Supplement to Bulletin No. 35s, giving altered prices of the "Sunic" X-ray combination. Also a price list (Bulletin 40s) of second-hand X-ray and electro-medical apparatus.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—List No. 337, advertising the "Alco" electric washer and wringer.

E.D.A. Activities.—The latest pamphlet of the British Electrical Development Association (E.D.A. 196) sets in contrast the trouble entailed by the use of raw fuel and the advantages of electric heating. Its appearance is attractive and its statements are convincing.

Patent Restoration.—An order has been made for the restoration of patent No. 18,215 of 1915 for "Improvements in or relating to trucks for railway or tramway vehicles" granted to Sidney Thomas and Frank Staits-Gardner.

For Sale.—By order of the liquidator, Messrs. Whitham and Son will sell by auction on November 8th and 9th at 3, Lisbon Street, Leeds, the stock of Messrs. Hudsons Electrical Engineering Co., Ltd., comprising motors, switchgear, plant, machinery, stores, &c.

By direction of the Disposal Board, Messrs. Lane & Smith will sell by auction on November 1st and following days at Witton, Birmingham, electrical plant and machinery.

The Lodon County Council invites offers for one 3,500-kW generating set.

Assets Auctions Co., Ltd., will sell by auction on October 4th, at 19-121, Newington Causeway, S.E., a quantity of electrical material, &c.

Bristol Corporation Electricity Department invites offers for surplus generating plant, &c. (See our advertisement pages to-day.)

Book Notices.—"Hydro-Electric Power in the Niagara District (35 pp.). Toronto: The Hydro-Electric Power Commission (Ontario).—This is a well produced brochure, profusely illustrated, dealing with various aspects of the supply of power in the largest of the Commission's systems. It is especially useful as showing the extent to which industry and the general well-being of the district are dependent upon the electric supply.

"The Metropolitan-Vickers Gazette," Vol. VI, No. 102, September, 1921.—This issue contains an illustrated description of a excess energy meter for measuring consumption above a contract quantity; an article on "High Voltage Bushing Insulators," by W. A. Coates, M.I.E.E.; and "The Story of the Induction Motor," a reprint of a paper read before the American I.E.E.

"The Toronto Hydro-Electric System," Tenth Annual Report, 1920. Published by the Toronto Electric Commissioners.—This gives in detail particulars of operation for the year ended December 31st last, showing very satisfactory results.

"Pittman's Latest Books, Autumn, 1921" (28 pp.).—A catalogue giving sizes, prices, and short descriptions of technical, commercial, and financial books recently published by Sir Isaac Pittman & Sons, Ltd.

"The Mechanical Handling of Goods," by C. H. Woodfield. Pp. xi+16, figs. 73. London: Sir I. Pittman & Sons. Price 2s. 6d. net.

"M. & C. Machine Mining," Vol. I, No. 3. Glasgow: Mayor & Coulson, Ltd. Price 6d.—This contains copious notes on coal-mining machinery and switchgear—their use, upkeep, &c.

"Engineering Abstracts from Current Periodical Literature," Polished outside the U.K. New series, No. 9. October, London: The Institution of Civil Engineers.

"Post office Electrical Engineers' Journal," Vol. 14, part 3. October, 1921. London: ELECTRICAL REVIEW, Ltd. Price 2s. net.

"The Electric Furnace," by F. J. Moffett. Pp. x+118; 33 figs. London: Sir I. Pittman & Sons. Price 2s. 6d. net.

"Metri System for Engineers," by C. B. Clapham. Pp. xii+181, 1 tables. London: Chapman & Hall, Ltd. Price 12s. 6d. net.

German Customs Duties.—The German Minister of Finance has issued an order, which took effect on October 20th, increasing from 900 to 1,900 per cent. the premium or "agio" which is leviable when the "gold" duties of the Customs tariff are paid in paper currency. The effect of the order is to double the paper currency duties by requiring 2,000 paper marks to be paid for each 100 marks "gold" duty leviable, instead of 1,000 paper marks as hitherto.

Coventry Corporation and the E.P.E.A.—The trouble between the Coventry Corporation Electricity Department and the E.P.E.A., which had reached so acute a stage that notices of withdrawal of their services had been given by the whole of the staff, has been settled by the Anomalies Committee of the National Joint Board, to which both parties to the dispute agreed to refer it, at the same time agreeing to accept the decision of the Board as binding. We learn from the secretary of the National Joint Board of Employers and Members of Staff, Mr. H. B. Keeping, that the sub-committee met in London under the chairmanship of Alderman Walker, and after a full hearing, decided unanimously that the notices to cease work must be withdrawn and no further attempts made to interfere with the arrangements made by the Coventry Corporation. It was also recommended that the gentleman who had been appointed to the staff of the electricity department should rejoin the E.P.E.A.

New Electrical Manufacturing Works at Leeds.—If excitement exists for anything in the industrial world, the "merry and bright" spirit of some branches of the electrical trade should rather be a good thing. It is certainly encouraging when we are discussing the question of industrial depression and unemployment to see signs of progress and development in any branch of industry, and to note the presence in our midst of those who have sufficient confidence in the future to make preparation for the revival in trade which we all hope will not be long in coming. One such sign is to be found in the building of new works by Messrs. Ingleby & Co., Ltd., dynamo and motor manufacturers, on a site of approximately 10 acres adjoining Old Lane, Beeston, Leeds, which less than two years ago was a field under cultivation. These works, which were formally opened last week by the

Lord Mayor of Leeds, consist of two buildings, the larger of which comprises commodious offices and a large machine shop of structural steel arranged for an overhead travelling crane; the other includes a tool shop as well as winding department and stores for finished motors and other materials. The works, which are capable of turning out electric motors for industrial purposes ranging from $\frac{1}{2}$ b.h.p. to 200 b.h.p., were designed by Mr. J. C. B. Ingleby, elder of the two brothers Ingleby, who commenced business in rented premises in Elland Road in 1908. During the war this became a controlled establishment and supplied a large number of motors to the Government factories. Special attention has been paid in the construction of the buildings to light, ventilation, and heating, and a most important feature is the way the works have been laid out for future extension; one or more bays can readily be added to the main building at comparatively small cost, there being ample land available on the site.

United States Exports of Electrical Goods.—The exports of electrical goods during August were valued at 6,057,489 dollars, as compared with 7,110,285 dollars in the corresponding month of 1920. Seven electric locomotives—not included under general electrical goods—valued at 242,362 dollars were also exported in August. The heaviest decreases compared with the corresponding month of last year were shown in batteries, carbons, fans, heating and cooking apparatus, interior wiring supplies, incandescent lamps, magnetos, spark plugs, &c., and switches and accessories, whereas motors, rheostats and controllers, telephones and transformers, showed healthy increases.—*Reuter's Trade Service* (Washington).

Exports of electrical goods from the United States showed a marked decrease during the first eight months of this year compared with the same period of 1920. This tendency was less noticeable in power equipment than in equipment for motor vehicles and similar lines. In telephones and transformers, however, American trade continues to expand. Japan has been quite an active buyer in many classes of goods, which is a noteworthy circumstance considering the growth of local manufacture.

Russia's Electrical Factories.—The production of the electrical factories in the first four months of 1921 is tabulated as follows in a Russian official journal:—

Goods.	Planned production.	Produced.	Percentage produced compared with programme.
Dynamo machines, motors and transformers ...	13,420 kW	10,704	80 %
Telephone and telegraph apparatus and parts ...	1,395	1,998	171 %
Wire and cable ...	39,700 pounds	36,100 pounds	91 %
Electric lamps ...	612,000	297,217	48.5 %
Electric accumulators ...	12,500 pounds	5,100 pounds	40.8 %
Insulators, trolleys, &c. ...	9,621 "	3,632 "	38 %
Carbons ...	3,324 "	3,938 "	120 %

The last two items are for six months.

Under the control of the Moscow Government there are 40 electrical factories, of which 34 are working. These factories are arranged in 28 producing units, under one control, to assure homogeneous production. The total number of workers and staff at the factories was (on January 1st) 7,273 workers, 2,328 employés, total 9,601; on May 1st, 8,426 workers, 2,400 employés, total 10,826. That is to say, the number of workers grew by 16 per cent. in four months, and the employés by 8 per cent. But this increase in labour force was not shown in the working of the factories, which are being run under inefficient conditions. In pre-war days 12,500 men were engaged at the factories, and in 1916 15,000 were employed. The chief problem is labour. Whereas in 1913 55 per cent. of the hands were skilled workmen, on January 1st, 1921, only 35 per cent. were skilled. At the high-pressure factories the ratio of skilled workers fell from 63 to 37 per cent., and those for weak-current apparatus fell from 55 to 26 per cent.

Attracting the Consumer.—The advent of autumn is being accompanied by many fresh efforts on the part of electrical manufacturers to extend the popularity of their products.

The ELECTRIC LAMP MANUFACTURERS' ASSOCIATION, through the medium of the Scheff Publicity Organisation, Ltd., has inaugurated a wide campaign to make known the lamps of its member firms. The arrangements are fully set out in a brochure recently issued, and the printing press is to be kept busy.

For the use of its agents, the EDISON SWAN ELECTRIC CO., LTD., has published a broadsheet which contains illustrations of several advertisements which may be reproduced in local newspapers, the firm supplying the necessary "electros." A new "Ediswan" showcard has been issued. This is a coloured card bearing the title "The World's Light Championship," and depicting a boxer sparring with a "Royal Ediswan" lamp mounted as a punching ball.

THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., is advertising the "Cosmos" radiant fire by means of a coloured show-card depicting two children standing over a fire with obvious enjoyment.

Trade Depression: The F.B.I. Suggestions.—The Executive Committee of the Federation of British Industries has appointed a special committee to consider, and to consult other interests with regard to the suggestions made in its memorandum on trade depression, a copy of which was forwarded to the Prime Minister by Sir W. Peter Rylands, the president. It consists of leading representatives of important industries, and includes the president, Mr. Dudley Docker, Sir R. V. Vassar Smith, Col. O. C. Armstrong, Mr. E. W. Petter, Mr. E. J. Pybus, and others. The memorandum stated that the situation presents two separate problems: (1) The discovery of the best means of alleviating the distress caused by unemployment; (2) the discovery of the best means of reviving trade and thus removing the cause of unemployment. After examining the causes of the present position, the question of restoring stability is reviewed, and it is shown that the cyclical trade depression such as we were accustomed to long before the war will yield to a revival of demand, and of this there are already signs in some trades. The document proceeds to discuss possible measures for alleviating the difficulties of the next few years, such as reduction of taxation, export credit schemes, barter trade, development of Dominions and Crown Colonies, and closes with reference to future competition. We quote the final sentences:—

"We have got to realise that if we are to sell goods to an impoverished world we must sell them at a price which that world can afford to pay, and that if foreign labour costs are below ours in any trade, either through their workmen accepting lower rates of remuneration than ours or giving higher efficiency for similar remuneration, no artificial measures will enable us to continue to give employment in that trade. The lowering of the cost of production involves, of course, two factors; the first is the improvement of management, organisation, and plant, and requires time and, above all, the expenditure of capital which war and present taxation and the diminution of the world's capital resources will render it extraordinarily difficult to supply. The second factor is either an increased efficiency of labour in proportion to its remuneration, or decreased remuneration without a decrease in efficiency. The choice before the country is to reach this result either by agreement, which would be infinitely the quickest and most satisfactory to everyone concerned, or by the sheer force of circumstances—continued unemployment, continued distress, and in the ultimate result starvation for the workman and bankruptcy for the employer."

The Australian E.T.U. and Union Labour.—The Sydney City Council had the following resolution before its meeting in September. It was in the name of the secretary of the Municipal Labour caucus: "That on and from a date to be fixed, all installations which it is intended to connect to the Council's mains must be installed by men who are certified by the secretary of the Electrical Trades Union of Australia, such men to be financial members of that organisation, and the consumers must produce a certificate to that effect before the Council will grant supply. Failure to produce such certificate will render the consumer liable to a fine, and supply of current will be withheld until the fine is paid."

Helium Fittings.—We understand that "Helium" electric light fittings (registered design No. 677,190, of Messrs. Albert Lee & Co., Ltd., New Zealand Avenue, E.C.1) have just been installed in the London School of Economics and Political Science (London University), also in Harrow College and many shops and public buildings. The firm holds the standard type of fitting in stock in various sizes for 60- to 1,000-watt gasfilled lamps.

Producer and Consumer in South Africa.—Every country possesses a national desire to work up its own home-grown material into finished articles of the greatest possible value, rather than to export the raw or semi-manufactured product and re-import it at some later stage of manufacture. This desire was intensified during the war, and in fact was transformed in many instances into a dire necessity. South Africa affords an interesting example of this tendency. In fact, her zeal in some instances outran her discretion, judging by the comparatively high prices at which certain home-produced articles have been selling. This phase of the movement has perhaps influenced the Union Government in creating a department to watch the interests of traders as well as manufacturers.

More than five years have elapsed since a Department of Industry and Science was formed, and during that period it has surveyed the chances of development in almost every possible branch of manufacture in the Union. Exports of South African produce, other than gold, rose in value from £21,419,000 in 1916 to £48,132,000 in 1919 and £42,252,000 in 1920. This advance in export trade has emphasised the need for the formation of a Department of the State which would deal with that branch of activity as well as with industry and manufacture. To fill this want the Union Government has now set up a Board of Trade and Industries whose principal functions will be to advise the Government on the working of the Customs and Excise duties, particularly with reference to the protection of home manufacture, and to examine costs of production, transportation, and labour at home and abroad, in relation to prices of South African and other produce. In short, the Board will endeavour to hold the balance between the manufacturer and consumer. Its duties also include the development of markets overseas for the raw materials and manufactured products of the Union.

The Chilean Railway Electrification Contract.—A report received from Santiago through Reuter's Trade Service referring to the contract awarded by the Chilean Government to the Westinghouse Electric International Co. (see ELECTRICAL REVIEW last week) at \$7,000,000, states that the bid of approximately \$12,000,000 made by the Allgemeine Electricitäts Gesellschaft was the highest of all tenders received. Work on the contract must be commenced within six months and must be completed in the spring of 1923. It is calculated that the cost of electrification of this section of the line will be amortised within six years, on account of the immense saving in fuel and labour.

German Exports to Spain.—During the first seven months of the present year the Germans sent among other goods to Spain over 2,000 tons of electrical installation material out of a total importation of 4,900 tons; over half the telegraph and telephone apparatus imported; more than a third of the fixed steam and gas engines; a third of the flywheels and pumps of all kinds; a third of the hydraulic motors; 40 per cent. of the machines not expressly enumerated in the Customs tariff, and the bulk of the railway material.—*Reuter's Trade Service* (Madrid).

Price of Steel Plates.—North-East Coast steel manufacturers have reduced the price of steel ship plates by 70s. per ton to £10 10s., which compares with £20 10s. at the beginning of the year.—*The Times*.

Contractors and Building Work.—It would seem from the *American Electrical Review* that waiting on the building boom has become a chronic habit with many contractor-dealers on that side of the Atlantic, as well as with the building industry as a whole. Our contemporary adds that the time to wait has gone by, and it is now time for action. Chas. L. Benjamin advises the contractor-dealer to go after fixture renewal business, and he tells how to find it. "Watch for real estate news, and see every man who buys a home." The "Contractors' Column" which we have published in the ELECTRICAL REVIEW for many years past is designed to help the British electrical contractor to do this sort of thing. "There have been many thousands of houses changing hands during the last year," says our contemporary.

"When a man buys a house that has been built for 10 years or more there is probably no other fitting or equipment on the property so far out of date as the lighting fixtures. In most cases the new owner gives his property a thorough cleaning out and a new coat of paint and paper, and even those old fixtures look even less appropriate than before. Fixture design has been so changed during the last 10 years, as a result of the passing of gas illumination and the progress in lamp manufacture, that no family can move from a fairly modern apartment into a house with old-time fixtures without feeling a strong desire for a change."

Lord Weir on Measures for Reviving Employment.—Lord Weir has prepared a statement on "The Revival of Employment," and it has been circulated to members of the House of Lords by the Scottish Economic League. It was printed in full in *The Times* of Monday last. The writer says that the choice at the present time seems to be clearly a reversion to longer hours, reduced costs and a revival of employment, or adherence to the short week, vast unemployment, and an inability to support our industrial population. It is not possible for any Government or trade union or any body of employers to guarantee to a body of workers the maintenance of any specific standard of living. "The controlling factor in that is imposed by the workers and their conditions in other countries." Lord Weir makes the following recommendations:—

"(a) That we concentrate on reviving employment for workers in their own trades by initiating a demand for the products of these trades.

"(b) That we cause this demand by reduction in price and thereby quicken enterprise and give confidence to potential customers.

"(c) That we reduce the price by reduction in cost achieved by a revision of the working conditions in industry and deal with wage reductions as a last resort.

"(d) That, subject to the trade unions agreeing to this course of action, the Government pledge themselves to use their influence and power to facilitate the granting of credit and the raising of capital for approved schemes and undertakings at home and in our Dominions and Colonies."

Lord Weir delivered an important speech on the situation of the engineering trades and the seriousness of the outlook, at the luncheon held on Wednesday in connection with the conference of the British Engineers' Association.

Electricity Supply Legislation.—Mr. P. A. Harris, at a recent meeting of the London County Council asked whether the delay in the passing into law of the Electricity Bill No. 2 was preventing the operation of the Electricity Act, 1919. Mr. G. H. Hume replied in the affirmative. Communications had recently been addressed to the Prime Minister and the Ministry of Transport calling attention to the important bearing which electrical development had upon the industrial situation generally, with special reference to the unemployment question, and pressing strongly on the Government that the necessary supplementary legislation should be passed by Parliament this year.—*Morning Post*.

Electrical Importers' Criticisms of the Working of the Safeguarding of Industries Act.—The *Evening Standard*, last week, quoted a number of examples of the "widespread dissatisfaction" with the practical working of the Safeguarding of Industries Act. The writer mentions, among other matters, what he describes as the emphatic criticism given by the Secretary of the Electrical Importers' and Traders' Association, who produced a telegram from "a well-known London firm," reading as follows:—"Large consignment lamps awaits dispatch at Rotterdam. Suppliers will not ship as Customs are holding up this side under Key Industries. Position very serious." The Secretary of the E.I. & T.A. is credited with saying:—

"A clause in the Act forbids the free importation of arc lamp carbons, so Customs are actually stopping all pocket batteries, because they contain a piece of carbon 1½ inches long, and worth about 3d. This is useless for arc lamp carbon. Worse than this, we have an immense British manufacture of these pocket batteries, but this trade depends on these imported small carbon rods. To-day there are one million carbon rods held up at the docks, and our workmen are kicking their heels in idleness. All this because the arc-lamps clause of the Act defines arc-lamp carbons as necessary for searchlights. The Act never mentioned carbon rods. In any case, our trade is completely dislocated. Further, glass tubing is held up, although it is the raw material for British-made electric lamps. Electric lamps themselves are not included in the Bill, but Customs declare them taxable, inasmuch as they contain a small piece of tungsten wire, worth one penny. The strange thing is that many of these lamps, imported from Holland, are made of British tungsten wire. Customs actually forbid a British product to re-enter its own country!"

The Fancy Goods Section Vigilance Committee of the London Chamber of Commerce has sent a circular letter to Members of Parliament drawing attention to experience of the first two weeks' operations of the Act. The Act, it states, is being interpreted by the Board of Trade and administered by I.M. Customs in such a way that fancy goods and other traders have passed a resolution expressing "Grave concern at the very serious dislocation of business created by the Act, particularly on account of the extraordinarily wide interpretations which are being placed by the authorities on certain items referred to in the Key Industries Schedule," and also calling upon the Government to bring in an amending Act "suspending the operations of the Safeguarding of Industries Act in so far as it concerns commodities not produced in this country."

In the course of its communication the committee states:—
"Arc Lamp Carbons.—It is laid down by the department that under this clause the Customs are entitled to hold up consignments of pocket torch batteries because they contain a minute piece of carbon rod—in spite of the fact that these obviously are not going to be used in connection with arc lamp carbons at all, nor could be. In addition to this a consignment of 600,000 carbon rods wanted by a firm of British dry battery manufacturers has already been held up."

Electric Lamps.—In the Ways and Means debates, Ministers assured the House that half-watt lamps were not to be protected (see "Hansard," e.g., May 31st, col. 940). Yet now electric lamps are held up at all the ports, to be taxed as containing tungsten.

British Trade Mark Applications.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions associated with the electrical trades and industries:—

Titan. No. 409,558. Class 8. Storage batteries and parts thereof.—General Lead Batteries Co., Chapel Street, Newark, New Jersey, U.S.A. November 9th, 1920.

Aerazon. No. 413,561. Class 18. Electric radiators for heating.—Aerazon Fabrik G. & B. Sternberg, 75 Ritterstrasse, Berlin, Germany. March 18th, 1921.

Aerazon. No. 413,563. Class 18. Electric radiators for heating.—Aerazon Fabrik G. & B. Sternberg, 75, Ritterstrasse, Berlin, Germany. March 18th, 1921.

Bakelake. No. 416,148. Class 50. Electrical insulating materials in which synthetic resin is the predominating material. Attwater & Sons, Hopwood Street, Mills, Preston. June 15th, 1921.

A.F.A. No. 416,106. Class 8. Electric appliances.—Accumulatorenfabrik Gesellschaft, 3 Askanischer Platz, Berlin, S.W.11. June 13th, 1921.

Cambrite. No. 417,046. Class 8. Electric cables.—W. T. Glover & Co., Ltd., Trafford Park Works, Manchester. July 18th, 1921.

Galvos. No. 417,312. Class 11. An electrical foot battery for medical use.—Elsie Rickards, 1, Weltham Road, Handsworth, Birmingham. July 29th, 1921.

Durazo. No. 417,233. Class 13. Electric incandescent lamps, and their parts, fittings, lamp holders, &c.—Osram Gesellschaft, 1-14 Ehrenbreitstrasse, Berlin, O.17. January 23rd, 1921.

Lamp Trade in South America.—According to *Commerce Reports*, American-made electric lamps are meeting with keen competition in South American markets from the German article. Engineers returning from South America state that the quality of the latter is poor, and that a high percentage of those furnished under a recent Government contract gave unsatisfactory length of service.

British Parsimony.—In connection with our criticism of the Government's economical measures in dealing with the Department of Overseas Trade, we observe that the *Daily Telegraph* correspondent at Montreal reports that indignant protests were made at a meeting of the Canadian representatives of British firms exporting to Canada against the manner in which the British Government was curtailing the activities of the British Trade Commissioner's offices in Canada, which had led to the resignation of Captain Edwards, Senior Trade Commissioner, and to sharp reductions of the office staffs. "The meeting was as a farewell to Captain Edwards, when the British trade representatives' organisation resented the curtailment of the work, and declared they had protested to the British Department of Overseas Trade but without avail. A general opinion was expressed that the curtailment was a work of false economy at a time when British trade in Canada is fighting to hold its position against the aggressive campaign of America and other exporting countries. Captain Edwards relinquishes his work as Senior Trade Commissioner, and will shortly return to England."

An American Electrical Man's Impressions in Germany.—Mr. G. C. Du Bois, president of the Western Electric Co. (U.S.A.), recently returned to America after a six weeks' tour of Europe, during which he visited France, Switzerland, Austria, Hungary, Germany, Belgium, and England. The *Chicago Electrical Review* quotes him as saying that "Germany to-day is in a position to undersell the world on most manufactured articles. Industrially, Germany seems to be as efficient as ever. With wages low as measured in the currency of other countries, with highly competent workers eager to produce and with the reparation question in a more settled state, Germany is in a position to go ahead in building up her industries to handle export business. At present she can turn out many lines of manufactured articles to sell profitably for less money than any other country. As nearly as I can calculate it, the cost of German labour in the metal-working trades, measured in dollars, which is the correct way to measure it when it enters into competition with the United States for foreign trade, is about one-sixth of the cost of equivalent labour here. While in all probability this will lead to protective measures on the part of competing countries, such as taxes on German exports and other measures for the encouragement of home industries, yet wages in such countries are now decreasing, and this tendency is likely to continue if it effectively meets German competition in foreign trade."

Hispano-American Electric Co.—According to information received from various sources and published in *Commerce Reports*, the City Council of Buenos Aires has recently agreed to transfer to the Hispano-American Electric Co. the franchise for the supply of electric light and power in the city of Buenos Aires, in succession to the German Trans-Atlantic Electric Co., to which a 50-year franchise had been given in 1907. The Hispano-American Electric Co. was founded in 1920 by the Banks of Madrid, Barcelona, and Bilbao, and has a board of directors made up of some of the most influential men of Spain. The president of the board of directors is Don Claudio Lopez Bru, Marquis of Comillas, and the home offices are at Madrid. While the company is by all indications entirely Spanish in its composition, there have been comments in South America which would indicate a feeling in the Argentine that the German interests have not been entirely eliminated, although on the surface there appears to be no direct evidence to that effect. The various systems taken over by the Hispano-American Electric Co. consist of three plants in Buenos Aires, a light and power plant in Mendoza, lighting and street railway systems in Valparaiso, and an electric street-car line in Montevideo. The German company owned the lighting and railway system in Santiago, Chile, but this was taken over by the Government during the war; it is understood that the new company is making every effort to secure the return of this property as successors of the German corporation. As an indication of the magnitude of the Hispano-American holdings in the Argentine, Chile, and Uruguay, the total capacity of the plants in Buenos Aires alone is at present 125,190 kW, with 66,000 kW in process of installation or on order; the present annual output of the Buenos Aires plants is said to be over 300,000,000 kWh.

D.K. New Club House.—Lady Ellis, wife of the chairman of the English Electric Co., opened the club house equipped for the use of the girl employées of Messrs. Dick, Kerr & Co., on October 12th. Mr. Livingstone, the works manager, presided. The club, corresponding to that established two years ago at Ashton Park for the firm's male employées, as a memorial to comrades who died in the war, is situated in Strand Road. Its programme is to include debating and dramatic societies, classes for dancing, teaching of various crafts and hobbies, and occasional lectures.

Bosch Operations in the United States.—The Robert Bosch Magneto Co., Inc., has just been incorporated under the laws of the State of New York, with a capital of 250,000 dollars. The company claims to have a new Bosch invention for use in the cheaper class of automobiles—a combination battery and ignition system. It will also offer a new Bosch electric lighting system for high-priced cars.—*Reuter's Trade Service* (New York).

The German Cable Industry.—It is stated that negotiations in the German cable industry, to which we referred recently in the matter of insulated conductors, are now proceeding, and are expected to result in the adhesion of the outside makers to the Cable Syndicate.

French Electrical Companies.—A new company has lately been formed in Paris (12, Rue Cassini) with a capital of 2,000,000 fr., and the title *La Société Hydro-Electrique du Val Vernier*, to utilise a waterfall on the river Marne near Gudmont (Haute Marne) for the generation of electrical energy for lighting and power purposes.

LIGHTING AND POWER NOTES.

Belfast.—COMMITTEE TO REMAIN.—As an outcome of the special meeting of the City Council, at which the decision to cancel the appointment of Messrs. Preece, Cardew, and Rider as consultants was rescinded, the Electricity Committee, which had tendered its resignation, has agreed to continue in office.

Banff.—ELECTRICITY SUPPLY.—A report has been received upon the scheme to introduce electric light and power to Banff and Macduff. Mr. Bell, city electrical engineer, Aberdeen, is consulting engineer. The estimated outlay is £24,000, including suction gas plant for motive power. Overhead cables are to be used.

Bangor.—BULK SUPPLY.—The Electricity Commissioners have authorised the City electrical engineer to re-open negotiations with the North Wales Power Co., for the supply of electricity in bulk, as they do not consider the circumstances warrant the installation of a 100-kW Diesel set in the borough electricity works.

Barton-on-Humber.—LEGAL PROCEEDINGS.—The Urban Council has been served with a writ by the Barton Electric Supply Co. consequent upon a refusal to enter into negotiations for an increase in the contract price for street lighting. At a specially convened meeting of the Council it was decided to defend the case.—*Yorkshire Post*.

Bedford.—YEAR'S WORKING.—The accounts of the Electricity Department (engineer: Mr. R. W. Phillips) for the year ended March 31st last show a total revenue of £78,705, as compared with £61,311 in 1919-20. Working expenses amounted to £54,572, as against £43,697, leaving a gross profit of £24,133 (£17,614). The net profit, after payment of all capital charges was £2,139, a slight decline from the previous year's figure—£2,628.

Birmingham.—UNEMPLOYMENT RELIEF.—Among the unemployment relief measures being taken by the City Council is an instruction to the Electric Supply Committee to commence work on a number of extensions.

NEW DESTROYER WORKS.—The Salvage Committee of the Corporation proposes to construct new destroyer works at Witton. A garage for electric vehicles will be installed at the works, and energy is to be generated by means of steam obtained from the burning of refuse. The proposed destroyer will consist of eight cells capable of dealing with 38,000 tons of refuse per annum. The estimated cost is £100,000.

EFFECT OF THE COAL STRIKE.—The General Purposes Committee of the City Council has issued a report on the steps taken during the coal strike to ensure fuel and light control. The effect on the finances of the Electricity Supply Department was to involve it in a loss of £43,100. The subsequent and continued effect in loss of business and disorganisation of working it is impossible to assess. The estimated reduction in the sale of electricity during the three months is put at 6.8 million units, of a gross selling value of £59,000, and deducting the cost of producing this extra quantity the loss is £32,400. Extra fuel and labour costs are estimated at £10,700, a total of £43,100.

Bognor.—INCREASED CHARGES.—The Electricity Supply Co. has received sanction from the Ministry of Transport to increase its maximum charge for electricity from 8d. to 1s. per unit from October 12th, with a minimum charge equivalent to 15 units per quarter for the winter months and 10 units per quarter for the summer months.

Continental.—RUSSIA.—A Moscow message says that in order to provide a supply of electricity for all the power consumers in the port of Petrograd, a second electrical station will be erected there.

The *Pravda* states that before the war there were 250 electricity works in Russia; now there are 660, of which 189 were constructed during the revolution, and 100 stations in 1920. At present, it is said, stations are being built or extended in 66 towns and 66 villages. Forty-four factories are being electrified, and the systems of electrical distribution are being extended in three Government towns, two districts, and 31 villages.

In the Donetz Basin 37 old stations have been reconstituted into 14 stations, to supply power to the mines, effecting an economy of 320,000 tons of fuel per annum; the superfluous equipment has been removed to other places.

In accordance with the unified plan of electrifying the country the Kasbir station for the electrification of the Moscow Government, "the most majestic in Europe," is being built; also the Dnieper of 800,000 kW at the Dnieper weirs; the Shatturskaya; the Utkin factory, of Petrograd; the Kisiloff, in the Ural; the Ivanovo-Vosnesenskaya; the Nishigorod; the Tula; the Volchoff; the Tchelyabinsk, and the Schernskaya stations in the Donetz Basin, all making a total of 1,200,000 kilowatts. How much has actually been accomplished of this grandiose scheme is not known.

JUTLAND.—The Commission appointed in November last to study the question of utilising the water power of Jutland for the production of electricity has just handed in its report. The Commission examined 16 schemes in connection with Jutland water power, and recommends, subject to further comprehensive investigations on the spot, the establishment of seven power stations; these which would be at Vestbirk, Holstebro, Bur i Ahlersgaard, Skjern, Karlsgaarde, and Ansaager, would cost something like 30 million kroner. The Commission considers that these plants could be established with reasonable hopes of profitable results, especially if wages fall.—*Reuter's Trade Service* (Copenhagen).

AUSTRIA.—A start has been made with the great Viennese hydro-electric scheme. The Town Council of Vienna, in conjunction with a Vienna Bank Trust, has formed a "water-power works share company" with a share capital of 500,000,000 kronen, half of which the Town Council and the banks will underwrite, some 100,000,000 kronen being subscribed. The company will raise a building capital of ten millions in special bonds, 3.6 milliards of which will be spent in the first constructive period from November this year to June, 1925, in building the hydro-electric station on the Ybbs, with complementary works. The programme of the second building period is only as yet drafted in the rough, but for the station on the Danube which the Vienna Wasserkraftwerke contemplates undertaking, the raising of 6.4 milliard kronen by the issue of bonds is foreseen. By the carrying out of these plans, some 100,000 h.p. is expected to be placed at the disposal of the Viennese Corporation by the end of 1935 at the latest. While the city participates to the extent of 50 per cent. in the capital of the company and exercises a proportionate influence, it is solely and wholly responsible for the interest on and the redemption of the bonds, as it stands to the company in the relation of its chief consumer. To hasten the works a premium of 12 kronen will be paid for every day saved and every kilowatt available before June 30th, 1928. The existing generating station of the Corporation might produce yearly, with the help of the peat station, 320,000,000 kWh; its actual yield is now 280,000,000 kWh. By the completion of the first part of the building programme, the Corporation works could raise its output by another 100,000,000 kWh, or fully one-third more.

FINLAND.—As a result of a recommendation made by the State Waterfall Committee, the Council of State decided last May to expropriate the Linnankoski and other lesser falls situated in the Vuoksen for the purpose of a projected State hydro-electric works at Imatra, in connection with the possible conversion of the Finnish railways to electric traction. Appeals made by the Elektro-metallurgical Co. of Ruokolska and the Petrograd Electric Power Transmission Co. for the revocation of the orders for expropriation have been dismissed.

Cookham.—INQUIRY.—On October 11th and 12th Col. T. Ekin held an inquiry at Cookham into two applications for Orders for supplying electricity to Cookham and district. The first application was by the Bourne End Electricity Corporation, Ltd., which has an electricity works at Bourne End, and desires to extend its cables to Cookham, through Cookham Dean and Cookham Rise to Marlow, as well as Little Marlow to Woodburn. The second application was made by Mr. George Young and three other promoters of a scheme to supply Cookham village and Cookham Dean and Cookham Rise from turbines driven by Thames water power at Cookham Mill.

Dorchester.—PURCHASE OF UNDERTAKING.—No opposition being apparent to the taking over of the local electricity supply undertaking by the Council, it has been decided to obtain the necessary Order for the purchase.

Edinburgh.—AREA OF SUPPLY.—The East Lothian County Council recently considered the scheme proposed by Edinburgh Corporation for the extension of the supply from the new station at Portobello. A memorandum, prepared by the County Clerk, pointed out that the ten miles radius agreed to by the Corporation would, roughly speaking, embrace the parishes of Prestonpans, Tranent, Penciland, and Ormiston, and perhaps a part of Gladsmuir Parish. It would not seem to be reasonable to allow Edinburgh to take out the best part of the county area without regard to the other part, making it probably impossible in the future to provide for the remainder efficiently and economically. It was understood that the Corporation had under consideration a somewhat wider radius than originally proposed—between 10 and 25 miles. It was unanimously agreed not to oppose the order if Edinburgh was willing to extend the radius of supply to 20 miles.—*Glasgow Herald*.

Electricity Districts.—LOCAL INQUIRIES.—The Electricity Commissioners give notice that they intend to hold a local inquiry in the Council Chamber at the Council House, Birmingham, on Tuesday, November 15th, at 10.30 a.m., and on the following days, with reference to the proposed South-West Midlands Electricity District,* and to consider schemes in connection therewith that have been submitted by (a) the Birmingham Corporation jointly with the Shropshire, Worcestershire & Staffordshire Electric Power Co., and (b) the Corporation of Worcester.

A local inquiry will also be held at the Town Hall, Sheffield, on Tuesday, November 29th, at 10.30 a.m., and on following days, with reference to the North-East Midlands Electricity District,* and the scheme which has been submitted by the Corporation of Sheffield for the formation of a Joint Electricity Authority for the area.

Elgin.—WATER-POWER SCHEMES.—At a recent meeting of the Town Council a committee was appointed to examine and report upon a scheme formulated by the Banff County Council to supply electricity to Morayshire and Banffshire, utilising the power of the river Spey. It was stated that power could be supplied in bulk at 1d. per kWh. The Council had already been invited to participate in a hydro-electric scheme drawn up by the Inverness-shire Council.

Glasgow.—ELECTRICITY CHARGES.—The Corporation is introducing "all electric" houses into its housing schemes as an experiment, and the Electricity Committee has recommended that the following charges, which are based on a "two-part" tariff system, be made, one charge being a weekly standing charge according to the size of the house, and the other charge being the works cost at Dalmarloch of the energy used: 5 apartments, 2s. per week; 4 apartments, 1s. 9d.; 3 apartments, 1s. 6d.; plus ½d. per unit used in each case.

Gargrave (Yorkshire).—ELECTRICITY SUPPLY.—A public meeting was held last week to receive a report on a proposed scheme of electricity supply for the district. Mr. Banks, electrical expert, detailed the scheme, which was to form a Gargrave Electricity Supply Co., to supply energy at 9d. per unit, as compared with the present Keighley (15 miles away) price of 8d. per unit; or at flat rates for varying number of lights. At the rates proposed the public would save about 50 per cent. as against the present gas supply, and the Council believed there would be a saving in street lighting, which the company would undertake, supplying energy and keeping the lamps in order, at £2 per lamp per year. The meeting approved the scheme, and a committee was appointed to work in conjunction with the company.

Hemel Hempstead.—ELECTRICITY SUPPLY.—The Town Council has decided to approach the Watford Urban District Council as to the terms on which it would be prepared to supply electricity to the borough.

Holmfrith.—ELECTRICITY SUPPLY EXTENSIONS.—The Urban District Council has agreed to a scheme of electricity extensions estimated to cost from £400 to £500.

Holsworthy.—STREET LIGHTING.—The Urban Council recently proposed to substitute electric for gas lighting, and applied to the Holsworthy Gas & Electric Supply Co., Ltd., for its terms. The company stated that its plant was already fully loaded, and additions could not be entertained. The Council, refusing to pay the high price for gas lighting, has consequently abandoned public lighting for the coming winter.

Irvestown (Co. Fermanagh).—STREET LIGHTING.—A Local Government Board inquiry has been held into an application for an installation of public electric lighting.

Kingstown (Co. Dublin).—STREET LIGHTING.—The Urban Council has appointed a committee to consider the introduction of public electric lighting.

Lancaster.—ELECTRICITY DISTRICT.—The Corporation is opposing the scheme for the formation of an area embracing Barrow, Millom, Grasmere, Kendal, Bootle, Ulverston, Carnforth, Morecambe, Lancaster, and Kirkby Lonsdale, with Barrow as the generating station site. It is considered that the proposed area is too scattered, and, having in mind the cost involved in transmission, distribution, &c., it is probable that an alternative scheme, with Lancaster as a centre, will be submitted.

Llandrindod Wells.—INCREASED CHARGES.—The Electric Light & Power Co., Ltd., has received sanction to increase its charge for electricity to a maximum of 1s. 2d. per unit, with a minimum for the winter quarter of 17s. 6d. for 15 units or less, for a period of five years.

PROPOSED PURCHASE.—The Urban District Council has under consideration a proposal for the purchase of the undertaking provided terms can be arranged.

Llandudno.—BULK SUPPLY.—The Town Council has approved the draft agreement with the North Wales Power and Traction Co., under which the company will supply electricity in bulk to the Council at 1½d. per unit, and decided to apply for the Electricity Commissioners' sanction to borrow £15,000, which the Council will lend to the Power Company

for the construction of a transmission line from the company's sub-station near Colwyn Bay to the Council's sub-station at Llandudno. The agreement is for twenty-five years, and the erection of the overhead transmission line will be started as soon as possible. *Liverpool Daily Post.*

Llanfairfechan.—ELECTRICITY SUPPLY.—The Urban District Council has decided to proceed with an electric lighting scheme at a cost of £10,000. Negotiations have been in progress with the North Wales Power Co. for the supply of electricity in bulk.

Litherland.—SUPPLY FROM BOOTLE.—The Electricity Commissioners have written to the Urban Council with reference to the proposed transfer of the Litherland Electric Lighting Order to the Bootle Corporation. The town clerk of Bootle has been instructed to proceed with the transfer of the Order. Litherland has asked the Bootle Corporation for terms and conditions for the use of electricity for street lighting, and the Corporation has offered to supply electricity at one-third of the rate at which private lighting is supplied, such rate being not less than one penny per unit, subject to the Litherland Council's paying all charges for connections, equipment and maintenance. Work is now proceeding on the laying of mains in the area, and the Bootle electrical engineer reports that the only satisfactory way to provide the capital required for service connections will be for consumers requiring the supply to pay the cost of them.

Liverpool.—PIER LIGHTING.—The Liverpool engineer has reported to the Tramways and Electricity Committee that the introduction of electric lighting at the Pier Head has proved eminently satisfactory, the lamps giving 50,000 candle power at a cost of £850 per annum.

LOAN SANCTIONED.—The Electricity Commissioners have sanctioned a loan of £25,290 for mains, sub-station, &c., for the housing estates.

Long Ashton.—ELECTRICITY CHARGES.—The North Somerset Electric Supply Co., Ltd., has fixed the maximum charge for electricity for lighting purposes at 10d. per unit from October 1st.

London.—FULHAM.—A reduction in the brilliancy of the electric lighting on October 12th was ascribed by the engineer to a reduction in steam power owing to a condenser having insufficient water. This was said to be due to the prolonged drought which caused the Thames, from which the water is taken, to fall to an extremely low level at ebb tide.

Londonderry.—ELECTRICITY SUPPLY DISPUTE.—The Lighting Committee last week decided to cut off within seven days the electricity supply to the North of Ireland Shipyard Co. and its yard, if an account for £3,264 were not paid. It was stated that the matter had been under discussion for some time, and it was essential that the account should be paid forthwith. The company contended that it had a grievance in respect of delay with regard to a promised extension and its completion, and that it, therefore, had a counterclaim. The question of what further action should be taken was allowed to stand.

Middlesbrough.—LOAN SANCTIONED.—The Corporation has received sanction to borrow £54,463 in respect of mains, converting plant, gas-engine sets, and building work in connection with the electricity undertaking. An application for sanction to borrow £13,875 for prospective expenditure on mains and services is still under consideration.

Newtown (Mont.).—ELECTRICITY SUPPLY.—The Urban Council has appointed a committee to consider a proposal to secure a pumping station and machinery from the Shropshire Union Railway & Canal Co., for the purpose of generating electricity for the town.

New Zealand.—THE ARAPUNI SCHEME.—The Arapuni hydro-electric scheme for the initial utilisation of 50,000 h.p., this being ultimately raised to 162,000 h.p., has been finally approved. It is estimated that the scheme will be completed in five years. The total cost is put at £1,879,000, divided among the following items:—Headworks, £1,305,000; transmission, £204,000; and sub-stations, £280,000. Work cannot be commenced until the financial conditions are more favourable, but it is anticipated that the delay will not be a long one. When started full energy will be concentrated on the scheme, other smaller schemes being subordinated to it.

Norden.—SCHEME POSTPONED.—The Urban District Council has adjourned consideration of schemes for the supply of electricity in the Council's area. The proposals provide for the supply by the Rochdale Corporation at a price five per cent. above that charged in the borough, and also for the application for a provisional order and the distribution of electricity by the Council itself.

Northwood.—SYSTEM OF SUPPLY.—The Electric Light and Power Co., Ltd., has now changed over from d.c. to a.c., the systems of supply being as follows: Northwood 240 and 480 V. 50 periods, single-phase. Eastcote 240 and 415 V. 50 periods, 3-phase. The Ruislip supply is to remain as heretofore, viz., 240 and 415 V. 33 periods, 3-phase.

Portsmouth.—**REDUCED CHARGES.**—The Town Council has decided to reduce the price of electricity for lighting from 8d. to 7½d. per unit, as from the December meter readings.

Radcliffe.—**ELECTRICITY IN RUEL.**—The Council is joining the South-East Lancashire Board for the generating of electricity in bulk, and a step in the direction of communal interests has already been taken by the local electricity station being linked up with the Lancashire Power Co.'s works at Outwood and with Bury. The Radcliffe station will probably be used only as a distributing centre.

Rickmansworth.—**ELECTRICITY SUPPLY.**—The Urban Council has appointed a committee to consider the question of an electricity supply for the district.

Seaford.—**INCREASED CHARGES.**—The Urban Council has increased the price of electricity by 2 per cent., as from October 1st.

South Africa.—**JOHANNESBURG.**—Mr. Bernard Price, chief engineer to the Victoria Falls and Transvaal Power Co., has replied to the contention that it would take 18 months to obtain an extraneous supply to supplement the electricity generated by the municipal power station, and that it would cost £60,000 for cables, besides transformers. Mr. Price states that adequate relief could be afforded without purchasing additional cables, transformers or other apparatus.

By alterations of the routes of the existing cables and rearranging the transformers already possessed, he contends that an additional supply could be made available in five months, more cheaply than by any other alternative.—*Financial Times*.

Truro.—**ELECTRICITY SUPPLY.**—The Town Council has decided to apply for an order to carry out a proposed electric lighting scheme as public work for the unemployed.

TRAMWAY AND RAILWAY NOTES.

Australia.—**N.S.W.**—The accounts of the State tramways for the year ended June 30th, 1921, show a total revenue of £3,471,738, as compared with £2,881,797 in the previous year. Working expenses totalled £2,943,252 (£2,486,121), leaving a gross profit of £528,486 (£395,676). After deduction of interest and other capital charges, there was a net surplus of £106,672.

Birmingham.—**EFFECT OF THE COAL STRIKE.**—The Tramways Committee states that at the commencement of the coal strike the tramway receipts immediately declined to the extent of about £1,000 per week. From May 3rd the services were cut down 25 per cent., with a further consequent decline in the receipts of about £1,000 weekly. From May 22nd to June 29th the services were entirely suspended. Since the termination of the strike the receipts have continued to decline, and are less than the corresponding returns last year by about £5,000 per week. It is estimated that the total loss to the department is at least £70,000.

Bradford.—**TRAMWAYMEN'S WAGES.**—Following a recent decision of the Tramways Committee to reduce wages in the parcels department, which is working at a heavy loss, the local branch of the United Vehicle Workers' Union has entered a protest, and contends that the wages are fixed by national agreement.

Liverpool.—**EFFECT OF FARE INCREASES.**—At Friday's (October 14th) meeting of the Tramways and Electricity Committee the chairman reported on the effect of the establishment of a twopenny minimum fare on the tramways. During the first nine months of the year there had been an increase in revenue of £52,027, but a decrease of nearly 38,000 passengers. The totals were: Receipts, £1,125,522, and passengers 128,893,061. The present system of fares had justified its introduction, and the receipts during the last three months not only covered all operating costs, interest, and sinking fund contributions, but showed a sufficient surplus to pay for renewals. Sufficient experience had been gained with sleeper tracks to indicate that they showed a clear economy both in capital cost and yearly maintenance and upkeep, at the same time providing very much more comfortable riding for passengers. The cost of materials showed reductions, and rails, which last year cost £23 per ton, could now be obtained at £16 per ton.

Rothsay.—**SUNDAY SERVICE.**—The Ministry of Transport has written the Town Council stating that complaints have been received that the absence of Sunday cars to Etrick Bay is injurious to certain sections of the working classes, and has asked the Council to reconsider the question.

Sunderland.—**UNFAIR COMPETITION.**—The Town Council has passed the following resolution:—"That in the opinion of this Council the competition of motor vehicles with tramways upon inequitable terms relating to (1) local taxation, (2) road maintenance charges, (3) statutory fares for ordinary passengers and workmen, and (4) regularity of service, will result in further increases in tramway costs and consequential fares. And that representations be made to the Prime Minister, the Minister of Transport, and the M.P.'s for the

borough urging the statutory regulation of such competition in the public interest." An attempt to defer consideration of the matter was defeated.

Swansea.—**NEW CARS PURCHASED.**—The Tramways Committee has purchased seven new cars at a cost of £3,045. It is intended to run the smaller cars on the trailer system to cope with the traffic on certain routes.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—**LONG-RANGE WIRELESS TELEGRAPHY.**—As soon as an opportunity occurs Mr. Hughes will submit to Parliament proposals for Australia to participate in a scheme of direct wireless communication with Great Britain. The *Daily Telegraph* reports that the Cabinet is not unanimous as to the wisdom of spending a quarter of a million when there is a general demand for economy, but the matter will have to be debated in Parliament.

Denmark.—The State network of telegraph and telephone lines in 1919-1920 had an extent of 2,843.2 km. of lines and 63,633.4 km. of wire, with 624 telegraph offices, 83 of which were also telephone offices; 161 telephone offices and 128 wireless stations. There were 733 telegraphic apparatus working, and 4,729 telephone posts, 23 of which were of the Creed pattern.

Mauritius.—**TELEPHONE IMPROVEMENTS.**—The telephone system, which for a quarter of a century has been run by a single company, is about to be improved. The Chamber of Commerce (in connection with a letter from the Government which asked the Chamber's views regarding certain concessions applied for by the company) has appointed a committee to consider the subject. Important improvements have already been effected by increasing the number of exchanges, but it is now proposed to effect further improvements by affording facilities for connecting private residences in the remote parts of the island with the Port Louis exchange. This will provide a market for a certain quantity of telephone material.—*The Times Trade Supplement*.

Spain.—**IMPROVED WIRELESS SERVICE.**—In a few weeks' time a noteworthy improvement will be effected in the wireless telegraph service between Madrid and London. At present it is possible to exchange traffic at certain hours, but delays and irregularities occur. Soon, thanks to new apparatus and a redistribution of the traffic, a continuous exchange of messages between Madrid and London will be inaugurated. For this purpose the station at Aranjuez, near Madrid, which was overloaded, will be set aside for traffic with England and France, while the station at Llobregat, near Barcelona, duly reinforced, will be the centre of reception and distribution of messages from and for Italy, Germany, and Austria, and the new Central European States. An auxiliary station at Madrid, for British traffic, already inaugurated, and one to be inaugurated eventually at Santander, for French traffic, will complete the new system.—*The Times Trade Supplement*.

The French Cable Co. and Wireless Interests.—M. Ernest May, chairman of the Compagnie Française des Câbles Télégraphiques, addressing the shareholders at the recent annual meeting, stated that, as was known, the company had subscribed for 20,000 shares in the Compagnie Générale de Télégraphie Sans Fil. When the directors became interested in the latter they thought that it would carry on wireless telegraphy between France and the countries served by the cables of the Compagnie Française, and that it perhaps would compete with the cables. During the course of the war the Compagnie Française asked for authority to establish installations of wireless telegraphy, but the application was refused. The directors, however, obtained an interest of 20 per cent. in the new company, which for the rest was formed under the best auspices. The French Telegraph Administration gave authority to the Compagnie Générale de Télégraphie Sans Fil to establish a station which would in particular communicate with transatlantic countries—those which the Compagnie Française serves with its cables—while at the same time imposing upon the former the obligation to constitute a special company for the working of this station. Consequently, in order to participate appropriately in the matter which interested them—that is to say, communication with the North of America and the West Indies—the directors of the cable company were naturally induced to subscribe also 20 per cent. of the capital in the new company. Down to the present time, the first augmentation in the capital of the cable company from 13,000,000 to 16,000,000 fr. and the reserves which had been formed had permitted of the subscription of the shares in the Compagnie Générale, and had also enabled the company to pay the first instalments on the shares of a 20 per cent. participation in the Société Radio-France, which would work the station. But after paying out the dividends to the shareholders in the cable company for the past year, the remaining funds at the disposal of the company would probably not suffice to complete the payments for the shares in the Radio-France. It was, therefore, proposed to convene a special meeting to authorise the direc-

tors to raise additional capital according to needs and up to an amount of 8,000,000 fr., and the conditions of the augmentation would be settled in consultation with the company's bankers.

United States.—THE WASHINGTON CONFERENCE.—The Government has added wireless and cable communications in the Pacific to the list of topics it recently suggested to the Powers for discussion at the forthcoming conference.—*Reuter* (Washington).

Wireless Telegraphy.—CO-OPERATION.—As the result of a wireless telegraph conference which has been sitting in Paris for several weeks and has been attended by representatives of the principal companies of the world, an agreement has been signed which, the *Daily Telegraph* hopes, will materially facilitate operations. The main object which the conference had before it was to organise international wireless telegraphy in accordance with the scientific progress achieved by all the companies. A feature of the agreement and a recognised advantage will be the rational allotment of the length of waves, so as to prevent the disturbance of long-distance communications. In order to organise these communications the discoveries made in the laboratories of the companies will be used in common, and it is confidently expected that this co-operation will ensure an improved commercial service and a quicker Press service at reduced prices. Mr. Owen D. Young, president of the Radio Corporation of America, presided at the conference, the French representatives being M. Gerardeau and Commandant Garnier, of the Compagnie Générale de Télégraphie Sans Fil and of the Compagnie Radio-France. These companies are at present constructing a powerful station at Sainte Assise, which, it is expected, will be able to reach any point in the world.

The *Daily Chronicle* announces that the Gesellschaft fur Drahtlose Telegraphie, of Germany, and Marconi's Wireless Telegraph Co., Ltd., are also concerned in the agreement.

PHOTOGRAPHIC RECEPTION.—Lecturing on wireless telephony to members of the Dublin Rotary Club on October 17th, Mr. James Smyth, of the General Post Office, said that a Dublin man named McNamara had perfected a machine which could photograph signals and thus obviate the necessity for "listening in."—*Daily Mail*.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Argentina.—November. State Railways. One year's supply of railway signal material, including telephone and telegraph materials, &c.*

Aylesbury.—November 11th. Town Council. Electric motors and pumps. (See this issue.)

Australia.—MELBOURNE.—Victorian Government Railways. November 9th. Armature banding machine with electric motor and starting gear (Cont. 34,378).

November 2nd. Electric storage battery complete for automatic telephone exchange (Cont. 34,229).*

January 4th. 150 electric train stops operated by a single-phase induction motor. One set of electrical pyrometer equipment for measuring temperatures of from 350 to 2,000 degrees Fahrenheit.—*Reuter's Trade Service* (Melbourne).

NEWCASTLE (N.S.W.).—December 22nd. City Council. One 25-kW motor-generator set. Electrical engineer and manager, Watt Street, Newcastle (N.S.W.).

Cwm (Mon.).—October 31st. Cwm and Tallistown Institute. Renewing the electric lighting installation. The secretary.

Edinburgh.—District Board of Control. Repairs and renewals involving electric fittings at Bangour Village Asylum after military occupation. Mr. E. T. French, clerk, Edinburgh District Board of Control, Castle Terrace, Edinburgh.

Greece.—ATHENS. November 14th. Telephone installation at Athens, C.B. type, capacity 5,000 local lines, 40 inter-urban lines, and at least 50 special lines connecting Athens with the Piræus.*

India.—CALCUTTA.—November 9th. Calcutta Electric Supply Corporation, Ltd. One 15,000-kW turbo-alternator and condensing plant. Two water-tube boilers with an evaporation of 60,000 lb. per hour. (October 7th.)

November 9th. Calcutta Electric Supply Corporation, Ltd. Paper-insulated, lead-covered cables, bitumen-sheathed cables, v.i.r. cables, and joint boxes (Spec. 72). (See this issue.)

London.—L.C.C.—October 24th. Electric goods lift (capacity 30 cwt.) at the Stamford Hill Stores Depot. (October 7th.)

H.M. Office of Works. October 24th. Electric lamps. (See this issue.)

November 28th. Water-tube boilers, super-heaters and economisers, &c. (See this issue.)

New Zealand.—WELLINGTON.—November 21st. Post and Telegraph Department. 750 red and 750 white switchboard cords, 3 conductor. (Spec. No. 87).*

Portsmouth.—November 18th. Corporation. Four centrifugal pumps, direct coupled to 3-phase, a.c. motors, sludge pump and motor, and various small motors, switchboard cables, lighting, and other apparatus. (See this issue.)

South Africa.—JOHANNESBURG.—November 7th. Rand Water Board. Two 350-kW steam-driven electrical generating sets, complete with switchboards and all accessories.*

HUMANSDORP, Cape Province. November 30th. Corporation. One water turbine and dynamo, switchboard with connections, battery of accumulators, and accessories, supply main and public lighting, aerial distributing lines, street lamps, fittings and accessories, section boxes, service cut-outs, meters, &c., ferro-concrete pipe line, reinforced concrete tank, buildings, and foundations. Forms, &c. (63s.) from the town clerk, Humansdorp, Cape Province.

DURBAN.—Municipal Council. 250 single-pole, or 125 double-pole ironclad fuses, 25 amperes, 200 volts; 500 combined double-pole enclosed switches and fuses, 35 amperes, 200 volts, suitable for house service use; 144 single-pole switch fuses, unmounted, 100 amperes, 200 volts; 50 single-pole switch fuses, of the "Brush" or other similar type, 50 amperes, 2,750 volts, suitable for sub-station use.*

One 3-phase transformer, 25 kVA capacity, 50 cycles.*

Venezuela.—His Excellency Dr. P. C. Dominici, Venezuelan Minister in London (7, Richmond Mansions, Earl's Court, S.W.), has been instructed by his Government to obtain particulars of the price of three portable receiving sets for wireless telephony.

Warrington.—November 15th. Electricity and Tramways Committee. Motors and transformers. (See this issue.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CLOSED.

Australia.—According to an announcement issued by the Colonial Office the Government of New South Wales has approved the placing with a Lancashire firm of an order (£50,000) for the boilers required to equip the power station of Newcastle, New South Wales.

London.—ST. PANCRAS.—Highways, Sewers and Public Works Committee.

Spare battery equipment for electric vehicle used for house refuse collecting, £347.—Messrs & Co. Ltd., recommended.

L.C.C.—Stores and Contracts Committee. Tender accepted during the three months ended September 30th:—

Electric traction lamps for the Tramways Department (schedule 170)—Stella Lamp Co., Ltd.

Portsmouth.—Town Council. Accepted:—

Steel work for the boiler house at the electric light station at £525.—Pierson & Co.

Sunderland.—Electricity Committee. Accepted:—

Five single-core 1 p. cables.—Pirelli-General Cable Works, Ltd.
2 and 3-core 1 p. cable.—British Insulated & Helsby Cables, Ltd.
Compound steel girders for overhead coal gantry.—Dorman, Lang & Co., Ltd.

The Town Council has rescinded the resolution instructing the Tramways Committee to purchase British instead of foreign-made rails. The whole matter is to be reinvestigated by the Committee.

St. Annes-on-Sea.—Electricity Department.

Four miles (approximately) armoured cable, Siemens Bros. & Co., Ltd.

Sheffield.—The lowest tenders for 400 steel tramcar tires for the Corporation were from Continental firms, but the Tramways Committee has accepted the lowest Sheffield tender of £3 12s. per tire, which will mean an expenditure of £475 more on the contract than the acceptance of the Continental tender would have involved. The Continental quotations were £2 8s. 3d. to £2 15s. 6d. per tire, and the Sheffield quotations £3 12s. to £5 1s. per tire.—*Financial Times*.

Royal Air Force.—RECRUITS WANTED.—The Inspector of Recruiting informs us that there are still a large number of vacancies in this arm of the Service for qualified electrical fitters, power station engineers, stationary engine drivers, shift engineers, and dynamo and switchboard attendants. This appears to be a good opportunity for those who are at present seeking employment, and all particulars will be forwarded by return of post to anyone interested on application to the Inspector of Recruiting, Royal Air Force, 4, Henrietta Street, Covent Garden, W.C. 2. In addition to the above there are a few vacancies for semi-skilled electricians who have a chance to complete their training in the Royal Air Force, and by joining the Electrical Services Works Company recruits are only required to serve for four years.

FORTHCOMING EVENTS.

- Electricity Supply Commercial Association (Greater London Division).—**Friday, October 21st. At Avenue House, 100, Fleet Street, E.C.4. At 7.45 p.m. Dinner. Admission, 10s. 6d. Refreshment, 5s. 6d.
- Birmingham and District Electric Club.—**Saturday, October 22nd. At the Victoria Restaurant, 10, Victoria Road, S.W. At 8 p.m. Dinner. Admission, 10s. 6d. Refreshment, 5s. 6d.
- Institution of Electrical Engineers.—**Thursday, November 3rd. At the Institution, Victoria Embankment. At 6 p.m. Presidential address, by Mr. J. E. Harrison.
- (North-Eastern Centre).—**Monday, October 24th. At the Armstrong College, Newcastle-on-Tyne. At 7.45 p.m. Presidential address by the Chairman, Prof. W. M. Lockington on "Engineering Application of Electricity to France."
- (South Midland Centre, Students' Section).—**Tuesday, October 25th. At the University, Birmingham. At 7.30 p.m. Chairman's (Mr. E. Gall) address and paper on "Singaporean Conductor Motors" by Mr. S. Elgar.
- Northampton Engineering College Engineering Society.—**Wednesday, October 26th. At the Northampton Institute (Room 102). At 5.30 p.m. Paper on "Insulators," by Mr. Venables.
- Electrical Trades' Benevolent Institution.—**Wednesday, October 26th. At the Trocadero Restaurant. At 7.30 p.m. Annual Festival Dinner.
- Institution of Mechanical Engineers.—**Friday, October 26th. Discussion on the Eleventh Alloys Report.
- (Graduates' Section).—**Monday, October 24th. At 7 p.m. Paper on "The Efficient Utilisation of Steam and Electric Power in Factories," by Mr. R. E. Light.
- Electrical Power Engineers' Association (Southern Division).—**Friday, October 25th. At the Grosvenor Hotel, Westminster, S.W. At 7 p.m. Lecture on "Notes on Surface Condensing Plant," by Mr. J. E. Johnson.
- Edinburgh Electrical Society.—**Friday, October 28th. At the Philosophical Institute. At 8 p.m. Questions and Answers night.
- Junior Institution of Engineers.—**Friday, October 28th. Lecture, "Water Gas Manufacture," by Mr. F. C. Surber.
- Physical Society of London.—**Friday, October 28th. At the Imperial College of Science, South Kensington, S.W. At 8 p.m. Ordinary scientific meeting.

NOTES.

Educational.—FRANCE.—The authorities of Bordeaux University, anxious to keep abreast of modern requirements, some months ago instituted a special course of instruction in wireless telegraphy, the curriculum followed being the instruction which is necessary for qualification as a wireless telegraphist in the mercantile marine. The first certificates qualifying their holders as electricians and wireless operators have just been distributed, and when the classes are resumed next month a more advanced course will also be given for those desirous of becoming engineers. The wireless operator's certificate automatically qualifies its holder (always, of course, subject to medical examination) for incorporation in the wireless telegraph section of the Army, or a temporary certificate of operation in the Navy and the right of admittance to the naval school at Toulon. The proximity of Bordeaux to the most powerful of the French wireless stations, at la Croix-d'Hins, makes possible practical demonstrations on a large scale.—*Reuter's Trade Service* (Paris).

The late Mr. Frederick Gustav Byng, of 11, Montagu Square, W., who died in July at the age of 37 years, leaving £87,872, left £2,000 to the Provost and Scholars of Oriel College, Oxford, for a scholarship for pupils at Harrow School, and £1,500 for such charitable institutions or objects as the trustees might select.

Appointments Vacant.—Assistant draughtsman (Rs. 350 per month) for the East Indian Railway Co.; junior mains assistant for the Rochdale Corporation electricity works; two or three plumber-jointers for the Manchester Corporation electricity department. (See our advertisement columns.)

Service Notes.—WIRELESS MEN FOR AIRCRAFT.—Volunteers are required from the wireless branch of the Navy for duty as operators and also as assistants to naval gunnery observer officers in aeroplanes working with the Fleet. Accepted candidates will be required to undergo a course of training in aerial gunnery. Extra pay will be paid to selected ratings at 1s. a day during preliminary training, and thereafter at 2s. a day continuously while detailed for aerial duties, says *The Times*.

Capt. R. B. T. PINKNEY has resigned his commission in the Tyne Electrical Engineers, which he held from 1915. He was promoted captain in 1916. Warrant Electrician F. GIBBETTS has been posted to the battleship *Emperor of India* on recommissioning.

Report of the Electricity Commissioners.—The first annual report of the Electricity Commissioners was issued on Wednesday last. (H. M. Stationery Office, price 3s. net.) As we receive it at the moment of going to press, we can only mention that up to March last, the total amount of the loans sanctioned by the Commissioners was 15 millions sterling; 536 applications for sanction to loans were received from municipal authorities, of which 432 were granted in full or in part; and 204 out of the 284 undertakings of this class were authorised to carry out extensions.

The report will be dealt with fully in our next issue.

R.N.D. Signal Dinner.—The third annual dinner of the R.N.D. Signal Company will be held at the Engineers' Club, Coventry Street, W.1, on Saturday, November 5th, at 6.30 p.m. Mr. B. Hardie Smith will take the chair. Evening dress will be worn, and tickets, 10s. 6d. each, may be obtained of Mr. A. G. Hilling, 1, Glaserton Road, N.16.

The Electro-Harmonic Society.—On Friday, October 14th, the Society's first concert of the season was given at the Cannon Street Hotel. Sir William Noble, Engineer-in-Chief of the G.P.O., took the chair, and the Great Hall was crowded with members and their guests. The programme was a long one and well varied. Mr. Bernard Flanders, A.R.A.M., presided at the piano, and songs were rendered by Miss Doris Vane (soprano), Mr. Walter Glynné (tenor), and Mr. Charles Tree. Mr. Herbert Collings gave a very lively sleight-of-hand display, and Messrs. Middleton Woods and Norman Long told stories, the latter also executing a few "ideas" upon the piano. Judging by the number present and the way the various items were received, the Society continues in popularity despite the increased subscription.

Cable Guide Award.—The French Academy of Sciences has awarded a navigation prize to M. William Loth for an invention enabling ships to be taken in and out of harbour by means of electromagnetic cable-guides. Admiral Fournier first brought this invention before the notice of the Academy, and it has been adopted by the French Navy after exhaustive trials off Brest. Havre will shortly be equipped with one of the cable-guides, which, it is anticipated, will greatly accelerate the traffic, besides diminishing the risk of accidents.—*Reuter's Trade Service* (Paris).

The Metric System in America.—The annual meeting of the American Metric Association will be held in the King Edward Hotel at Toronto during the morning, afternoon, and evening of Thursday, December 29th, 1921. In August the secretary of this Association visited Montreal and Toronto, and was much encouraged by the preparatory work that had been done in the interest of the metric movement in Canada. It was pointed out that the old United States measures of capacity, which differed by more than 20 per cent. from the Canadian measures having the same names, were illegal in Canada, and the Canadian measures for liquids were illegal in the United States; while the metric measures are legal for all transactions in all countries. He found many of the leading officials and business men heartily in favour of making the change to the more convenient metric method of measuring as soon as it could be expeditiously made.

The object of the meeting on December 29th is to bring together public officials, engineers, business men, and others who are interested in securing for the United States and Canada the benefits of the general use of this system, and to utilise the information thus gained in guiding the metric movement. As far as possible, the papers to be presented at the coming meeting will outline the steps necessary for the change in the industries and government. The Britten-Ladd Metric Bill now before the United States Congress will be among the subjects discussed. The policy of the American Metric Association is to bring out the desired facts for the benefit of all concerned. Suggestions and questions should be sent to the American Metric Association, 156, Fifth Avenue, New York City.

Power from Boston Water Supply.—Nearly 16,000,000 kWh was delivered in 1920 to the interconnected systems of the Edison Electric Illuminating Co. of Boston and the New England Power Co. by the Wachusett and Sudbury hydro-electric plants of the Metropolitan District Commission as a by-product of the Boston water supply. The Wachusett station, situated at Clinton, Mass., receives water from the Wachusett reservoir under a head of 96 ft., and after passing it through four 1,000-kVA water-wheels discharges it into a tunnel feeding the metropolitan area. Similarly, the Sudbury station, operating under a head of 65 ft., with a plant rating of 1,450 kVA, discharges water into the Boston supply. Last year the Wachusett station delivered 7,474,485 kWh to the two companies, and from Sudbury the Edison Co. took 6,382,831 kWh. The Boston Edison-New England Power 66,000-volt line enables the plants to be interconnected when desirable, and has resulted in a much larger sale of energy to these utilities than would otherwise have taken place. In eight years \$500,000 worth of by-product energy has been sold from the Boston water supply to these utilities and for pumping.—*Electrical World*.

The Business Aspects of Electricity Supply.—Mr. H. Richardson, Corporation electrical engineer, Dundee, addressing members of the Rotary Club on the modern business aspects of electrical power supply, made interesting comparisons between Great Britain and other countries, notably America and the Continent, showing that the consumption per head of the population was very low in this country, although British prices compared favourably with American and Continental charges. He advocated that municipalities should set aside funds for experiment, and should encourage and reward initiative and invention in the same manner as electricity supply companies. In the business of power supply there should be mutual confidence between private enterprise and municipal enterprise, because their objects were identical and both had done well by the public.

The Electrical Trades Benevolent Institution.—At the annual Festival which is to be held next Wednesday, Sir Tom Callender will preside, and it is hoped that there will be a record attendance. On this occasion ladies are invited, for the first time, an innovation which should greatly enhance the attractions of the Festival, and we hope, will ensure a satisfactory report on its financial result.

Resignation of Sir Eric Geddes.—It is announced that Sir Eric Geddes has resigned the position of Minister of Transport. Until the future of the department has been settled Mr. Neal, the Parliamentary Under-Secretary, will be in charge.

INSTITUTION NOTES.

P.O. Telephone and Telegraph Society of London.—Mr. F. J. Brown, C.B.E., chairman, lectured to members of the Society at the first meeting of the winter session that was held on October 17th at the Institution of Electrical Engineers, and during the course of his remarks, said, according to the *Daily Telegraph*, that the Imperial wireless scheme that had been adopted by the Government had been criticised on two grounds. First, it was contended that direct communication should have been established with India; and that communication with Australia should have been either direct or through a single intermediate station only. In the judgment of the best experts, however, the shorter stages were preferable on all grounds, and especially on those of reliability and cheapness, although the stations contemplated would be able to communicate direct between England and Australia for an average of two hours daily, and between England and India for a longer period. The second point of criticism was that the stations would be State-owned. It was urged that the scheme should have been left to private enterprise, which was so successful in establishing cable communication. But there was a very important point of difference. Owing to the comparatively few wave-lengths available for long-distance wireless communication, and the mutual interference between stations, the Imperial scheme, whoever owned it, had to be a practical monopoly; and it was clearly preferable that a monopoly should be in the hands of the State. This did not apply to cables, which did not interfere physically with one another.

Keighley Association of Engineers.—The first lecture of the season under the auspices of the Association was given on October 8th by Mr. W. M. Selvey, of Sheffield, who spoke on "The Heat Balance of an Electrical Power Station." Mr. Robert Hudson (president) occupied the chair.—*Yorkshire Observer*.

South Wales Institute of Engineers.—An exhibition of fuel-saving appliances and methods is to be held at the Institution, Cardiff, on November 17th. During the exhibition Mr. David Brownlie will read a paper on "Boiler-house Management."

West of Scotland Mining Electrical Engineers.—At the opening meeting of the session, held on October 15th, it was reported that the combined membership was 332. Mr. T. J. Jamieson Lenzie, president, in his address, dealt with the proposals for the standardisation of plugs in connection with coal cutters.

Barrow and District Association of Engineers.—At the opening meeting of the autumn session of the Association on October 14th last, the new president, Mr. J. Callander, M.I.M.E., delivered an address on "The Development of Marine Propulsion as Affected by the Introduction of the Turbine." After carefully tracing the development of marine turbines up to the adoption of wheel gearing, Mr. Callander said that two other methods of speed reduction called for comment, namely, electrical and hydraulic transmission. With electrical transmission the turbine could be run at full speed under all conditions, and left in charge of the governor; the reduction ratio could be varied indefinitely. In warships, where a high power was installed and the ship was run for 90 per cent. of its life at 10 per cent. or even 5 per cent. of full power, the advantage was substantial. In the mercantile marine the time during which a ship was under way at anything but full power was negligible, and the advantage claimed had little foundation.

The Institute of Physics.—The new Board of this Institute is constituted as follows:—

President: Sir J. J. Thomson, O.M., F.R.S.
Past-President: Sir Richard Glazebrook, K.C.B., F.R.S.
Vice-Presidents: Prof. W. H. Eccles, F.R.S., Prof. C. H. Lees, F.R.S., Major E. O. Henriot, R.E., C. C. Paterson, O.R.E.

Treasurer: Sir Robert Hadfield, Bart., F.R.S.
Honorary Secretary: Prof. Alfred W. Porter, F.R.S.
Non-Official Members of Board: Inst. Comm. T. Y. Baker, F.N., J. E. Barnard, Dr. R. S. Clay, W. R. Cooper, Prof. C. L. Fortescue, O.B.E., Prof. Andrew Gray, Dr. G. W. C. Kaye, Sir Charles Parsons, K.C.B., F.R.S., C. E. S. Phillips, O.B.E., Dr. E. H. Rayner, Prof. S. Russ, F. E. Smith, O.B.E., F.R.S., Sir Napier Shaw, F.R.S., R. S. Whipple.

Particulars relating to the Institute can be obtained from the Secretary, Mr. F. S. Spiers, O.B.E., 10, Essex Street, London, W.O.2.

Institution of Electrical Engineers.—The first meeting of the new session will be held at the Institution building on Thursday, November 3rd, at 6 p.m., when Mr. J. S. Highfield will deliver his presidential address.

NORTH-EASTERN CENTRE.—The opening meeting will be held

at the Armstrong College on Monday, October 24th, 1921, at 7.15 p.m., when the chairman, Prof. W. M. Thornton, will give his inaugural address, entitled "Engineering Application of Electricity in Gases."

SOUTH MIDLAND CENTRE—Students' Section.—A successful smoking concert was held on October 11th at the Grand Hotel, Birmingham. The University Glee Party rendered a number of items. At the opening meeting of the session on October 25th, Mr. E. Gallizia will deliver his address as chairman, and a paper on "Single-phase Commutator Motors" will be read by Mr. N. Elliot.

Birkbeck College (University of London).—Mr. L. Bolton, winner of the £1,000 prize offered by *The Scientific American* for the best essay on Einstein's theory, will give two lectures on "Relativity" at Birkbeck College, Fetter Lane, E.C. 4, on Mondays, October 24th and 31st, at 5.30 p.m. Admission is free, without ticket.

Wireless Telegraphy.—Prof. R. Widdington, D.Sc., of Leeds University, lectured at the Grand Hall, on the Scarborough Spa, last week, on "The How and Why of Modern Wireless." The professor illustrated his remarks by demonstrations in wireless telegraphy and telephony, including the transmission of a gramophone rendering of "O Star of Eve" (*Tannhäuser*). Mr. E. R. Cross presided.

The annual meeting of the Leeds Amateur Wireless Society took place at the Leeds University on October 14th, when it was decided that an exhibition should be held shortly, at which it is hoped to have the support of the University staff.

Mr. Thos. F. Finucane was the lecturer, last week, at the Leeds Institute, his subject being "The Romance of Wireless." The speaker did not doubt that ten years hence wireless telephony would be a commercial proposition. In the course of his lecture and demonstration the members of the audience were enabled to hear music being played at Wakefield and transmitted by wireless telephony. The lecturer also showed a cinematograph film illustrating the wireless equipment of a Handley-Page aeroplane flying between London and Brussels, in which the airmen were given their direction by means of the Marconi direction finder. He instanced the passing of direction to ships at sea by wireless, the device which ensured that the S.O.S. signal would not be missed even if the operator were absent, and other important developments.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

The Times states that, from a large number of candidates, Glasgow University Court, on Monday, selected Dr. G. W. O. Howe to be the first occupant of the newly-founded James Watt Chair of Electrical Engineering. Dr. Howe, who is 45 years of age, is at present head of the Department of Electrical Standards and Measurements at the National Physical Laboratory. We tender him our hearty congratulations on his appointment.

It is interesting to hear that Mr. R. BORLASE MATTHEWS, Wh.Ex., M.L.E.E., &c., has been asked to read a paper before the Royal Dutch Institute of Engineers at Nijmegen (Netherlands), and he is doing so to-day (October 21st) on the subject of the application of electricity to farming. As some of our readers are aware, Mr. Matthews has devoted considerable attention to this matter in recent years, and has carried out considerable experimental work on a commercial scale (i.e., on an entirely different basis to laboratory or college practice) on his 600-acre farm at Greater Felcourt, East Grinstead.

On October 13th the marriage took place at All Saints' Church, Maidstone, of Mr. STANLEY WILSON, of the Western Electric Co., and late of Luton Corporation, to Barbara Jessie, youngest daughter of Mr. Fred. J. Oliver, J.P., of Maidstone.

We learn that Mr. R. THOMSEN has obtained the appointment of station superintendent to the Coventry Corporation Electricity Department. He took up his duties on October 1st. There was a large number of applicants. Mr. Thomsen was previously resident engineer at the Thornhill power station of the Yorkshire Electric Power Co.

Mr. W. T. DAY, of *The Pioneer and Civil and Military Gazette*, Ltd., 11, Arundel Street, Strand, London, W.C. 2, is leaving England on November 11th for a trade investigation tour throughout India, calling at Bombay, Allahabad, Delhi, Lahore, Karachi, Calcutta, Cawnpore, Madras, &c. His services are at the disposal of readers desiring special information with a view to appointing agents.

We regret to read in the *Sheffield papers* that Sir ROBERT HADFIELD has this week undergone an operation in a nursing home in London. We are glad to hear that the operation was successful.

A large photograph of the Dover Corporation tramway staff has been presented to the manager, Mr. E. H. BOND, as a token of esteem.

Mr. H. WILSON, for 15 years mains superintendent at the Maidstone Corporation Electricity Works, who is leaving to become distribution engineer to the Croydon Corporation, has been presented by the electricity works staff with an arm-

of Reading.

MR. W. E. MANDELICK.—We regret to read in *The Times* that the death has occurred in Berlin, after an operation, of Mr. William Edward Mandelick of London, formerly secretary and business manager of the London General Omnibus Co. and secretary of the London electric tube railways.

Hamstead Electrical Co. Ltd. (177,925). Private company. Registered Office: 143, Canal, £1,000 in £1 shares. To carry on the business of electrical and general engineers and contractors, installers, builders, plumbers, electricians, etc. in the United Kingdom, with one share each in R. G. B. & Co. (Electricians) Ltd., 100, Cricklewood, N.W. merchant: W. N. Walters, 355, Finchley Road, Hampstead, N.W. engineer. The first directors are not named. Registered office: 355, Finchley Road, Hampstead, N.W.

British Universal Variable Gears, Ltd.—G. M. Brown, of 17, Grosvenor Gardens, S.W., appointed receiver on October 5th, under powers contained in debentures dated May 31st and June 4th, 1921.

Pernambuco Tramways & Power Co.—Partly-paid scrip for £335,400 8 per cent. prior lien debentures of £100 each (bearer).

Drake & Gorham, Ltd.—The directors report that the net profit for the year ended June 30th, 1921, is £13,435, after payment of all charges, including bonuses due to staff, interest paid and accrued on seven-year notes, interest on loan, writing off expenses in connection with issue of notes and loan, and making provision for contingencies. Including £12,235 brought forward there is a total of £25,668, which it is proposed to appropriate as follows: Dividend at the rate of 6 per cent. for the year, £7,500; by writing down goodwill, £5,000; by reserve for E.P.D. and corporation profits tax, say, £7,400; carrying forward £5,768. Although the results in the earlier part of the financial year were satisfactory they were adversely affected during the later months by general trade depression and the electricians' and coal strikes. In December an issue of £50,000 10 per cent. seven-year notes was made, the amount being largely over-subscribed. A loan of £12,000 has also been secured on the lease of the head offices. The capital thus provided was essential for the conduct of the business then in hand, but owing to the reduction in turnover which has since taken place the directors are considering the advisability of extending the sphere of the company's operations in other directions. Annual meeting: October 27th, London.

Associated Fire Alarms, Ltd.—The profit for the year ended June, 1921 (after reserving £1,082 for income tax and corporation profits tax) amounts to £3,126, as compared with £2,312 last year. Adding last year's balance of £3,842, the balance at the credit of the profit and loss account amounts to £6,968, the whole of which it is proposed to carry forward. We understand that the company has several important contracts in hand for the protection of premises by its automatic fire alarms, including the Air Ministry depôts at Ruislip and Milton; Dickinson & Jones's new building in Regent Street; Peter Robinson's new building in Oxford Street; Selfridge's new building in Oxford Street, and the Three Counties Mental Hospital in Bedfordshire.

Amalgamated Wireless (Australasia), Ltd.—On its trading activities during the year ended June 30th last, this company made a profit of £9,775, or £928 more than in 1919-20. In their report on the company's operations in 1920-21, the directors state that ships' wireless business was very satisfactory, although it suffered by reason of shipping strike disorganisation. Wireless patents of considerable value are stated to have been added to those owned by the company, and an experimental station has been erected in Victoria. The company's general electrical business, which traded as the Austral Electric Co., is reported to have extended so rapidly that it became expedient to form it into a separate limited liability company. That was done in April last, the "parent" company retaining the entire interest.

Automatic Telephones (Australasia), Ltd.—This company earned a net profit of £6,018 during the year ended June 30th, 1921. During the latter part of the year the company secured considerable supplies of equipment, the balance of which has been landed since closing the year's accounts. Prompt delivery of material can be offered which has hitherto been very scarce. From the New Zealand Government substantial orders have been received, some of which have been executed, and others are still in course of manufacture. Collingwood exchange (Melbourne) and extensions to City North (Sydney) should be completely furnished during this current year; also Sydenham and St. Albans (Christchurch), New Zealand. The department proposes to extend the automatic system to Queensland, and is preparing a specification for Albion and Newmarket (Brisbane).

A Swiss Investment Company.—It is announced that the Swiss Bank Verein and two other Swiss financial institutions have taken over a 7 per cent. ten-year loan for 10,000,000 fr. of the Columbus Electrical Undertakings Co. of Baden. The latter, which has a share capital of 30,000,000 fr., is said to require fresh funds for consolidating its current liabilities and for providing means for the extension of the Compania Italo-Argentina de Electricidad of Buenos Aires, in which the Swiss company holds a considerable portion of the share capital. The dividend of the Columbus company for the past year is at the rate of 8 per cent., as in 1919-20.

Belgian Companies.—The report of the Société Intercommunale Belge d'Electricité, of Brussels, for the year ending June 30th last shows a profit of 1,725,751 fr., as compared with only 424,880 fr. in the preceding twelve months.

A profit of 271,447 fr. for the year ending June 30th last is shown in the report just issued by the Société d'Electricité de l'Ouest de la Belgique, of Brussels, as compared with only 67,756 fr. in the preceding twelve months.

Prospectus.—Indicators, Ltd.—The list is to close to-morrow, October 22nd, in an issue of 15,327 7 per cent. cumulative preferred participating shares of £1 each at par. The company was formed in 1919 to acquire certain patents for automatic electrically-operated indicator apparatus to be placed in railway carriages, on platforms, and on tramway cars and at tramway signal stations. The present issue is made to provide further working capital and to complete important contracts already obtained.

Stothert & Pitt, Ltd.—Further dividend of 7½ per cent., making 12½ per cent., free of tax. The balance is carried forward, subject to E.P.D.

Anglo-American Telegraph Co., Ltd.—Interim dividends for quarter ended September 10th 15s. per cent. on ordinary stock and £1 10s. per cent. on preferred stock, less tax.

Indo-European Telegraph Co., Ltd.—Interim dividend for the half-year ended June 30th at the rate of 5 per cent. per annum, free of tax.

United River Plate Telephone Co., Ltd.—Interim dividend of 3 per cent. (3s. per share) on the old ordinary shares, free of tax, for the half-year ended June.

STOCKS AND SHARES.

TUESDAY EVENING.

The sensational slump in the value of the German mark stands out as one of the prominent features of the Stock Exchange this week. It has played its part in bringing about further depression in many of the markets. Liquidation from Holland was ascribed to the need for realising money on the part of Dutch holders of marks, who saw their paper rapidly depreciating in value. Meanwhile, there has been heavy selling at home. Several big accounts in the city are known to have given trouble just lately, part of which trouble has probably been adjusted, though the settlement leaves behind a legacy of nervousness. In the circumstances, it is not surprising that markets find a difficulty in showing improvement. The new issues continue amongst the firm spots in the House. Lancashire Power debenture stock has recovered to 3½ premium after being 2½ premium. County of London Electric new debenture has risen to 4½ premium. Mersey Power debenture, which opened at 1½ and fell to ½ is now 1 premium, while several others of older date are maintaining their prices. Clyde Valley 8 per cent. second preferences are still about 1/16 discount.

Amongst electricity supply shares, County of London ordinary eased off to ¾, on selling by people who were exchanging from ordinary shares into the new debenture stock. Charing Cross ordinary at 4½ are ½ better. These are the only changes in the London list. Active business is being done in the County of London fully-paid debenture stock on the basis of 97½. Shropshire, Worcestershire & Staffordshire Electric Power 6 per cent. preference changed hands the other day at 10s. The debenture stock is barely "par."

Victoria Falls ordinary are 10s. 3d. The company's debentures have recently been rising, and the 5 per cent. first mortgage stands about 103, while the 5½ per cent. second mortgage is 102½. For both there is some little demand. The preference also keep hard at 18s.

An amount of £200,000 8 per cent. first mortgage debentures in the North Wales Power & Traction Co., Ltd., unconditionally guaranteed as to principal and interest by the Aluminium Corporation, Ltd., is being offered at 97. One-third of the circular containing the offer is occupied by a copy of a letter received from the managing director of the company, in which he sets out a short history of the company, and gives an account of its progress. The following paragraph relates to the profits:—

"The sales of the North Wales Power & Traction Co. for the eight months ended August 31st last were at the rate of £27,279 per annum. The agreements already arranged for the supply of energy to Llandudno, Colwyn Bay, and Llysfaen will increase receipts from sales by £25,000 per annum. The transmission lines from Colwyn Bay to Chester and Wrexham should be completed in the course of next year, and should produce a further income of £62,500 per annum. The company will then have an income, after deduction of working and other costs, of approximately £70,000 per annum available for the payment of the interest amounting to £40,000 per annum."

It will be noticed that there is a good deal of estimate about this profit-statement, and it may be that investors will prefer other stocks where the amount available for interest can be more definitely shown.

The cable group is one of the very few departments in the Stock Exchange that show a firm front. Westerns are 5s. better. Globes are 7s. 6d. up. Eastern ordinary recovered a point more than its dividend of 50s., and Eastern Extension shares gained the 5s. dividend taken off last week. Other parts of the cable market are steady, with Anglo-American deferred a little better at 17½. Oriental Telephones are 2 ex dividend, and United River Plates at 5½ have further given way. Marconis have come on offer at 32s. 6d.; Marconi Marines weakened to 17s. 6d. Radio Corporations, at 10s. for the common and 9s. 3d. the preferred, are both lower. American dollar stocks in utility companies mostly stand substantially down on the week, owing to the fact of the New York Exchange having touched nearly 4 dollars to the £. In none of them, however, is there any increase of business. Mexicans are inclined to give way. Mexican Light & Power preferred shed a point. For the company's second mortgage bonds there has been a fairly good demand in the neighbourhood of 48½. Brazilian Tractions at 29 are a point higher, and Anglo-Argentine second preference shares stiffened to 22.

Iron, coal, and steel shares have fallen noticeably, and with them Babcock & Wilcox lost 3s. 9d., declining to 45s. Edison-

Swans fell a form to 6s. 3d., and English Electrics continue heavy. General Electric ordinary at 16s. 3d. are again 1s. 3d. down. The company's preference shares of both classes remain at 17s. 6d. Any shares which were saleable at all have had to be sold with a view to the possibility of their having to be satisfied of claims arising out of all kinds of contingencies, financial and commercial, which have become clamant owing to the vagaries of the exchanges. There are few markets round the Stock Exchange in which this factor is not making itself felt at the present time. The rubber market manages to evade the depression to some extent, owing to the price of rubber having gone up a little during the past few days.

Underground Electric incomes are 4 points down at 70½. Metropolitan gave way to 24. The suggestion that the Government should lend money to the railway companies at a low rate, in order that the railways might, in their turn, employ large extra numbers of men, has found no welcome in high quarters, and the consequence is that Home Railway stocks are as much out of favour as ever.

People who had stock open before the end of July, 1914, are faced with the knowledge that they must clear off whatever liabilities remain before the beginning of next August. Their efforts to sell stock in order to meet such liabilities are accelerating the pace at which prices fall under the influences of demoralised foreign exchanges, unemployment, and bad trade. The picture is a dark one, and everybody in the city is so saturated with pessimism that even to suggest a ray of light on the situation is to be scouted as an extreme optimist. Moreover, it must be candidly confessed that to entertain any hope of immediate improvement, either in Stock Exchange prices or business, does seem to be indulging in a larger amount of licence than immediate circumstances appear to warrant.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price	Yield.
	1919. 1920.	Oct. 1921.	Oct. 1921.
Brompton Ordinary	12 12	62	29 8 2
Charing Cross Ordinary ..	7 8	42	9 2 4
do. do. 4½ Pref.	4 4	34	7 4 4
Chelsea	4 6	34	9 4 8
City of London	13 14	13	10 13 4
do. do. 6 per cent. Pref. ..	6 6	17	6 17 2
County of London	6 6	18	9 0 4
do. do. 6 per cent. Pref. ..	6 6	8	7 10 0
Kensington Ordinary	7 9	44	10 0 0
London Electric	24 24	1	7 10 0
do. do. 6 per cent. Pref. ..	6 6	24	10 9 0
Metropolitan	6 7	4	8 15 0
do. 4½ per cent. Pref. ..	4 4	21	7 13 2
St. James' and Pall Mall ..	12 12	62	9 1 4
South London	6 7	28	10 13 2
South Metropolitan Pref. ..	7 7	15 9	8 17 10
Westminster Ordinary ..	10 10	62	8 13 10

TELEGRAPHS AND TELEPHONES.

	Dividend	Price	Yield.
	1919. 1920.	Oct. 1921.	Oct. 1921.
Anglo-Am. Tel. Pref.	6 6	87	6 18 0
do. do. Def.	14 14	171	8 11 6
Chile Telephone	6 6	52	5 14 3
Cuba Sub. Ord.	7 7	7	9 13 2
Eastern Extension	10 10	104 3d	6 1 0
Eastern Tel. Ord.	10 10	166 3d	6 0 1
Globe Tel. and T. Ord. ..	10 10	162	6 0 4
do. do. Pref.	6 6	93	6 9 9
Great Northern Tel.	22 24	242	9 15 0
Indo-European	10 10	39	8 6 8
Marconi	25 15	18	9 4 7
Oriental Telephone Ord. ..	12 12	22	6 0 0
United R. Plate Tel.	8 8	56	6 16 2
West India and Panama ..	NH NH	5½	NH
Western Telegraph	10 10	10	5 19 5

HOME RATES.

	Dividend	Price	Yield.
	1919. 1920.	Oct. 1921.	Oct. 1921.
Central London Ord. Assented ..	4 4	40½	8 1 8
Metropolitan	12 14	24	6 5 0
do. District	NH NH	16½	NH
Underground Electric Ordinary ..	NH NH	9	NH
do. do. "A"	NH NH	5 9	NH
do. do. "Income"	4 2	76½	4 5 1

FOREIGN TRAMS, &c.

	Dividend	Price	Yield.
	1919. 1920.	Oct. 1921.	Oct. 1921.
Anglo-Arg. Trams, First Pref. ..	5½ 12½	28	10 9 6
do. do. 2nd Pref.	NH 6½	2½	10 9 6
do. do. 6½ Deb.	NH NH	89½	7 17 0
Brazil Traction	NH NH	28	10 9 6
British Columbia Elec. Ry. Ptoe. ..	6 5	60	8 6 8
do. do. Preferred	6 13½	53½	8 14 2
do. do. Deferred	8 13½	174	11 8 6
do. do. Deb.	42 42	67	7 1 8
Mexico Trams 5 per cent. Bonds ..	NH NH	69	NH
do. do. 6 per cent. Bonds ..	NH NH	59	NH
Mexican Light Common	NH NH	26	NH
do. do. Pref.	NH NH	26	NH
do. do. 1st Bonds	NH 5	56½	9 0 0

MANUFACTURING COMPANIES.

	Dividend	Price	Yield.
	1919. 1920.	Oct. 1921.	Oct. 1921.
Babcock & Wilcox	15 16	27	7 2 3
British Aluminium Ord.	10 10	15	10 0 0
British Insulated Ord.	15 16	14	10 8 8
Callenders	15 15	18 9	6 13 8
do. 4½ Pref.	6½ 6½	18 9	13 15 0
Orpington Ord.	10 10	14 6	7 7 1
Edison Swan	10 10	14 6	16 17 0
do. do. 6 per cent. Deb. ..	5 5	78	15 4 10
Electric Construction	10 10	10 9	8 11 6
English Electric	8 8	9 6	12 6 2
do. do. Pref.	6 6	13 6	10 5 0
Gen. Elec. Pref.	6 6	10 9	6 18 6
do. Ord.	10 10	10 9	8 16 8
Henley	15 15	17	9 8 2
do. 4½ Pref.	4½ 4½	32	6 11 9
India Rubber	10 10	10	10 11 9
Mos. Vickers Pref.	8 8	10	10 11 9
Siemens Ord.	10 10	14	10 11 9
Telegraph Con.	30 30	21½	10 11 9

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, October 19th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Oxalic	per lb.	7½d.
a	Ammonia Sal	per ton	26s
a	Ammonia, Murate (large crystal) ..	"	26s
a	Bisulphide of Carbon	"	281
a	Borax	"	431
a	Copper Sulphate	per lb.	6d.
a	Potash, Chlorate	"	£16 10s.
a	Perchlorate	"	216
a	Shellac	per cwt.	215
a	Sulphur, Sublimed Flowers	"	34d.
a	Lump	"	27
a	Soda, Chlorate	per lb.	7½d.
a	Crystals	per ton	"
a	Sodium Bichromate, casks	per lb.	"
METALS, &c.			
a	Babbitt's Metal Ingots	per ton	£80 to £275
a	Brass (rolled metal 2½" basis) ..	per lb.	10½ to 10½
c	" Tubes (solid drawn)	"	11½d.
c	" Wire, basis	"	12½
c	Copper Tubes (solid drawn) ..	per ton	£103
c	" Bars (best selected)	"	£103
c	" Sheet	"	£103
c	" Rod	"	£103
d	" (Electrolytic) Bars	"	145 10s.
d	" Sheets	"	291
d	" Wire Rods	"	11d.
d	" E.C. Wire	per lb.	3/6
d	Ebonite Rod	"	3/6
d	Sheet	"	3/6
d	German Silver Wire	"	12/6
d	Gutta-percha, fine	"	1/2
d	India-rubber, Para fine	per ton	14½ inc.
d	Iron Pig (Cleveland Warrants) ..	"	£30
d	" Wire, galv. No. 8, P.O. qual. ..	"	£24 15s.
d	Lead, English Pig	"	£9 15s. to £10
d	Mercury	per bot.	5s. to 7 6 inc.
d	Mica (in original cases) small ..	per lb.	3d. to 3/4
d	" " medium	"	4/ to 8/
d	" " large	"	10/ to 20/ & up
d	Phosphor Bronze, plain castings ..	"	1/4 to 1/8
d	" " rolled bars and rods ..	"	2/4 to 2/6
d	" " rolled strip & sheet ..	"	3/4 to 2/7
d	Silicium Bronze Wire	per lb.	1/3
d	Steel, Magnet, in bars	"	1/6
d	Tin, Block (English)	per ton	£155 to £166
d	" Wire, No. 1 to 16	per lb.	3/6
d	White Anti-friction Metals ..	per ton	£65 to £275

Quotations supplied by—

a	G. Boor & Co.	a	James & Shakespear.
c	Thos. Bolton & Sons, Ltd.	b	Edward Tull & Co.
d	Frederick Smith & Co.	f	Bolling & Lowe.
e	F. Wiggins & Sons.	i	Richard Johnson & Nephew, Ltd.
f	India-Rubber, Gutta-Percha and	n	P. Ormiston & Sons.
	Telegraph Works Co., Ltd.		
			W. F. Dennis & Co.

A Rotary Electric Furnace.—Alan D. Dauch, of the George J. Hagan Corporation, Pittsburgh, describes, in an article contributed to the *Electrical World*, a rotary electric furnace constructed by his firm. This was designed to permit continuous heat treating, annealing and carbonising, and took the place of an oil-fired furnace. The moving hearth is a continuous annular ring. The dimensions of the furnace are as follows:—Overall outside diameter, 49 ft.; outside height, 7 ft.; outside diameter of rotating hearth, 15 ft.; inside diameter of hearth, 5 ft.; width of hearth, 5 ft.; height of heating chamber, 2 ft. The furnace walls are of standard construction, bonded with "Adamant" cement and encased by sheet steel reinforced with structural beams. The hearth rotates on a series of roller bearings twenty in number. The furnace has two adjacent, pneumatically-operated doors for charging and discharging. The hearth is driven by an electric motor through gears capable of giving six speeds varying from one revolution in thirty minutes to one in seventy-five minutes. The heating elements are two in number, and consist of nickel-chromium ribbon mounted on the inner and outer walls of the furnace. The first section or heating zone extends from the charging door for two-thirds of the circumference; this has a 210-kW loading, the remainder, the "soaking" section, is 60 kW. The temperature of each zone can be maintained at any value between 200 and 1,800 deg. F. The heating current is 60-cycle, 3-phase, 440-V; the controls are operated by single-phase, 60-cycle, 110-V power.

Under actual operating conditions 11.75 lb. of steel has been heated to 1,525 deg. F. and soaked at the same temperature per kWh consumed. This is at the rate of 170 kWh per short ton. The charge per hour consists of approximately 3,000 lb. of various automobile parts such as spring clips, steering knuckles, connecting rods and front axles. The weights of the different parts vary from 3 lb. each to 180 lb. each. The time during which the pieces are in the furnace naturally depends on the cross-section and weight of the particular part. This feature of time in the furnace is very aptly taken care of by the different speeds at which the hearth may be revolved.

THE COMMERCIAL MOTOR EXHIBITION.

THE Fifth International Commercial Motor Exhibition opened at Olympia on October 13th; it remains open until to-morrow, Saturday. The large building holds an imposing display of trade vehicles of all designs, typical of the advance made in recent years in this important branch of transport.

While petrol-driven vehicles predominate, there are several exhibits of electric vehicles, which are coming more and more into favour for operation within a moderate radius. Magneto, of course, appear in large numbers, while the remainder of the exhibits of electrical interest are principally lighting systems for cars.

MESSESS. RICHARD GARRETT & SONS, LTD., display a 2½-ton "electric" (fig. 1) for commercial purposes. This vehicle is capable of doing a 30-mile run on one charge at an approximate speed of 10 m.p.h. on a level road. The loading platform measures about 10 ft. x 6 ft., the overall length and width of the vehicle being 15.4 x 6.6 ft. respectively. The battery, which weighs about 21 cwt., consists of 44 "Iron-clad Exide" cells. The drive is provided by a high-efficiency series-wound motor capable of withstanding a 300 per cent. overload. As this machine is made by an associated firm, it is designed in every particular to suit its proper application. The power is transmitted to a differential countershaft by a chain immersed in an oil bath. From this shaft two roller chains are connected to large-diameter sprockets on the rear wheels. The controller is of the segmental drum type and provides for four forward and two reverse speeds. The controller lever is situated on the steering column. A patent trip gear is fitted which ensures that the application of either foot or hand brake automatically returns the controller to "neutral"; this prevents a sudden start upon the release of the brakes. For starting on hills there is a pedal which cuts out the trip gear. The rest of Messrs. Garrett's exhibit consists of steam wagons and trailers.

MESSESS. NEWTON BROS. (DERBY), LTD., have an exhibit confined to a 2½-ton carrier vehicle fitted with a steel end-tipping body. This is driven by a pair of motors spring mounted independently of the back axle. The actual drive is made by pinions on the motor shafts which engage with internal

distributors, and rotary safety valves. The armature between distributor end plate, and driving end plate are die cast as a single unit. A "Tungar" rectifier is on view, as well as a "Type G" magneto with impulse starter. The latter enables the heaviest engine to be started with a minimum of effort and without danger of backfire.

GUY MOTORS, LTD., display, among a number of petrol-propelled vehicles, an electric wagon of from 2 to 2½ tons capacity.

CLAYTON WAGONS, LTD., also exhibit an electric vehicle. In this wagon, which is capable of dealing with a 3-ton load, the motor and crankshaft are arranged as one unit.

MESSESS. RANSOMES, SIMS & JEFFERIES exhibit examples of their "Orwell" vehicles and trucks. A 4-ton lorry is included in the exhibit. This is driven by two motors each of from 4 to 12 h.p. capacity according to speed and load conditions. The battery consists of 40 cells with an output of 323 ampere-hours. The speed of the vehicle is roughly 7 m.p.h. on a level road. The 2-ton electric refuse-collecting vehicle shown has an electrically-operated tipping gear. This gear consists of a powerful horizontal square-threaded shaft working through a heavy bronze crosshead, and is connected by links and rollers to the channel framework to which the body is secured. The gear is driven by a cross-shaft through enclosed bevel gearing. Two trucks are on view. One is a four-wheeled

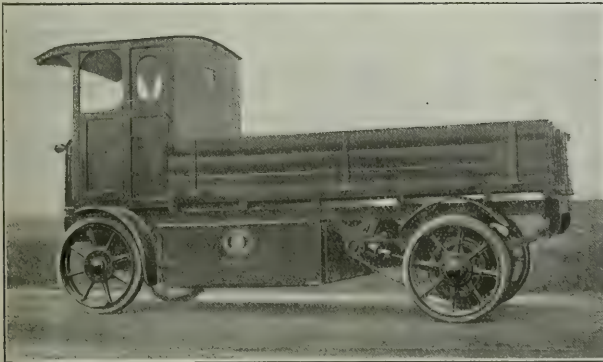


FIG. 1.—A GARRETT 2½-TON ELECTRIC VEHICLE.



FIG. 2.—RANSOMES' ELECTRIC RUNABOUT CRANE.

spur wheels fitted to the rear wheels of the vehicle. The controller is of the series-parallel type arranged to give six speeds, four forward and two reverse, the control lever is conveniently mounted near the driver's seat. All the driving gears are enclosed as a protection against mud and water. The motors can be replaced with little trouble as no dismantling of the rear axle is involved. An average distance of 22 miles can be covered on one charge.

THE GENERAL VEHICLE CO., LTD., shows three examples of its electric vehicle construction. The largest is a 5-ton "G.V." wagon for the carriage of road making materials, coal, ashes, &c. The body can be tipped to either side or endwise, the gear being electrically operated and controlled from the driver's cab. An end-tipping 2-ton chassis is shown; this is specially designed for the collection of house refuse.

In this vehicle the single motor is entirely enclosed. Power is transmitted to a countershaft by a Morse silent chain and from the countershaft to the rear wheels by roller chains. The controller is of the continuous torque type, so arranged that speed changes can be effected without shutting off power. It is placed under the driver's seat, and is easily accessible. Five forward and two reverse speeds are provided for.

THE BRITISH THOMSON-HOUSTON CO., LTD., has a large display of magnetos for a wide range of vehicles, including types "C4" and "G6" for light lorry engines; these are light-weight machines with laminated pole pieces, spark gap

truck, fitted with an elevating platform, capable of dealing with a load of 4,000 lb. with a maximum speed of 5 m.p.h. The other is of the same carrying capacity but three-wheeled; this is fitted with a single series motor, while the four-wheeled type has two separate motors. The item which is probably attracting the most attention is a new runabout crane (figs. 2 and 3), which must be unrivalled for ease of manipulation. This has a lifting capacity of 15 cwt., its overall width does not exceed 6 ft., and it can be rotated in a 6 ft. 3 in. diameter circle. There are two independent motors driving two opposite wheels, while at right angles to these drivers, on each side, are other wheels; this ensures an even distribution of weight. The truck for purposes of travelling, either forward or reverse, is operated by a directional controller, placed on the right-hand side of the driver, and operated by a lever (1) (fig. 3) working in a gate, interlocked with the left foot pedal (5) which controls a resistance drum and only by depressing the pedal control which breaks the circuit, can the controller handle be placed in the forward or reverse positions. By releasing the pedal (5) circuit is made through a series of resistance steps which govern the speed of the vehicle. The current can be cut off immediately by depressing the pedal. The brake pedal (2) actuates two compensated brake bands working on drums keyed on the motor spindles. These brakes can be used either as service or ratchet brakes. The batteries

supply the crane and constitute permanent counter-weights. By means of the steering wheel (6) and lifting a part of the crane the motor controls (1), the steering wheels, with the crane and motor, (1) and (2), can be turned and locked at any angle to the driving wheels. At the same time a series of levers (3) in the motor controller reverse the direction of the driving motor and so, which are the crane and motor, exert a "couple" on the whole structure. The crane controller is placed on the left of the driver, and is operated by a lever (6) working in a gate, controlling the

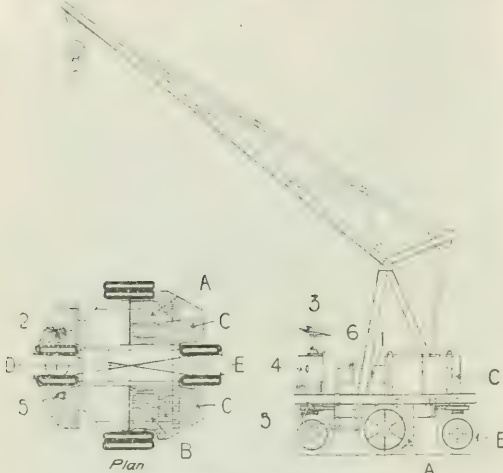


FIG. 3.—RANSOME'S ELECTRIC RUN-OUT CRANE.

raising or lowering of the hook. The derricking motion of the job is controlled by the same lever and the mechanism is so arranged as to obtain an approximately horizontal movement of the load, that is to say, when lifting the job, the hoist rope is paid out, and when lowering the job the rope is wound back on the hoisting drum.

MESSRS. C. A. VANDERVELL & CO., LTD., have numerous examples of "C.A.V.-Willard" batteries for commercial cars, in addition to lighting sets and other electrical accessories. Samples of a new threaded rubber insulation, used for separators in accumulators, are on view. Although this material is so closely woven as to prevent the passage of light, it permits free circulation of the acid in an accumulator and, moreover, has a much longer life than any previous type of separator material. The base of the material is rubber; this is pierced by small cotton threads—195,000 to 30 sq. in. Among the advantages claimed for this material are high voltage maintenance and low heat characteristics. Among the lighting dynamos exhibited is the "N.G.S.C." type which has an output of 150 watts at a pressure of 12 volts. This is suitable for most classes of commercial vehicle. An aluminium switch-board is shown upon which are mounted instruments and three switches for controlling the dynamo, head and tail, and side and tail lights. A two-pin plug is fitted for the insertion of an inspection lamp. All types of lamps for vehicles are displayed and the exhibit also includes examples of a strong and well-made illuminated sign for fixing to the front of a vehicle for advertising purposes. This contains three low-voltage lamps which can be supplied from a battery or dynamo. A wide range of sparking plugs also appears on this stand.

CONNER MAGNETO & IGNITION, LTD., show a selection of their "C.M.I." magnetos. The firm also exhibits its coil ignition system. In this the coil is built up on a laminated core. A moving armature or vibrator whose time frequency varies as the voltage in the coil primary is fitted. A resistance is connected across this, being normally short circuited. As the speed of the vibrator increases, the short circuit is opened and the resistance comes into use, cutting down the value of the current from the battery to normal. The contact breaker is driven at camshaft speed, and the points are shunted by a condenser. The contact breaker has a distributor of moulded insulation having segments, corresponding to the number of cylinders, embedded in it. These segments are traversed by a carbon brush rotating with the camshaft. In this appliance the ignition value of the spark is kept constant irrespective of the engine speed. Fitted upon this stand, for demonstrative purposes, is a "Lorrilite" set for vehicle lighting. This consists of a small self-regulating magneto-dynamo with a normal output of 24 watts, which, however, can be exceeded if necessary. The dynamo is mounted adjacent to the engine and is driven at about four times the crankshaft speed by means of a pulley and clutch. The magnetic field is composed of three tungsten steel magneto magnets, and the armature is an assembly of laminations on a hollow straight shaft. Between speeds of 2,000 and 3,000 r.p.m., the

output is practically constant, as is shown by demonstration, but sufficient light for a standing vehicle is given at 1,150 r.p.m. (armature speed), and the dynamo can be run up to 5,500 r.p.m. without injury.

MESSRS. TILLYN-SILVERMAN MOTORS, LTD., display examples of their petrol-electric vehicles. These are an omnibus with a 10-h.p. engine; a "charabanc de luxe", and 2-ton and 4-ton vehicles. The system is noted for its efficiency between the petrol engine and the driving motor as well as the ease of control. The dynamo is driven direct from the engine flywheel by a laminated spring connection. The motor is directly coupled with the cardan shaft driving the rear axle; the final drive is by worm gear. The controller and speed regulator are carried in separate aluminium cases. The controller is of the tramway type, operating by varying the resistance in the shunt field of the generator, and by shunting the series field of the motor. By cutting out the motor and taking leads from a special pair of terminals on the dynamo, the set can be used as a portable arc-welding equipment. The engine and generator can also be used for numerous power purposes as they form a complete self-contained power plant.

MESSRS. NORTH & SOONS, LTD., exhibit several models of "Watford" magnetos, some of which are specially designed to take the place of Bosch magnetos. A special "Ford" type is also shown.

THE BRITISH LIGHTING & IGNITION CO., LTD., also has a large display of magnetos suitable for all types and sizes of engines. In the "S.H." types, the current is produced at a low pressure and a coil is used to transform this to the correct ignition value. Starting and lighting equipment also appears on this stand. The "B.L.I.C." starting motor is of simple construction. The starter drives the engine by means of a sliding pinion which engages a gear ring on the periphery of the flywheel. When the engine fires it over-runs the motor and automatically thrusts the pinion out of engagement—a pull-off spring assisting this action. The lighting equipment consists of a dynamo and battery together with the necessary lamps and switches. The battery is charged during the day-time, the maximum charging rate corresponding to a speed of 20' or 25 m.p.h.; when the lights are all on at night, the charging rate is maintained. The pulling-out of the side and tail lights switch automatically establishes the maximum charging rate.

THE LUCAS ELECTRICAL CO., LTD., exhibits examples of magnetos for one, two, three, four, and six-cylinder engines.

THE FELLOWS MAGNETO CO., LTD., is another firm displaying magnetos as well as specially-arranged spare part cases which contain screws, nuts, washers, contact-breaker springs and carbons, terminals, &c. This firm is also showing a small electric vulcaniser for use in conjunction with a 12-volt starting and lighting equipment.

It will be seen from the above short description that the electrical engineer has played a large part in this year's show, and the increase in the number of electric vehicles indicates great activity in this direction.

THE TRADE OF AUSTRALIA.

[IMPORTS AND EXPORTS.]

THE following figures, showing the values of the imports of electrical and allied goods into Australia in 1919-20, are taken from the recently published official trade returns. For purposes of comparison the figures for 1918-19 are given, and notes of increases or decreases are made. Only in the case of cables is it possible to indicate any unit other than value.

	1918-19	1919-20	Inc. or dec.
<i>Gas and oil engines.</i>	£	£	£
Total	111,000	255,000	+ 144,000
From United Kingdom	25,000	133,000	+ 108,000
.. Canada	10,000	11,000	+ 1,000
.. United States	105,000	99,000	- 7,000
.. Sweden	—	3,000	+ 3,000
<i>High-speed reciprocating steam engines (direct coupled).</i>			
Total	4,000	4,000	+ 3,000
From United Kingdom	1,000	4,000	+ 3,000
<i>Dynamo-electric machines, static transformers, induction coils, electric fans and parts thereof.</i>			
Total	501,000	731,000	+ 230,000
From United Kingdom	182,000	321,000	+ 142,000
.. United States	308,000	390,000	+ 82,000
<i>Regulating, starting and controlling apparatus.</i>			
Total	93,000	125,000	+ 32,000
From United Kingdom	25,000	48,000	+ 25,000
.. United States	66,000	74,000	+ 8,000
<i>Electric fittings, viz., switches, fuses and lightning arresters.</i>			
Total	112,000	174,000	+ 62,000
From United Kingdom	30,000	95,000	+ 65,000
.. United States	61,000	71,000	+ 7,000
.. Japan	16,000	6,000	- 10,000

	1918-19	1919-20	Inc. or dec.
	£	£	£
<i>Electric heating and cooking appliances.</i>			
Total ...	15,000	19,000	+ 4,000
From United Kingdom ...	7,000	9,000	+ 2,000
.. United States ...	8,000	10,000	+ 2,000
<i>Electrical appliances, other.</i>			
Total ...	421,000	323,000	- 98,000
From United Kingdom ...	58,000	107,000	+ 49,000
.. United States ...	168,000	153,000	- 15,000
.. Japan ...	51,000	17,000	- 37,000
.. Netherlands ...	140,000	29,000	- 111,000
<i>Telephone apparatus.</i>			
Total ...	81,000	99,000	+ 18,000
.. United Kingdom ...	9,000	34,000	+ 25,000
.. United States ...	70,000	59,000	- 11,000
<i>Accumulators or storage batteries.</i>			
Total ...	119,000	128,000	+ 9,000
From United Kingdom ...	11,000	44,000	+ 33,000
.. United States ...	107,000	81,000	- 26,000

NORTH WALES COUNTIES ASYLUM, DENBIGH.

A HYDRO-ELECTRIC INSTALLATION.

In 1919 the North Wales Counties Asylum Authorities instructed Mr. S. E. Britton to report to them upon several water resources located within a few miles' radius of the Asylum, with a view to utilising water-power in place of their existing steam plant for generating electricity. In the following year the Asylum Authorities decided upon the development of a scheme on the river Ystrad, and applied to the Lunacy Commissioners and the Ministry of Health for sanction to proceed with the development.

The river Ystrad passes through land belonging to the Authorities, and the site selected for the hydro-electric installation is about 400 yards distant from the Asylum.

The area of the catchment utilised by the installation is 17 square miles, and the average rainfall in the district 50 inches

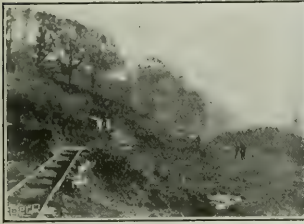


FIG. 1.

FIG. 1—THE VALLEY ON THE UP-STREAM SIDE OF THE POWER HOUSE, BEFORE INUNDATION.



FIG. 2.

FIG. 2—THE POWER HOUSE AND FISH PASS.

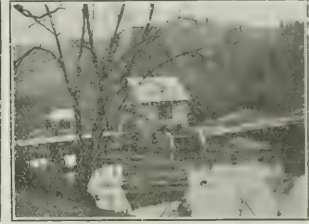


FIG. 3.

FIG. 3—THE POWER HOUSE, DAM, AND RESERVOIR.

	1918-19	1919-20	Inc. or dec.
	£	£	£
<i>Arc lamp carbons.</i>			
Total ...	19,000	13,000	- 6,000
From United Kingdom ...	1,000	4,000	+ 3,000
.. United States ...	17,000	3,000	- 14,000
<i>Arc lamps, carbon in blocks, vacuum tubes, measuring and recording instruments, insulating tape.</i>			
Total ...	143,000	138,000	- 5,000
From United Kingdom ...	31,000	65,000	+ 34,000
.. United States ...	99,000	48,000	- 51,000
<i>Lamps and lampgear.</i>			
Total ...	176,000	169,000	- 7,000
From United Kingdom ...	25,000	50,000	+ 25,000
.. Japan ...	27,000	19,000	- 8,000
.. United States ...	108,000	90,000	- 18,000
<i>Steam turbines, economisers, superheaters, &c.</i>			
Total ...	80,000	139,000	+ 59,000
From United Kingdom ...	74,000	100,000	+ 35,000
.. United States ...	5,000	21,000	+ 16,000
<i>Cable and wire, covered.</i>			
Total ...	Tons 4,000	3,740	- 260
From United Kingdom ...	£ 612,000	£ 631,000	+ 19,000
.. Canada ...	Tons 825	2,955	+ 2,130
.. Japan ...	£ 147,000	£ 532,000	+ 385,000
.. United States ...	Tons 450	148	- 302
.. Japan ...	£ 49,000	£ 14,000	- 35,000
.. United States ...	Tons 1,700	337	- 1,363
.. Japan ...	£ 293,000	£ 51,000	- 242,000
.. United States ...	Tons 970	300	- 670
.. United States ...	£ 123,000	£ 34,000	- 89,000

It is interesting to note that Australia has made a beginning in the export of electrical machinery and appliances. The values of such goods, of Australian manufacture, are given below:—

<i>Machinery and appliances, electrical.</i>			
Total ...	£	£	£
To New Zealand ...	3,000	6,500	+ 3,500
.. Fiji ...	1,000	3,000	+ 2,000
.. Papua ...	1,500	1,000	- 500
.. Java ...	1,300	—	- 1,300

<i>Electrical materials.</i>			
Total ...	£	£	£
To New Zealand ...	2,500	12,000	+ 9,500
.. Fiji ...	1,200	10,000	+ 8,800
.. Fiji ...	250	1,000	+ 750

per annum, from which it was calculated that the erection of a dam to give a fall of 15 ft. and a reservoir having an area of three acres would provide water power capable of producing electricity to the extent of 200,000 kWh per annum. The scheme involved the erection of a dam 160 ft. long across the valley of the river, a fish pass to facilitate the passage of



FIG. 4.

FIG. 4. THE DAM DURING CONSTRUCTION.



FIG. 5.

FIG. 5. THE WOODEN FORMER BEING CONCRETED IN, TO FORM THE DRAUGHT TUBE.

fish over the dam, and a power station housing a water turbine and generator and switchgear.

A specification was prepared and sent to several contractors, but owing to the unsettled state of labour and cost of materials and the difficulty of obtaining the class of materials required, no tenders were received. The Asylum Authorities then empowered Mr. Britton to make the best arrangement he could to carry out the work, by direct labour or otherwise.

A contractor was eventually found who was prepared to carry out the excavations and concrete work to a schedule of prices, subject to fluctuations in cost of labour and materials. Messrs. J. Gordon & Co. contracted for the supply and erection of the turbine, generator, switchboard, sluice gates, and strainer rack, and the other sections of the work were carried out by direct labour.

Figure 7 is a general layout of the scheme, showing the ground level of the valley, the depth to which excavations had to be carried, and the arrangement of the dam and fish pass.

Figure 6 gives a vertical section of the power house. The turbine is of the Francis vertical-shaft type, designed to

develop 120 h.p. at 270 revolutions per minute, when working with a fall of 15 ft. The generator is also of the vertical-shaft type, having an output of 700 amperes at 120 volts, and is direct coupled to the turbine.

Two 0.75 in. paper insulated lead-sheathed and steel armoured cables are laid direct in the ground. These connect

ELECTRICAL NOTES FROM INDIA.

(FROM OUR BOMBAY CORRESPONDENT.)

It is understood that the directors of the Bombay Electric Supply & Tramways Co., Ltd., have decided not to proceed with the installation of two 6,000-kW Curtis turbines, condensing plant, and the necessary boilers, &c. (already purchased in England), but to take energy in bulk for the present from the Tata Hydro-electric Supply Co., Ltd., to meet the demands for power in Bombay.

This decision is doubtless the result of the prevailing price of coal in India, something like Rs. 25 per ton being paid at present for coal used at their Kussara power station.

As previously noted, the Tata Hydro-electric Supply Co., Ltd., furnishes some 3,000 kW during the evening, to assist the B.E.S. & T. Co. over the peak, this supply being taken to the Esplanade sub-station of the Tramways Co. and there transformed.

At present no means exist for paralleling the two systems (except on the d.c. side of converters), but there is nearing completion at Kussara, a small sub-station containing three transformers, each of 150-kVA capacity, which will be used as regulators, to enable the Tramways Co. to parallel with Tata's for a brief period while certain Kussara feeders are being changed over from one supply to the other. These regulators are necessary, as the supply from Tata's is at 6,600 V, and that from the Kussara power station 5,500 V.

The rating of these regulating transformers is somewhat misleading, the 150-kVA capacity of each regulator representing the load only, as between the 5,500 V and the 6,600 V supplies, and not the main supplementary supply.

The capacity of the Kussara power station is at present 15,000 kW, made up of:—

- One 6,000-kW Curtis turbine.
- Two 2,000-kW Brush-Parsons turbines.
- Two 1,000-kW Brush-Parsons turbines.
- Three 1,000-kW Brush E.E. Co.'s reciprocators.

But the B. & W. boiler equipment is inadequate for more than about 10,000 kW, i.e., allowing for the necessary number of boilers being out of commission for overhaul, hence the need for the additional supply in bulk from Tata's.

The temporary illuminations for the Prince of Wales's visit in November have had to be curtailed somewhat, though certain facilities have been granted to the Taj Mahal Hotel (Bombay's chief caravanserai) for extra power.

Certain extensions are in hand in the northern part of Bombay Island, to cope with the demand for power, which extra load will be taken from Tata's as occasion demands; but the two systems will not be operated in parallel, except at the moment when the load on certain feeders is being transferred.

HYDRO-ELECTRIC DEVELOPMENT IN SOUTHERN INDIA.

The limited supplies of coal, and other kinds of fuel in

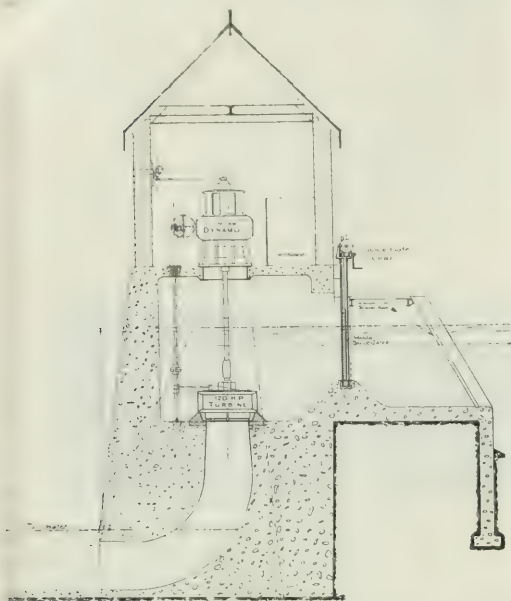


FIG. 6.—VERTICAL SECTION OF POWER HOUSE AND DAM.

the generator to the main switchboard in the power house at the Asylum, where steam plant has been in use for a number of years. This power house contains three 35-kW steam dynamos, which in the past have supplied 85,000 kWh per annum for lighting and power purposes.

The water power installation will now be used in place of the steam plant, and it is intended to install additional electrical

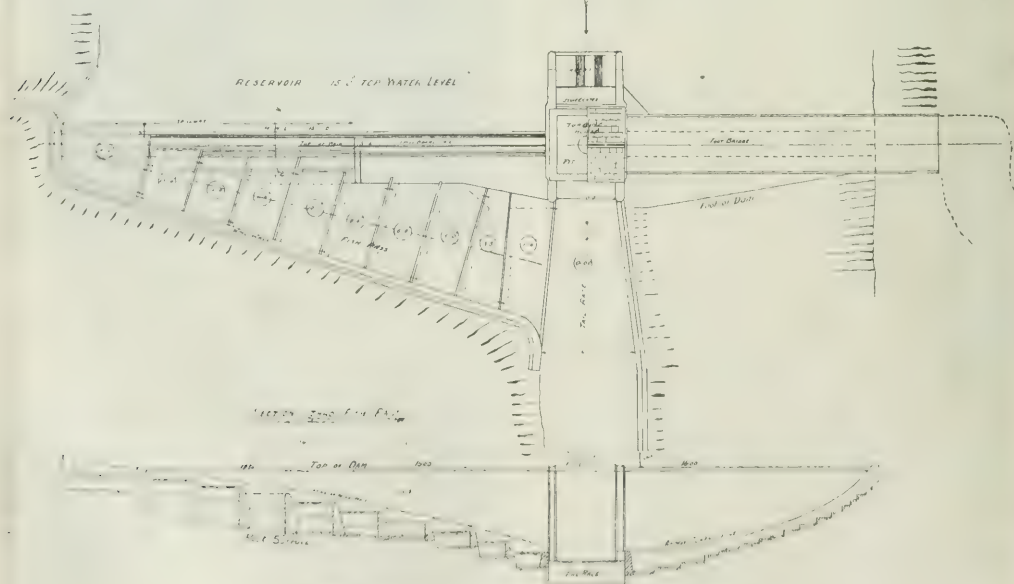


FIG. 7. PLAN AND ELEVATION OF DAM AND FISH PASS.

apparatus so as to utilise to the full the possible output of the hydro-electric installation.

We are indebted to Mr. S. E. Britton for the photographs and particulars embodied in this article.

India, coupled with the prevailing high prices of these commodities, has inevitably drawn the attention of the Government and of electrical men in general, to the tremendous resources of power which India possesses in its rivers. The develop-

ment of industries was rendered difficult, without an abundant and cheap supply of power; and this lack has retarded, as much as anything, the expansion of Indian industrial life.

The great house of Tata realised this, and directed its energies to the harnessing of falls on the Bombay side, as stated here recently.

These notes are devoted chiefly to a *résumé* of the hydro-electric undertakings at present in operation, and projected, in Southern India.

The Kaveri hydro-electric scheme at Sivasamudram in Mysore has been in operation since 1902, and has received some notice in the technical Press. Originally designed for a capacity of 4,000 kW, this power station is to be increased to some 32,000 kW by means of a dam. At a site known as Kanambadi, a dam some two miles across has been built. The first stage of this work will increase the water supply to 750 cuses in the summer months; and the second stage will further increase this to 900 cuses, ensuring a constant supply which will develop 32,000 kW.

A great difficulty with nearly all Indian rivers is that the flow is not regular and constant, and in dry weather some rivers completely dry up; therefore in order to carry out useful hydro-electric schemes, it becomes necessary to dam these streams, and conserve the enormous quantities of water which come down in the monsoon.

This is what is being done at Kanambadi, and it will enable the supplies of electricity to the Kolar gold fields, the cities of Bangalore, Mysore, &c., to be considerably augmented.

There are several other projects in connection with the same river (says the *Times of India Engineering Supplement*) where advantage will be taken of some important falls on a tributary. It will thus be seen that the Mysore State is taking full advantage of the Kaveri river, which is such an asset to the country.

It was one of the Dewans (Prime Ministers) of His Highness the Maharajah of Mysore, who held office from 1883 to 1891 (Sir Sheshadri Iyer) who first launched the above undertaking. He enlisted the assistance of the best engineers he could find; and it speaks well for their enterprise and skill that the project has proved so progressive since its inauguration.

It appears that the existing turbines are to be replaced with new Francis turbines; that the l.p. busbars are to be duplicated; and that the step-up transformer house is to be removed from the head of the cliff, and reconstructed and extended as a part of the present generating station.

The Government of India, a few years ago, appointed officers to carry out a hydrographic survey of India. Though in the time specified it was not possible to do more than give a superficial report of the great possibilities, it was quite clear that their survey opened up many new avenues, if funds should become available for carrying out the suggestions.

The *Times of India Engineering Supplement* has just referred to several other schemes which are contemplated, or in operation. One of these is for the harnessing of the Geroppa Falls. Though the amount of water coming over these falls is much less than some of the more famous ones in Africa and America, the fall is said to be one of the largest in the world. The river Sharavathi has a sheer drop of nearly 900 ft., and forms certainly one of the impressive sights in the world. A scheme has been worked out whereby the waters of the river will be dammed at some distance above the falls. The financial aspect of the scheme, and the doubtfulness of the demand within a reasonable distance have caused the scheme to be held up, but "it would form one of the greatest schemes in the East if it were carried through." "Mysore is in the van in hydro-electric schemes, and the advantage is already felt in the revenues of the State. If these schemes are carried out it will then be possible to carry on the smelting of the iron at the Bhadravarati works some 60 miles away."

A much smaller scheme referred to relates to streams flowing down the Nilgiri Hills to the plains. One of these rivers was dammed at a place called Kateri, above a place where the river takes a great leap of several hundred feet. The Government of India had built at a distance of four or five miles from this place a large cordite factory, where all the cordite used in India was made. The power required for working this large works was obtained from the generating station near the fall. The dam is 38 ft. high, and there is an effective head pressure of 620 ft. This is the first of several larger schemes which are to be carried out by the Tata Co.

Another hydro-electric scheme in South India is one situated at Gokak. Here one of the tributaries of the Kistna falls over a high rock, nearly 200 ft. high. The name of the river is the Chatparba. During the monsoon this fall is one of the finest in India, for a mighty volume of water flows over the rock. The supply required for the generating station is taken off at a point a couple of miles above the falls and is conveyed by channels to a point on the right bank of the river, where it falls over the rock. Here the station has been built, which supplies the generating power needed for the large cotton mills built in the vicinity.

During the hot season very little water passes over the falls, for practically all the supply is needed for the turbines. These schemes, says the writer, show that the people are awakening to the value of hydro-electric power for the development of industrial life, and there are signs that the progress will be much more rapid in the future than up to

date. India needs all the "white coal" she can procure, and she needs men of wide views and enterprise to develop the great possibilities that lie in the many rivers she possesses.

IMPORTS OF NEW ZEALAND.

The following table shows the values, and in certain instances the quantities, of electrical and allied goods imported into New Zealand in 1920, according to the recently issued official trade returns. The figures for 1919 have been given for purposes of comparison, and notes of increases or decreases added.

		1919	1920	Inc. or dec.
<i>Electric batteries and cells.—</i>				
Total	£	13,000	44,000	+ 1,000
From United Kingdom	£	6,000	15,000	+ 9,000
„ United States	£	35,000	29,000	- 7,000
<i>Generators, motors and transformers.—</i>				
Total	£	103,000	241,000	+ 138,000
From United Kingdom	£	34,000	103,000	+ 69,000
„ United States	£	68,000	134,000	+ 66,000
<i>Insulated cable and wire.—</i>				
Total	£	122,000	289,000	+ 167,000
From United Kingdom	£	70,000	237,000	+ 167,000
„ United States	£	9,000	23,000	+ 14,000
„ Japan	£	40,000	6,000	- 34,000
<i>Electric lamps.—</i>				
Total	£	77,000	97,000	+ 20,000
From United Kingdom	£	16,000	34,000	+ 18,000
„ Netherlands	£	21,000	24,000	+ 3,000
„ Japan	£	3,000	1,000	- 2,000
„ United States	£	36,000	37,000	+ 1,000
<i>Carbons in blocks.—</i>				
Total	£	23,000	13,000	- 10,000
From United Kingdom	£	8,000	6,000	- 2,000
„ United States	£	14,000	6,000	- 8,000
<i>Other electrical material.—</i>				
Total	£	191,000	250,000	+ 59,000
From United Kingdom	£	41,000	112,000	+ 71,000
„ United States	£	135,000	114,000	- 21,000
„ Japan	£	8,000	11,000	+ 3,000
<i>Electricity meters.—</i>				
Total	No.	6,000	10,500	+ 4,500
From United Kingdom	No.	12,000	32,000	+ 20,000
„ Switzerland	No.	1,200	5,200	+ 4,000
„ Sweden	No.	3,000	20,000	+ 17,000
„ United States	No.	800	900	+ 100
„ United States	No.	1,140	2,400	+ 1,260
„ United States	No.	3,900	5,000	+ 1,100
„ United States	£	7,750	9,400	+ 1,650
<i>Recording and testing instruments and meters.—</i>				
Total	£	6,000	12,000	+ 6,000
From United Kingdom	£	3,000	9,000	+ 6,000
„ United States	£	3,000	2,000	- 1,000
<i>Telephones and accessories.—</i>				
Total	£	112,000	39,000	- 73,000
From United Kingdom	£	14,000	28,000	+ 14,000
„ United States	£	98,000	8,000	- 90,000
„ Sweden	£	3,000	3,000	-
<i>Copper wire, bare.—</i>				
Total	£	26,000	51,000	+ 25,000
From United Kingdom	£	21,000	53,000	+ 11,000
„ Japan	£	2,000	2,000	-
„ United States	£	2,000	6,000	+ 4,000
<i>Iron telegraph and telephone wire.—</i>				
Total	tons	144	24	- 117
„ United States	tons	5,300	646	- 4,654
„ United States	tons	330	646	+ 316
<i>Gas, oil and hot air engines, other than for traction.—</i>				
Total	£	66,000	118,000	+ 52,000
From United Kingdom	£	32,000	62,000	+ 30,000
„ United States	£	31,000	50,000	+ 19,000
<i>Steam engines over 1,000 i.h.p.—</i>				
Total	£	—	6,000	+ 6,000
From United States	£	—	6,000	+ 6,000
<i>Steam engines, 1,000 i.h.p. and under.—</i>				
Total	£	6,000	13,000	+ 7,000
From United Kingdom	£	5,000	9,000	+ 4,000
„ United States	£	1,000	4,000	+ 3,000
<i>Steam boilers, over 500 i.h.p.—</i>				
Total	£	1,500	2,000	+ 500
From United Kingdom	£	1,500	2,000	+ 500
<i>Steam boilers, 500 i.h.p. and under, feed-water heaters, &c.—</i>				
Total	£	8,000	28,000	+ 20,000
From United Kingdom	£	8,000	28,000	+ 20,000

“DELAS” AIR EXTRACTORS.

THE “Delas” system of air extraction, manufactured by Messrs. Cole, Marchent & Morley, Ltd., under license from La Société Condenseur Delas, of Paris, has been developed with the object of securing stability of operation and increased efficiency.

It is known that, other things being equal, the degree of vacuum depends on the distance, signified by D in fig. 1.

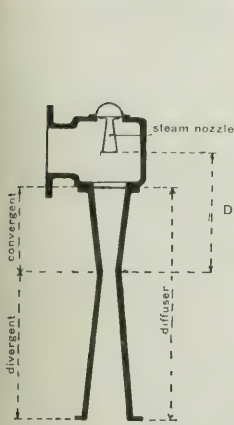


FIG. 1.—DIAGRAM ILLUSTRATING DEGREE OF VACUUM.

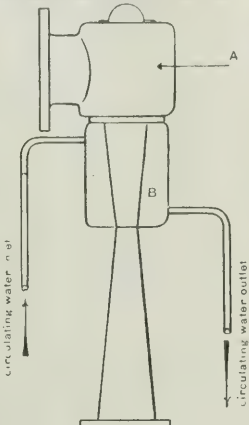


FIG. 2.—EXTRACTOR FITTED WITH WATER JACKET.

between the throat of the diffuser and the end of the steam nozzle. By increasing this distance the friction surface and the weight of air withdrawn are increased, and a higher vacuum is created. If the distance becomes too great, a drop in vacuum is noticed, and at the same time an ever-increasing rise in the temperature of the convergent resulting in the failure of the extractor. The inventor was thus led to believe that failure started with this increase in temperature, and

11 inches. The circulating water was then introduced and at once the vacuum rose to 28 inches. Normal working commenced with perfect stability and, better still, when the nozzle was further removed, a still greater weight of air was drawn, which caused a corresponding increase in the vacuum. This modification has also simplified manufacture and enabled a very high vacuum with absolute stability to be obtained, and at the same time an almost isothermic and very economical working of the extractors.

It will be seen from the above, and it has been proved by careful experiments under varying conditions of steam pressure and air extraction, that a water-cooled convergent parallel diffuser has a degree of stability such that failure is practically impossible even with very low steam pressures at the nozzles and a largely-increased amount of air extracted.

It is well known that the extracted air is compressed to atmospheric pressure in the diffuser. In a convergent divergent ordinary diffuser the compression is adiabatic, and the temperature at the discharge outlet shows an appreciable degree of superheating, in cases as much as 518 deg. F. total temperature. In the “Delas” air extractors having a cooled diffuser, the discharge temperature is between 212 and 215

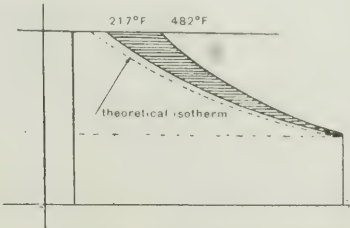
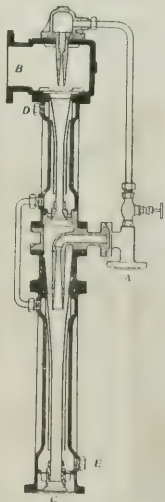
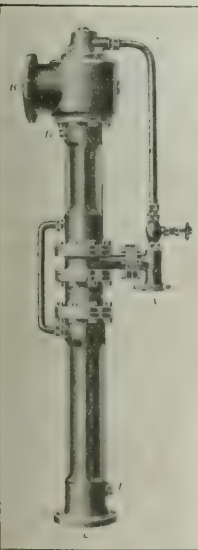
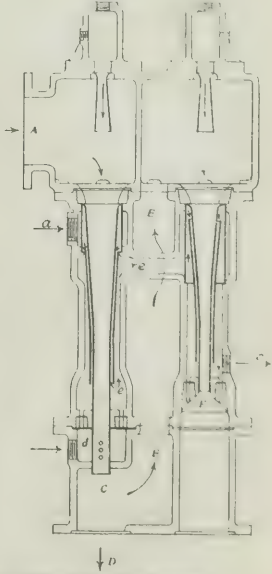
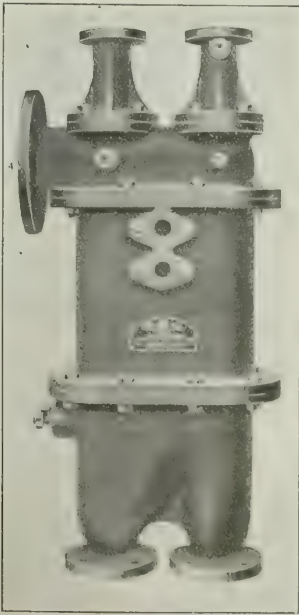


FIG. 3.—WORK RENDERED UNNECESSARY BY COOLED DIFFUSER

deg. F., which practically corresponds to atmospheric pressure. The compression line is, therefore, in the first case adiabatic, as the upper curve in fig. 3, and in the second case, that is with a cooled diffuser, isothermic, i.e., as the adjacent line. The shaded area between these curves represents work which the water circulation renders unnecessary, thus showing an increase in the efficiency of the apparatus, and enabling it to do the same duty with a reduced steam consumption.



FIGS. 4 AND 5.—DOUBLE STAGE EXTRACTOR WITHOUT INTERMEDIATE CONDENSER.



FIGS. 6 AND 7.—EXTRACTOR WITH INTERMEDIATE CONDENSER.

would be obviated if the convergent were kept cold. He proved this in the following manner:

An extractor A, see fig. 2, was fitted with a water jacket i.e., encircling the convergent and was at first started up without the water being introduced. The distance between the steam nozzle and the throat of the diffuser was gradually increased until the apparatus failed, when the vacuum registered only

Three types of extractor are manufactured. The first is a single stage extractor, the second a double compression stage extractor with a single nozzle on each stage and total recuperation of heat units in the feed water, while the third is supplied with an intermediate condenser, likewise with two compression stages and a single nozzle at each stage, the heat of the second stage being always recoverable.

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TEACHING THE TRUTH.

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THE presidential address of Mr. W. L. Hichens to the Economic Science Section of the British Association was, as we remarked, one of several attempts that have recently been made to explain to the workers, and to the general public, the operation of the laws which govern business enterprises. Sir W. J. Noble, in a letter published in *The Times* of September 17th, urged all employers to summon their workpeople together, and to impart to them knowledge of economic truths. Sir Alfred Yarrow, in a recent issue of the same newspaper, contributed an important article on the industrial situation, showing the urgent need for our being able to sell our goods to other countries in order to be able to buy from abroad the five days' supplies which every week have to be imported in order to satisfy the demands of our population for the common necessities of life.

There can be no doubt that the greater part of labour unrest and discontent is the outcome of sheer ignorance of how things work. There are those, of course, who would destroy for destruction's sake; and there are also those who would trace, in all agitations, in every sign of difference of opinion between employers and employed, the subtle hand of the destroyer. It is, however, ignorance that leads to the supposition that restriction of output brings about prosperity in the shape of high wages. The trade unionist—we have heard him—says: "There are bootmakers out of work because too many boots have been made. Don't make so many, and spread the work out, and so employment will last longer." If he could realise that such restriction of output put up the price of boots, not only by the extra amount paid in wages for each pair, which would, generally speaking, be in direct proportion, but also by an entirely disproportionate amount of standing charges which can only be absorbed by the product, he would see that less boots than ever could be bought. For this reason demand would fall, and a vicious circle would be set up which could only be broken down by a complete reversal of the methods adopted in the hope of improving matters. Let boots—or any other manufactured product—be sufficiently cheap, and more can be sold. Individual consumers will buy more freely, and more buyers will arise, so that trade will increase to a greater extent than the prices have fallen. With increase of trade, both employment and profits will increase.

Again, knowledge of the truth would dispel the fallacy that the whole of the difference between cost of production and selling price is profit. Of the selling price of a piece of electrical machinery, only a small part consists of direct labour in the works of the electrical manufacturer. He has to buy his laminations from the sheet-iron worker, his insulated wire from the copper wire manufacturer, his insulating material from the paper mill, rubber factory, or porcelain works, his castings from the foundry—the list could be extended indefinitely. Workers in all those industries have to be paid, standing charges on all those factories have to be met, the capital employed has to be paid for, before the workman in the electrical factory can do a hand's turn at the final product. And when the machine stands on the floor of the factory, complete and ready to be dispatched, it cannot be sold for the amount it has cost up to that moment. There are the overhead expenses of the factory itself to be met—rent, rates and taxes, cost of power, cost of supervision, maintenance, tendering and selling, accounting and collecting, provision for replacement of plant, for bad debts, and numerous other things which will occur to the minds of our readers. All these

must be paid in full before investors of capital receive a penny. Yet labour frequently supposes that the rewards of capital are disproportionately large as compared with those of labour. The truth is that the amount paid in direct wages exceeds, many times over, the amount distributed in dividends and interest. The sharing of profits between employers and employed leads to insignificant benefit to the worker, while tending to reduce the reward of capital to such a point that money for investment is not forthcoming. There is a school of thought which teaches the sterility of money, and that payment for its use is wrong. No system that has yet been evolved provides any satisfactory alternative. The confiscation of accumulated wealth leads to the state of things now seen in Russia, whose starving millions would gladly grow corn enough for themselves and to send us in exchange for agricultural machinery, were there any means of organising and utilising their efforts. Without one of two things, a regular income or some accumulated capital, it is impossible to live from day to day. The wage-earner, in normal times, has continuity of employment, and a regular income in the form of wages; the individual trader has to pay those wages and to maintain himself through bad times as well as good, and if his banking account will not stand it, he goes to the wall. The Russian peasant has no accumulated wealth, and since there is no one left to pay him a regular wage, he starves to death.

This is no time for sticking at details. When business, as now, is not obtainable at prices which will allow of the payment of the present rates of wages, even when profits and standing charges are neglected, then wages must come down. The situation now is that export business cannot be obtained at anything above the bare cost of material and labour, and unless matters speedily improve the same will be true of the home trade. Trade union restrictions must go. Demarcation between trades has been carried to an absurdity, and even when there was work for all they were definitely injurious. In these days of scarcity, the extra cost of calling in extra workmen to finish off a job that one workman of average ability could do by himself, is often sufficient to prevent the job from being done at all.

Workers to-day would be well advised to devote their attention to work. We cannot get orders at the present high costs. The demand for goods exists—we referred months ago to Sir Robert Hadfield's statement that there is a world hunger for steel. There is a world hunger for everything that can be manufactured, but it must be satisfied at the prices people can afford to pay.

The Work of the Electricity Commissioners.

THAT the Electricity Commissioners did not suffer from lack of occupation during the first 14 months of their constitution was generally understood; the proof is now in our hands in the shape of their first annual report, a perusal of which compels the conclusion that they must have been amongst the busiest men in the Kingdom during the period concerned. Unfortunately that period ended six months ago, so that many matters which were under consideration are only dealt with fully up to the point they had then reached, though in some cases the course of subsequent events is briefly indicated in foot-notes. An abstract of the voluminous record is commenced elsewhere in this issue.

Apart from an historical *résumé* of the development of the electricity supply industry in this country up to and including the appointment of the Commissioners, the report consists of a mass of detail under numerous sub-heads. Referring to the reorganisation of the supply of electricity, the prime motive of their constitution, the Commissioners regretfully remark that progress in this direction must be gradual, and that in view of the innumerable difficulties in the way, the high hopes of the Electric Power Supply Committee are not

likely to be realised as rapidly as was anticipated. The principal obstacle is, of course, the scarcity of funds, and this will probably keep the brake on progress for some years to come. Reasons are also given for the delays inseparable from the procedure laid down by the Act of 1919 in connection with the initiation of new schemes for electricity districts, from which it appears that even in the most favourable circumstances, considerable time must elapse between the provisional determination of a district and the approval by Parliament of a scheme for the district. This is cold comfort for the many districts which have not yet got beyond the stage of delimitation. However, the Commissioners are doing their best to shorten the proceedings, to induce promoters and objectors to curb their appetite for desultory debate at the inquiries, and to reduce the second local inquiry required in each case to a formality.

Into the record of achievement we can scarcely dip without going overhead; but we may note that the Commissioners have authorised the erection of new generating stations having an initial capacity of 150,000 kW, and extensions of existing stations aggregating 547,000 kW; they have sanctioned expenditure by municipal authorities exceeding 15 millions sterling, and numerous schemes for mutual assistance, and they have carried out an immense amount of routine administrative work, as well as their advisory duties in connection with the Ministry of Transport.

One of the strongest features of the system created by the appointment of the Electricity Commissioners is the fact that they are not political heads of departments, at the mercy of permanent officials—mere figure-heads; they are themselves the active working officials, informed with knowledge and experience of the position and needs of the industry, and keenly anxious to promote the interests of the industry together with those of the public. They have many difficulties to contend with, not a few of which are legacies from past legislation which, owing to the exigencies of parliamentary procedure, they have not yet been able to remedy, and a somewhat plaintive note of restiveness is here and there discernible in the report. But they have bent themselves to their Herculean task with a zeal and energy that compel admiration, and a courtesy and consideration that win the goodwill of those who come in contact with them; and in congratulating them upon the record of their first year's work, we may add an expression of confidence in the successful outcome of their efforts to reorganise and uplift the industry of electricity supply.

Charges for Supply and Industrial Councils.

No. 5 District Industrial Council (West Midlands area) is urging the various District Councils and the National Council to press for statutory powers to be conferred on the Ministry of Transport, so that in granting any Order authorising increased maximum prices to undertakings it can make it conditional on the undertakers giving effect to all the recommendations of their District Industrial Council. The intention of No. 5 Council is commendable enough, but what it proposes is obviously out of the question. Nothing can be done in this way, of course, except by Act of Parliament, and it is clearly outside practical politics that an Act of Parliament should be passed giving the Minister of Transport power and responsibility with regard to wages in the electricity supply industry, and this only in respect of those undertakings which required an increase of price, leaving the rest of the industry outside his purview. Again, it is difficult to see how an Order could be made "conditional" upon such an indefinite qualification as fulfilling the recommendations of a District Council. As a matter of fact, the whole matter had already engaged the attention of the National Council, with the result that the Ministry of Transport pointed out that everything reasonable had been done to safeguard the interests of the District Councils through the special provision by which the District Councils were given a status for making representations whenever any

undertaking applied for increase of maximum price. The Ministry referred to the satisfactory working of this arrangement, and clearly intimated that the further suggestion would not receive support.

As the matter stands at present, the payment of wages according to the District Councils' schedule is one of the factors which is taken into account by the Electricity Commissioners when granting an increase of price, and so far the Electricity Commissioners have done everything in their power to support the payment of wages according to the schedules of District Councils.

No. 5 Council also includes in its proposal a suggestion that some means shall be devised whereby "Industrial Councils can give effective support to applications from undertakers for orders to increase maximum prices where it appears that without such increase authorities are unable to pay standard rates or observe standard conditions without incurring a loss on working." The exact bearing of this is somewhat enigmatic, but it is obvious that No. 5 Council thinks that if it could give what it calls "effective support" better maximum prices would be got than are obtainable at present. The Council can, of course, support any application made for an increase in charges, and this is taken into account by the Electricity Commissioners. The further implication in the words "effective support," therefore, does not, we think, carry a proper suggestion, seeing that every case is most fully gone into by the Electricity Commissioners, who already take into account the representations of District Councils. There are, obviously, certain cases where the Commissioners' hands are tied by existing legislation, and where they cannot give increases of price adequately to meet the needs of an undertaking, but no amount of "effective support" can alter this. Everyone knows that the Commissioners themselves deplore their inability as much as anybody, but until further legislation is passed nothing can be done. Altogether, although we sympathise with the objects of both of the suggestions made by No. 5 District Council, we are afraid it has not yet found out a practicable path towards the ends in view.

It is satisfactory to observe that the **Gas on Trains.** French Government has decided that the use of gas as an illuminant on railway trains must come to an end. The Minister of Public Works and Transport, M. le Trocquer, has issued a circular which decrees that before January 1st, 1923, gas lighting on express trains must have entirely disappeared. On suburban trains, electricity must be the sole lighting agency by the beginning of 1924, and in another year, or by January 1st, 1925, all other trains must be lit by electricity. A similar step was contemplated in 1914, but action was delayed by the war.

The Batignolles tunnel disaster, where two crowded trains collided, and were then set on fire through the ignition of gas from a tank broken in the collision, has been the means of teaching a lesson which has been promptly taken to heart. As a result, in three years from the end of the present year, it will be impossible for such a catastrophe to occur in France. The use of double-decked steam railway carriages is, fortunately, not common in this country, the Mumbles Railway, which consists of a train of tramcars drawn by a steam locomotive, being the only example that occurs to us.

Fire as a concomitant of railway disasters, however, is by no means unknown in Great Britain, and it is obvious that if gas is used on trains it stands a great chance of being ignited. This risk should long ago have made the British Government take the necessary action to compel its abolition. There is no reason for the use of gas, for the Great Northern Railway has equipped a restaurant train with electric cooking devices. All railways should follow, that example, and a time limit for the accomplishment of the change should be fixed.

We should not advocate Government action but for the fact that uniformity is unlikely to be attained without it. While the boards of railway companies include

influential gas magnates, such individuals will advocate the use of gas for lighting and cooking. The furthering of the exclusive use of electricity for these purposes on trains is a line of action that might very well be pressed by the British Electrical Development Association.

The question of the resumption of **The Norwegian Electrochemical Industry.** production by the electrochemical works in Norway is now under consideration. Only a few of the 15 works were kept in operation during the past summer, as difficulties were encountered in effecting sales, together with exchange problems and economic troubles in the case of some works. It is, however, now considered desirable to restart activity, but the first condition lies in a reduction of the costs of production. The existing wages agreement, which expired on July 1st, 1921, rendered it impossible to work at a profit, and negotiations for a new agreement are expected to begin when the work of mediation in the cases of the saw-mill and paper trade disputes has been concluded. If the wages question can be satisfactorily solved, it is calculated that all the carbide works, aluminium works, &c., including the Odda works, will again be brought into operation. As for the latter, it is stated that the works cannot come into activity again unless the companies obtain facilities for raising a loan of £600,000 in England, and work in this direction is said to be proceeding with the support of the State Department of Finance.

We recently referred to the contract conditions of German syndicates, which **The German Insulating Tube Syndicate** compel their customers to accept delivery at any time suitable to the former, and at prices prevailing on the day of delivery, so that customers are at the complete mercy of the members of the syndicates. One of the latter was the Sales Bureau of the United Insulating Tube Manufacturers, the managers of which have since issued a reply to the charge of an abuse of their powers. They state that the members of the syndicate are compelled to impose such conditions as they themselves are bound by similar and, in some cases, by more strict conditions by the firms which supply them with raw materials for the manufacture of the tubes. Under the circumstances the tube makers claim to be in a position of defence in order to be protected against possible sudden changes subsequently and of losses of millions of marks; and they expect their customers in turn to exercise the necessary precaution for themselves in relation to their own clients. The syndicate draws attention to a report by the Berlin Chamber of Commerce in support of its policy. This report states that the course taken by the manufacturers of insulating tubes in 1919, and down to April in 1920, was extremely difficult both with regard to the acquisition of raw materials and in the matter of prices paid for them. Merchants suffered in common with makers and were only able to supply their customers in accordance with the deliveries on the part of producers and at the market prices at any time fixed by the latter. No trade custom, the Chamber remarks, has developed in the tube industry which would justify the purchaser in cancelling an order entered into, at non-binding prices. It is not usual in the insulating tube trade for the seller to inform the buyer of increases in prices before each delivery, and for the latter to refuse acceptance owing to the advance in prices, although a year may elapse between the placing of the order and the delivery, and prices in the meantime may have materially increased.

A German newspaper comment on the attitude of the syndicate is that the rights are all on the side of the tube makers, whereas they ought to be divided between the latter and their customers, and that if profiteering is avoided by makers a return to normal conditions will be facilitated.

JOHN SOMERVILLE HIGHFIELD, M.I.E.E., M.Inst.C.E.,

President of the Institution of Electrical Engineers, Session 1921-22.

To a great many people the happy coincidence of event with circumstance—as for instance when Christmas presents happen to arrive on Christmas Day—is always a source of satisfaction.

The Institution of Electrical Engineers has every reason to be satisfied that the circumstance of its year of Jubilee should coincide with the attainment not only of a Royal Charter, but of the patronage of the King as well.

The timing of this event is really more of a coincidence than the result of deliberate design, yet nothing else could so fitly celebrate the close of 50 years of the Institution's existence. The desire for a Royal Charter, in place of its then company constitution, loomed large in Mr. Wordingham's presidential programme, but circumstances prevented both him and his successor from doing more than discuss the scope and aims of the proposed charter. It has remained for Mr. Atkinson and his Council to crown a very strenuous and successful term of office by securing the double advantage to the Institution of a Royal Charter coupled with Royal patronage. The Institution has reason to be proud of the conduct, by its Past-President and Honorary Treasurer, of the negotiations, extending over several months, which have in so short a time, and at the end of a long and tiring parliamentary session, led to so satisfactory a result. Had a single set-back occurred in the sequence of negotiations, official investigations and formalities necessary to the granting of the Charter, the coincidence of Jubilee year with Charter would have been impossible.

Mr. J. S. Highfield, on taking over office on October 1st, stepped into this inheritance. It is appropriate that as chairman of the General Purposes Committee, to which the question of the Charter was referred by the Council, he has had an important share in framing the measure which will be completed during his presidency, for the Institution has to draft and submit to the Privy Council the By-laws under which it is henceforward to work.

And again, the Institution may be congratulated that such a task is in the hands of a President who not only is aware of, but may be counted on to use, all the experience on the question that has been accumulated during the past few years.

Mr. Highfield comes of engineering stock, his grandfather having been a civil engineer. Before he went to King's College, London, for his academic training in science and engineering, he passed much of his boyhood in the atmosphere of the workshop and the

laboratory, making with his father, who was an enthusiastic amateur mechanic and chemist, all sorts of mechanical and electrical apparatus, the two of them filling the house with ingenious devices. Among other things they built a sailing boat, and thus early laid the foundation of that intimate knowledge of sailcraft which provides the President with much of his recreation, and the ability to attack engineering problems from the sailor's point of view—often the simplest and soundest point of view. It has been said that if the President were wrecked on a desert island he would build a boat and make a sail for it before he built a hut to live in.

At King's College he was a student under John Hopkinson, and at the end of the course remained as his demonstrator and research assistant for another year.

After some time with the Chloride Electrical Storage Co., where he was able to practise on a large scale much of the battery work he had done as a boy in his father's workshop, Mr. Highfield got drawn into the electricity supply industry. First at Stafford and then at St. Helens he applied the principles in which he had been so thoroughly well grounded under Dr. John Hopkinson.

At Stafford he designed the Highfield booster, which added greatly to the life and usefulness of secondary batteries on variable loads, and although a more rapid reversal than the Highfield principle permits is now available, for all but the most rapid load reversals the Highfield booster still provides a complete automatic control for secondary

batteries. The most interesting application of the booster was in connection with the City & South London Railway—the first genuine electric railway—when it was worked on Hopkinson's 5-wire direct-current system.

Mr. Highfield's most important electricity supply work was done with the Metropolitan Electric Supply Co. First as chief engineer and next as engineer and manager, he from the start adopted the principle of concentrating the generating plant at the Willesden station coupled with the shutting-down of the plants scattered over the supply area. In the first three years of his service with the Metropolitan Co. he increased their profits by £100,000. Mr. Highfield still holds the position of consulting engineer to the Metropolitan Electric Supply Co.

Great Britain became wealthy when she developed her overseas trade. On the security of that overseas trade her population increased far beyond the capacity of Great Britain to supply that population with food,

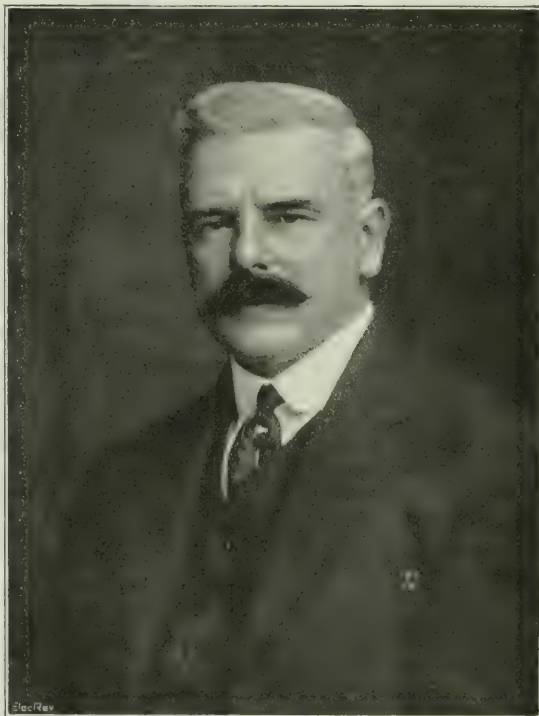


Photo.

JOHN SOMERVILLE HIGHFIELD.

Ellott & Fry.

and our present troubles from unemployment are largely due to the failure of that overseas trade.

The art of successful trading probably demands as much imagination and invention in its votaries as the art of architecture, though the imagination is of a different order, but outside the body of traders themselves the British community understands very little about trade. Mr. Highfield has always been a student of the art of trading, and has applied its principles to trading in electricity. At the present time, when electricity supply and its future conduct are occupying the time and thought of the industry and of the Government department set up to improve it, his paper on "The Supply of Electricity," read before the Society of Arts in May, 1919, is a contribution to the subject which will repay careful study. The principles of trading in electricity there laid down are the results of the President's experience with the Metropolitan Electric Supply Co. and the Cornwall Electric Power Co.

From the supplier's point of view the Cornwall Electric Power Act is the most comprehensive in the country since the Power Co. can both supply and distribute all over the county with the exception of two boroughs. As their consulting engineer, Mr. Highfield designed their power station at Hayle and the overhead transmission system. The company paid a handsome dividend in the second year of its existence.

Monsieur Thury's system of high-pressure direct-current transmission, with the motors of the sub-station motor-generators in series, made a deep impression on Mr. Highfield. He read three papers on the Thury system before meetings of the Institution—in London, in Glasgow, and in Paris—and installed a section as part of the Metropolitan Electric Supply Co.'s system. But reasons other than its technical success or otherwise determined the fate of the Thury system in this country, successful as it had been and still is in the Rhone Valley. The Thury system of high-pressure direct-current transmission is only one application of the high-pressure direct-current principle, and Mr. Highfield

and his brother have never ceased to work at other applications. Should their present efforts be crowned with success several difficulties inherent in 3-phase transmission would be overcome, and the cost of transmission, which now bulks so largely in the price of electricity when distances are measured in scores of miles, would be materially reduced.

His knowledge of the sea naturally led Mr. Highfield, during the war, to devote his energies to submarine detection, his work resulting in a towed "fish" for sound detection by hydrophone and a siren above audible frequency for detection by echo. These devices may have no permanent application, but in another field he established an experimental factory for the electrolytic purification of clays in the colloid state, which may ultimately have many commercial applications. The method was devised, however, as a war measure to help the glass industry, seriously handicapped by the want of suitable clay crucibles.

The President has already served three terms as a member of the Council of the Institution. His term of office as a vice-president was divided into two periods by the rule governing the retirement of vice-presidents which happily gives both himself and the Institution the advantage, which he would not otherwise have had, of stepping from Vice-President to President, familiar with the last Council and its work.

Mr. Highfield's position and experience as an engineer and as a man of affairs, and his long service on the Council, fit him in every way for the responsible and arduous post of President of the Institution. He can feel assured of the sympathetic good wishes of the industry during his term of office, and of the co-operation of all those, his fellow workers in electrical engineering, who wish well to the use and development of electricity in this country, the importance of which has so recently been recognised by the State through the patronage of the Institution by the King and by the granting of a Royal Charter by his Privy Council.

ELECTRICITY IN ISOLATED BUILDINGS.

By E. H. FREEMAN.

It is unnecessary to-day to argue in favour of the use of electricity in town buildings where a supply is available from street mains. The matter has been discussed and settled long ago, and the only deterrent is the cost of installation, which will gradually be reduced so that electric lighting and heating will be practicable for any type or size of dwelling. It is, however, not always realised how much stronger the arguments become when the case of the isolated building, remote from the amenities of town life, is considered. Difficulties of water supply; the waste and work involved in keeping a kitchen range burning all day to boil the afternoon tea kettle; servant troubles; cost of decorations, and many other daily trials, are all really arguments in favour of an electrical installation. Once a supply is available the pumping can be carried out by power—direct from the engine or from a motor; the tea kettle can be boiled from the battery; house work is eased by the use of a vacuum cleaner or an electric iron; labour is saved by the abolition of paraffin lamps and the reduced dust from fires; and redecorating can be put off another year or two without loss of self respect.

These points have all carried weight in the past, but the electrical plant has been regarded as a luxury, to be installed in the large country mansion, and treated as out of the question for the smaller house or farm in which 60 to 80 lights represents the total connected load. Increased cost of labour, fuel, and other essentials is, however, gradually bringing home to these smaller users the fact that the electric light plant is an economy in the long run, and some consideration as to the details

of the most suitable installation may, therefore, not be amiss.

Ignoring the rare occasions when reliable water power is available, the prospective purchaser is at once faced with a host of alternatives. Is the fuel to be paraffin,



FIG. 1.—A COUNTRY HOUSE LIGHTED WITH ELECTRICITY.

petrol, crude oil, or gas? Is he to install an automatic, semi-automatic, or non-automatic plant? Is a vertical high-speed engine better than a horizontal low-speed engine of the type with which he is often already more or less familiar. These and many other questions are difficult problems for the non-technical buyer—and often for the experienced engineer as well, for that matter.

As regards fuel, it is very unlikely that gas will be available in an isolated building such as is being considered. If it is, part of the argument for the electrical plant disappears, but if gas is available the gas engine will usually be found most convenient, being lower in first cost and generally cheaper to run than the oil engine. If a gas supply is not available, the relative advantages of petrol, paraffin, and crude oil need consideration as, for such small plants, suction gas or steam will rarely be found advantageous. For engines of, say, 10 h.p. and over, crude oil will probably be best; the running costs in this case are less than with the paraffin engine, and the saving in fuel will pay for the extra initial cost, with interest and depreciation, within a few years. With the smaller engines with which we are mainly concerned, however, the ad-

there has been a large increase in the number of automatic sets on the market, many of them of American origin, and the advisability of adopting such plants needs consideration.

At first sight such sets seem very tempting, particularly to the non-technical buyer. The "you-touch-the-button-and-we-do-the-rest" principle seems to provide a simple solution to the difficulty of having a man of some sort to run the plant. Then the whole plant is delivered "complete" and the advertisements give the impression that the ordering of the plant completes the lighting installation. The position is, however, not quite so simple as the advertisements imply. The ad-



FIG. 2.

FIGS. 2 AND 3.—ENGINE HOUSE, WITH SAW-BENCH DRIVEN FROM THE ENGINE.

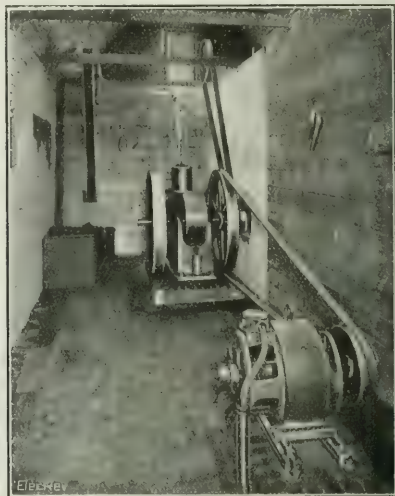


FIG. 3.

vantage is not so great. The difference in first cost is less, and there is frequently difficulty in obtaining small supplies of crude oil. The cost of fuel per annum is also so small in any case that it is not worth while adopting the more economical engine. Petrol is probably never likely to be adopted unless one of the small automatic or semi-automatic plants is installed. The petrol engine is certainly more expensive for fuel than the paraffin engine, and also has more wear and tear, as it is generally a high-speed engine. There is also some risk of fire with a petrol-driven set. The engine room may be left closed for hours at a time with the engine running, and a very small leak may cause an explosive mixture. Whilst it is impossible to lay down any hard-and-fast rule, it is probable that paraffin will be found most convenient for the great majority of installations.

The next important point is the type of plant to be adopted—automatic, semi-automatic, or non-automatic. With the first type the engine is usually started and stopped entirely by automatic devices on the switchboard; with the second the set is started when desired off the battery, by a push button, and frequently stopped automatically at the completion of the charge; with the third type the entire control is by hand. The last of these has been almost universally adopted until the last few years. Several makes of automatic and semi-automatic plants have been on the market for years, but although large numbers have been installed the non-automatic plant has held the field. Of late, however,

vantages of such plants are of the obvious kind, and are largely advertised, but one does not hear so much about the other side of the picture. A full automatic plant of what may be regarded as the normal type is designed to run the load direct off the engine. It includes a battery often of comparatively small capacity which is only



FIG. 4.—ENGINE HOUSE AND BATTERY ROOM.

used when two or three lights are in use, except for starting up the engine by motoring the dynamo. This it does automatically when the battery voltage drops below a fixed minimum. Several technical objections to such a plant are obvious. The engine must be large enough to deal with the maximum possible load for considerable periods. The average load is, however, not more than 30 per cent. to 40 per cent. of this, and the engine will, therefore, be working most of the time on this small

output. No engine can do its best under such conditions. Governing (and voltage regulation) will be bad, and the engine is likely to sputter and give trouble from this cause sooner or later. The plant will also be called on at times—for example, during most of the afternoon on a dull winter day—to run with only five or six lights in use out of, say, 50 or 60. Such a load is rather too much for the battery, but too small for the engine, and the plant is apt to alternate between starting and stopping with considerable strain on the battery, and much jumpiness of light due to the frequent and heavy variations in voltage. The strain on the battery also must obviously be severe, as the worst load, that of motoring the dynamo to start the engine, only comes on when the battery voltage is low, *i.e.*, when the battery is practically discharged and should have no further discharge at all.

These opinions, based rather on theoretical considerations than on actual experience, are supported by the fact that many of the makers of automatic plants have recently increased the capacity of the battery supplied—in some cases to a considerable extent—with the result that the apparent saving in first cost is now very small if it exists at all. In spite of the increased capacity, however, it is to be expected that the life of the battery of an automatic plant will be much less than with one hand-controlled.

Some of these objections apply more or less to the semi-automatic plants. Most of these are arranged for

Apart from all these technical objections, there is the generally admitted fact that small automatic devices are best avoided. Such plants as those under consideration are often used very intermittently. The small country house is shut for the winter, or the farm uses practically no light in the summer, and in such conditions automatic gear does not have a fair chance. The attendant also relies too fully on the magic word "automatic," and forgets the necessity of lubrication, fuel supply, and general cleaning.

On the whole, the writer is of opinion that the older type of plant with a standard horizontal paraffin engine, a belt-driven dynamo, and a storage battery of capacity to run the load for two or three evenings, will still be found the best in the long run. Small engines such as we are considering can be started up in quite a short time, and once started; can be left on charge with very little attention. The attendant will know fairly closely, from the ampere-hour meter and by experience, when the charge will be complete, and need not, of course, wait in the engine room all the time. The engine will always be running at practically full load under the best possible conditions, and this fully compensates for the loss of efficiency in taking all the load through the battery.

Such plants should have a switchboard with an ample number of stops for the battery, charge and discharge switch—seven or eight for a 50-volt and twelve to fourteen for a 100-volt installation—and an automatic cut-in

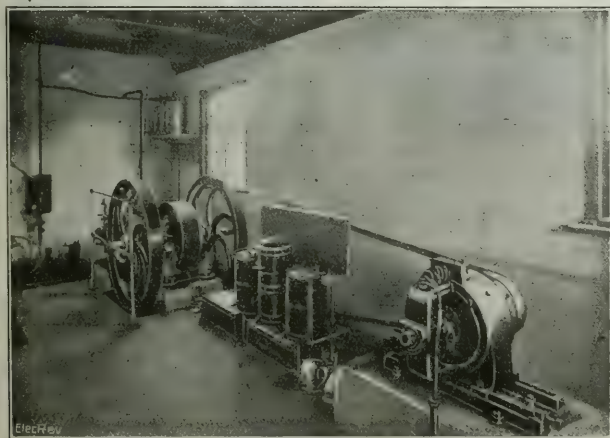


FIG. 5. A WELL-ARRANGED OIL-ELECTRIC PLANT.

starting up off the battery by motoring the dynamo, with hand-operated push-button control, and for automatic stopping of the engine on completion of the charge. There is no objection to the latter point except the difficulty of tuning up a single defective cell, or of regulating the voltage to suit the load or the state of the battery. The other devices are, however, likely to cause trouble though probably to a less extent than with the full automatic plant. A careful user will see that the battery is not fully discharged before starting up the engine, and there is, therefore, less strain on the battery, and a probable longer life. On the other hand, the regular failure to discharge the battery fully will gradually cause reduction in its capacity.

There is a further objection to both types of plant, namely, the difficulty of arranging for the occasional over-charge of the battery that is essential to its proper operation. This can, of course, be done with either type of plant, but only by hand control, and once this is admitted to be necessary, say, once a month or more, the full claims of automatic working disappear. This applies both to the automatic and the semi-automatic type of plant as this overcharge can only be given by cutting out the stopping device which is common to both.

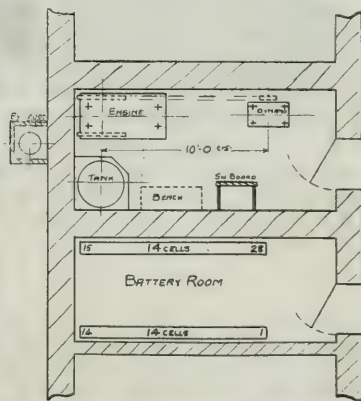


FIG. 6. ELECTRICAL PLANT INSTALLED IN AN EXISTING BUILDING.

and cut-out switch in the battery circuit. The battery should, of course, be fixed adjacent to the engine and not at the house, as proper attention to the battery is almost impossible with the latter arrangement.

Regulation of voltage by a booster would not be worth while on small plants, but it is possible that an adjustable series resistance in place of end-cell regulation might be worth while in some cases. It would make the battery charge and discharge switch unnecessary, whilst the adjustable resistance could be placed in the house and the voltage at the lamps regulated without any attendance being required at the engine room.

A comparison of costs will show that there is no material advantage in favour of the automatic or semi-automatic plants.

It will be seen that the prices of plants of different makes vary considerably, as might be expected, but many points need consideration as well as mere cost. The non-automatic plant covers a really reliable installation with all accessories, however, and its cost compares quite favourably with that of other types. Erection costs are probably rather heavier, but not seriously so, as it is, of course, necessary to provide proper foundations and housing even for the tiniest plant.

ELECTRICITY IN ISOLATED BUILDINGS.
ESTIMATED COSTS OF PLANT (NOT ERECTED)

Ref.	Type of plant.	Engine output, Volt.	h.p.	Den. output, amp.	Bat. cap., Watts.	Total cost, £	Fuel.
A	Automatic	50	—	800	—	396	Petrol
B	Automatic	50	—	1900	—	408	Petrol
C	Automatic	100	—	800	—	367	Petrol
D	Automatic	100	—	1900	—	485	Petrol
E	Automatic	32	3	1250	225	230	Paraffin
F	Automatic	25	—	750	126	148	Petrol
G	Automatic	50	—	750	60	162	Petrol
H	Automatic	100	—	2000	140	480	Petrol
J	Automatic	100	—	3600	230	654	Petrol
K	Automatic	100	—	3100	216	664	Paraffin
L	Semi-automatic	32	—	750	80	143	Paraffin
M	Semi-auto. or hand oper.	25	2	750	120	185	Petrol
N	Semi-auto. or hand oper.	50	5	1500	120	270	Paraffin
O	Semi-auto. or hand oper.	100	5	2500	120	394	Paraffin
P	Semi-automatic	25	1½	750	72	145	Paraffin
Q	Semi-automatic	50	2½	1000	72	192	Paraffin
R	Semi-automatic	50	3½	1500	120	260	Paraffin
S	Semi-auto. or hand oper.	50	3½	1500	145	264	Petrol or Paraffin
T	Semi-auto. or hand oper.	25	1½	750	72	141	Petrol or Paraffin
U	Semi-automatic	32	2½	1250	115	171	Petrol
V	Non-automatic	50	2½	1700	108	210	Paraffin
W	Non-automatic	100	2½	1800	70	250	Paraffin
X	Non-automatic	50	4	2250	180	300	Paraffin
Y	Non-automatic	100	3½	2200	108	340	Paraffin

Note.—Details of engine, dynamo, and battery sizes are as advertised by makers. Where these are not stated the particulars are not given by the makers.

The question of running cost is not a serious item compared with the convenience. In pre-war days an analysis of a considerable number of records showed that a shilling a light per year usually covered the cost of fuel and lubricating oil. Accurate estimates are almost impossible, due to variations in the habits of the users. Some people are away in the winter and others in the summer; some are wasteful and others economical; some want brilliant lighting everywhere and others prefer semi-darkness except where the light is actually in use. It has not been possible to obtain accurate records for post-war installations, and even if available they would be of little use, due to the fluctuations in the price of fuel. At present prices the pre-war experience would

mean a cost for fuel and consumable stores of about 3s. to 5s. per light per year—or, on, say, a 50-light installation, £8 to £12 per year. Interest and depreciation would be several times this amount. The complete installation would amount to some such figure as £400, and interest must be taken as 7 per cent. and depreciation at least 8 per cent. on the average, corresponding to an annual charge of £60. Fuel costs are obviously of minor importance.

The cost per unit is of secondary importance, but may be of interest. Pre-war records showed that the average consumption of energy, for lighting only, varied from 4 units to 8 units per light per year. On these figures the total consumption for a 50-light installation might be anywhere between 200 and 400 units, corresponding to a cost, on the figures given earlier, of about 8d. to 9d. per unit for fuel. As this excludes interest and depreciation and attendance it will be obvious that if a supply from external mains can be obtained it will be advisable to adopt it rather than to install a private plant, even at charges per unit well above those ruling in most country towns.

The question of maintenance must also be considered, but it is difficult to get any reliable figures for this. There are plenty of records for the non-automatic plants, which show that, if instructions are followed, an ordinary gardener, without any previous experience, can run such plants, with a few hours' attention per week, for scarcely any cost apart from fuel and consumable stores. Two such plants, recently overhauled after the war, have worked for ten years or more with a total maintenance expenditure, apart from fuel, of under £5 on each of them. The batteries still have years of life in front of them, and engines and dynamos are in perfect order.

With the automatic plants, however, details are more difficult. Most of these plants have only been on the market two or three years, and battery troubles are only likely to arise after a few (a very few) years' use. It is difficult to believe that plants working under such conditions can fail to involve heavy maintenance costs after two or three years' working.

(To be concluded.)

STAINLESS STEEL.

In the minds of the public, no doubt, the impression is firmly rooted that the principal use of "stainless steel" is to make table knives; but this interesting material has a vastly wider scope, and with a view to dispelling false impressions and imparting a just sense of its possibilities, last week Messrs. Thomas Firth and Sons, Ltd., Sheffield, gave a demonstration of its behaviour in the form of turbine blading, and in other applications. Incidentally, it may be pointed out that stainless steel is not, as many suppose, a recent invention; it originated in the Brown-Firth Research Laboratories, which are jointly owned by Messrs. John Brown and Co., Ltd., and Messrs. Thomas Firth & Sons, Ltd., as long ago as 1913, when Mr. Harry Brearley, who was in charge of the laboratories, reported that low-carbon high-chromium steel, which was being considered for rifle barrels and inner gun tubes, had been found to have unexpected anti-corrosive properties. "Highly polished pieces which have been exposed to the atmosphere in the chemical laboratory for two or three weeks remain perfectly bright, whereas ordinary mild steel becomes quite rusty." It could also be hardened and softened, and "would appear, therefore, to be especially well suited for the manufacture of spindles (hardened), gas and water meters, pistons and plungers for pumps, ventilators and valves for gas engines, blades for turbines," &c. This was indeed a prophetic statement, betraying remarkable insight into the future. In the course of a brief lecture by Dr. W. H. Hatfield, the present head of the Brown-Firth Research Laboratories, the properties and characteristics of stainless steel were described, and it was shown by ocular demonstration

that not only all the articles mentioned by Mr. Brearley, but many more, such as saws, fenders, frying-pans, golf-club heads, stair-rods, surgical instruments, &c., had been made of the steel that never tarnishes.

Of chief interest, however, was the turbine blading. The fact that "stainless steel" resisted corrosion under conditions similar to those obtaining in a turbine had long ago suggested that it would be suitable for this purpose, and the idea was put to the test in the power house of Messrs. Firth & Sons' Tinsley works; a 2,000-kW Westinghouse turbine, running at 3,000 r.p.m., was installed in August, 1916, and has been in regular use since then, with steam at 200 lb. per sq. in., superheated to about 600 deg. F. A number of experimental blades were fitted in the turbine on June 11th, 1920. Alongside of the blades of stainless steel there were fitted, for comparison purposes, a number of new blades of the standard type supplied by the makers, of 5 per cent. nickel steel. The details of the experimental blades fitted are as follows:—

In wheel No. 8, situated at the low-pressure end of the turbine, were fitted 12 new blades, three of stainless steel, highly polished, with three of stainless steel unpolished alongside of them. On the opposite side of the same wheel, three more of stainless steel unpolished, with three standard blades alongside. These blades are 7 in. long by ¾ in. wide, the diameter of the wheel being 4 ft. 1½ in.

In the velocity wheel, at the high-pressure end of the turbine, were fitted 24 new blades. On one side of the wheel 12 of stainless steel unpolished, and on the opposite side six of stainless steel unpolished, with three

of stainless steel highly polished, and three standard blades alongside. These blades are $\frac{7}{8}$ in. long by $\frac{1}{4}$ in. wide, and the wheel is 3 ft. 7 $\frac{1}{2}$ in. in diameter.

The conditions of the velocity wheel are typical of those with dry steam at a high temperature, and the conditions at wheel No. 8 are typical of very wet steam.

photograph, whilst in fig. 2 they are as opened out. Fig. 3 shows stainless steel turbine blades as opened out, and the photograph clearly shows the difference in the response to both corrosion and erosion when comparison is made with the adjoining nickel steel blades.

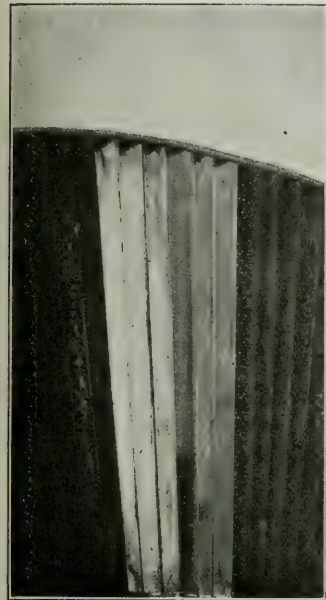


FIG. 1.

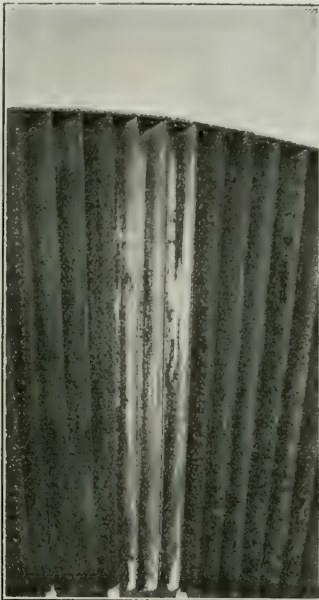


FIG. 2.

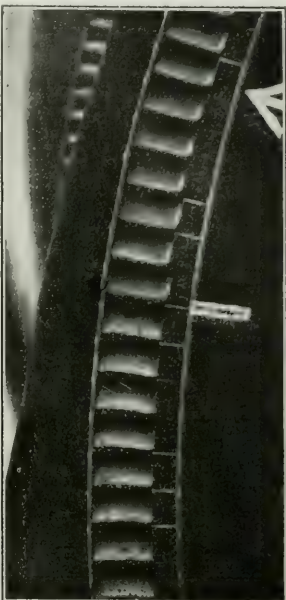


FIG. 3.

STAINLESS STEEL TURBINE BLADES AFTER 16 MONTHS' SERVICE.

The work done by this generating set since the fitting of the new blades is represented by a run of 3,471 hours, with a demand averaging a 50 per cent. load. The appearance of the blades on opening up the turbine has to be seen in order to be properly appreciated. Whilst the standard blades have corroded in the usual way, the stainless ones, both polished and unpolished, are practically untouched and retain their original brightness. What discoloration has appeared is probably due to rust carried over from the other blades, as shown by the fast that it washes off with a damp rag.

In fig. 1 is reproduced a photograph showing three

The stainless steel contained 0.30 per cent. carbon and 13.4 per cent. chromium; whilst the nickel steel contained 0.19 per cent. carbon and 4.71 per cent. nickel.

The mechanical properties of the two steels as placed in the turbine are given in the following table:—

	Nickel.	Stainless.
Yield-point, tons/sq. in. ...	25.2	44.1
Max. stress, tons/sq. in. ...	34.7	54.5
Elongation, per cent. ...	32.0	20.0
Red. of area, per cent. ...	61.0	59.7
Brinell hardness number ...	149.0	255.0

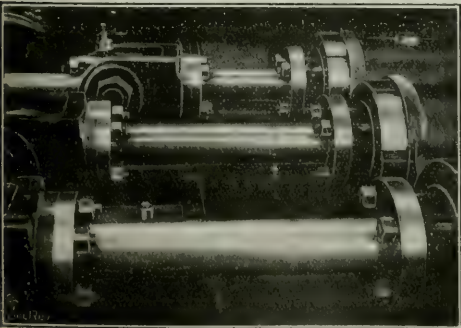


FIG. 4.—STAINLESS STEEL PUMP ROD.
The arrow shows ridge on non-ferrous alloy rod.

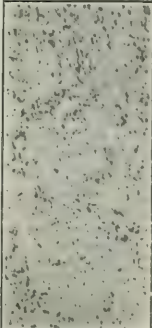
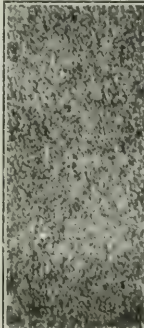
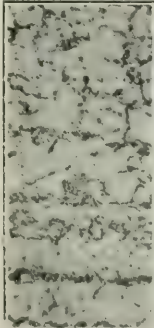


FIG. 5. FIG. 6. FIG. 7.
PHOTOMICROGRAPHS OF NICKEL AND STAINLESS STEEL.
($\times 500$ diameters.)

unpolished and three polished stainless blades after 15 months in service. Fig. 2 shows three of the unpolished stainless blades and three ordinary composition nickel steel ones put in new into the turbine at the same time as the stainless blades. In fig. 1 the blades have been rubbed with a damp cloth prior to the taking of the

The microstructure of the blades is reproduced in the accompanying photomicrographs, figs. 5 and 6, which are both at 500 diameters. It will be seen that the nickel steel is in the soft condition and consists of ferrite holding nickel in solution, with a little pearlite running through it. The stainless steel (fig. 6) is seen to consist

of fine-grained structure resulting from the effect of tempering upon the hardened condition. Fig. 7 shows the structure of stainless steel when hardened.

The experiment shows that the introduction of stainless steel for use in turbine blading will be of great advantage, and it is quite clear that improved efficiency, due to the retention of a clean, smooth surface on the blades, and the saving of time and of awkward situations by the avoidance of shutting down for repairs, reblading, cleaning, &c., will be of direct interest to turbine engineers.

Through the courtesy of Mr. Samuelson, of the British Thomson-Houston Co., the results of a similar experiment performed in connection with one of the B.T.H. turbines have been made available. Early in 1916, the company had one wheel bladed with five different kinds of material, the object being to find out which of these would best stand up against the action of the steam. The row of blades selected was situated at about the middle of the machine, where indications of erosion and corrosion had frequently been seen. The blading materials selected were phosphor-bronze, nickel-bronze, brass, mild steel, and stainless steel (two hardened and two hardened and tempered stainless blades were inserted). The machine was put into service in the autumn of 1916, and was opened up for examination for the first time in April, 1918. The inside of the machine was found to be perfectly clean, and all blading in good condition. A certain amount of erosion was visible on all the trial blades except those made of non-rusting steel; the brass blades seemed to have suffered most. There were no marks whatever on the stainless steel, while the mild steel blade edges were rough; phosphor-bronze and nickel-bronze seemed to have the same resisting quality to the action of the steam and moisture.

The machine was then closed up and again put into service, and was opened up a second time for examination in July, 1921, when the inspection confirmed the previous conclusion, *i.e.*, that the stainless steel blades were in very good condition and absolutely unaffected, the edges being as sharp as when put in, and there was apparently no difference between the hardened and unhardened samples. The phosphor-bronze, nickel-bronze, and brass blades were all roughened at the entrance edge, and very little difference was noted between them. The mild steel blades were badly roughened, and the entrance edge was worn away nearly 1/16th of an inch. "As far as resisting properties are concerned," says Mr. Samuelson, "the stainless steel is very superior to any other blading material which we have so far tried."

Another interesting experiment was performed by Messrs. Thomas Firth & Sons with a three-throw electrically-driven hydraulic pump manufactured by Messrs. Davy Bros., Ltd., Sheffield, working at a pressure of 1,800 lb. per sq. in., and installed in 1915. One ram was made of stainless steel, the other two being of the standard non-ferrous alloy used by the makers. This pump ran continuously—night and day—until the termination of the war. The wear on the stainless ram was 1/64th of an inch on the diameter, whilst in the case of the non-ferrous rams it reached so high a figure as 7/64ths of an inch. Fig. 4 illustrates the present condition of these rods. The less wear upon the stainless rod means much in saving wear of the packing.

Stainless steel is an alloy containing about 12 to 14 per cent. of chromium, and can be hardened in air, oil, or water, the hardening temperature being not 760 or 780 deg. C. as in the case of ordinary carbon steel, but 950 to 1,000 deg. (orange yellow). The electric furnace is particularly well suited for the production of stainless steel, owing to the highly reducing and basic conditions, keeping phosphorus and sulphur down, and the high temperature ensuring clean ingots, free from flaws. The steel is unaffected by most acids, exceptions being citric, formic, and sulphuric; running water, moist air, &c., have no effect on it. The steel scales less than other steels at high temperatures. Up to a temperature of 800 deg. C. only superficial colour effects are observed.

It is noteworthy that the colour changes in tempering occur at much higher temperatures than in the case of carbon steels. The thermal conductivity of stainless steel is less than a third of that of pure iron. The best results are obtained with polished surfaces, but this is not necessary for the material to be rust-resisting; grinding should be done with water, as the stainless property is impaired by scorching the material. The steel is most readily machined when hardened and tempered by heating to 750-800 deg. C. and cooling in air; the softest condition is obtained by heating to 850-870 deg. C. and cooling very slowly.

A valuable feature of stainless steel is that it maintains its strength at high temperatures, having a breaking stress, when hardened and tempered, of 87 tons per sq. in. at 500 deg. C. It also offers a high resistance to fatigue when tested by the usual methods.

Since our visit to the works, Messrs. Thomas Firth and Sons have informed us that one of their customers has furnished data with regard to stainless steel blades 28 in. in length, which have been in constant service in one of his turbines during the last four or five years, and have given entire satisfaction. This example proves that long blades of this material can withstand the vibratory stresses to which they are exposed.

It will be seen, therefore, that Messrs. Thomas Firth and Sons are to be congratulated on the invention and development of a material possessing properties of the first importance to the engineering world, and that Sheffield has once again justified her position at the head of the world's steel-making industry.

THE PRESENT NEEDS OF THE BRITISH ENGINEERING INDUSTRY.

A WHOLE-DAY conference of members of the British Engineers' Association was held on Wednesday, October 19th, at the Hotel Victoria, London, to discuss "The Problem of Restoring Vitality to the Engineering Industry." Mr. Neville Gwynne, president, was in the chair.

Among those present at the conference were: The Rt. Hon. Lord Weir of Eastwood, Mr. E. W. Petter, chairman of the Executive Committee, Mr. D. A. Bremner, director, Sir John Cowan, Sir James Kennal, Sir John E. Thornycroft, K.B.E., Sir R. Ashton Lister, M.P., and Sir Wiltred Stokes, K.B.E.

Between the morning and afternoon sessions of the conference, luncheon was served, and an important speech on the industrial situation and the questions before the conference was made by Lord Weir.

The conference, after full discussion, forwarded to the Prime Minister a memorandum, recording its considered opinion that the following are essential features and conditions of a national effort to restore prosperity to the engineering industry:—

1. The loyal co-operation of labour in a great national effort to revitalise our industries and commerce which are the only possible sources of its own well-being.
2. The repudiation by the trade unions of the declared policy of their extremist sections to render the system of capitalism and private enterprise unworkable.
3. The institution of compulsory secret ballots by the trade unions.
4. The reduction of cost of production by amending the conditions affecting the output per £ of wages paid.
5. The careful consideration of a national trade policy more in consonance with the new conditions with respect to foreign competition in our home market and the raising of tariff walls abroad tending to shut out our exports.
6. The development of the home market and the confinement to this country of contracts involving the expenditure of public moneys.
7. The development of markets within the Empire.
8. National economy.
9. Reduced taxation of wealth productive industries.
10. Unemployment relief work to be of a reproductive nature to the greatest extent practicable.
11. The payment of doles uncompensated by work done to be reduced to the minimum.
12. Cheaper coal, valued in terms of heat units.
13. Due consideration to be paid by the Government to the possible effects upon industry of a policy of deflation.

14. The taking of drastic measures to reduce the cost of living in so far as it may be due to profiteering by the few at the expense of the many.

15. A more complete and better organisation of industry for its good government from within.

In the opening sentences of his speech, Lord Weir said he spoke not as a politician nor as an economist, but as a manufacturer and an engineer. He congratulated the Association on holding the conference. Such action was very significant, because it disclosed its appreciation of the gravity of the situation and its recognition that success could only emerge through unity of effort and policy, and he took it that the conference was the first step toward formulating an engineering policy. He went on to refer to the infinite variety of the factors involved in the present situation, and added that no single course of action by itself could bring about any immediate cure. He was neither a pessimist nor an optimist, but he was sure that no British engineer who was aware of the past history of British engineering and the technical position of the craft, could fail to be confident in the tremendous recuperative power of the industry. The patient was sick—maybe very ill indeed—but his constitution was a sound one. He had far too many doctors in the last few years and far too many patent medicines. The organs were all right, and no operations were required. In Scotland they had cured many cases by the cold-water cure, and perhaps some such treatment was required by industry to-day. The problem before them was how best to restore vitality to the engineering industry to assure that orders would revive as insufficient orders were being received to give employment to the workers. Russia and other countries were not buying. New enterprise was taking a rest until prices fell. Countries able to buy were not buying from us because our prices were artificially high. There was a certain amount of foreign trade definitely available and we were not getting it. There was also home trade available, but home firms were not getting that. In the expectation of reduction of price, customers at home, in the Empire, and abroad were restricting and postponing their demands. Belgium took the recent order for Chinese locomotives and rolling-stock, and under to-day's conditions in this country, he failed to see why Belgium should not take the next Chinese order. Again, during the last nine months we in this country bought £19,000,000 worth of iron and steel from abroad. Infinitely more serious and more significant was the fact that during September, 1921, we bought more iron and steel from abroad than ever we had done in the past history of this country.

He desired to ask those who were supposed to lead us to answer the following question: "Which is the best statesmanship, to grant British credit or British guarantees of credit to a foreign country, yes, even to a British colony, to enable it to purchase from Glasgow a huge bridge, which will be built of imported steel, or to tell the British steelmaker and his workers that these credits and guarantees will be withheld until the steelmaker and his workers can arrange between themselves to produce that steel at home and give the necessary employment?"

The Labour Party's programme for unemployment called on the Government to provide either work or maintenance. Apart from the underlying fallacy that a Government could ever carry the community on its back, in contradistinction to the real truth that the community carried the Government, such a suggestion would apparently work out as follows: Under it we should have a local authority relief scheme in Lanarkshire giving unproductive and inefficient employment to miners, ironworkers, and labourers, working alongside closed pits and closed iron works, while Glasgow harbour was filled with vessels bringing in imported foreign iron, smelted with foreign coal. That was the type of ineffectual and purlind policy which appeared likely to emerge from the manner in which one heard the Government proposed to deal with the situation. The main question was one of the conditions governing the costs of production in the different countries, and it applied not only to the most highly specialised manufactures, but to the lowliest domestic commodities. British employment would be governed by the cost of British production. Apart from wage rates, wage costs were inflated to-day by unjustifiable working conditions. These excess costs were brought about by a network of conditions which had grown up during the last few years as a result of trade union pressure exercised in one form or another. All of them had definitely increased costs. Against this he failed to find a solitary example of trade union action or suggestion to secure any decrease in costs. The trade union attitude always appeared to be based on the assumption that the profit of the manufacturer was sufficient to provide for all these alleged improved conditions, or that they could be passed on to the consumer in the price. The existing state of the industry proved that both assumptions were wrong. The trade unions forgot that we were no longer the only industrial nation, that we must not only sell abroad, but that our home market was an open one.

Lord Weir said it was his conviction that very few yet fully realised the true incidence of the shorter working week on costs and prices, and the extent to which this single item had contributed to produce to-day's situation. After assuming the enormous burdens placed on us by the war and the further burdens on our industry brought about by the dislocation of world trade, it was difficult to see how we were warranted in agreeing to assume not only the burden of a 15 per cent.

increase in wage rates per hour, but the further burden of additional capital charges to enable output to be produced in the shorter period, the additional oncost charges, and the very miscellaneous mass of increases brought about in different industries by two men being required in place of one, and by three shifts in place of two.

He estimated the increase in cost of British products last year due to the shortened week at over £200,000,000. Output had gone down approximately in proportion to the hours. To reduce costs in a normal year by £200,000,000 without affecting weekly earnings would be the most direct and immediately effective help which could be given to many of our industries to-day.

The speaker went on to refer to the obstruction to systems of remuneration by result, the rules and regulations affecting overtime and night shift working, and other matters which, if abolished, would effect a substantial reduction in the cost of a British working hour without affecting the worker's pay.

If the abolition of restrictive conditions were now discussed with the trade unions in a spirit of frankness, and an agreement was reached, any further wage rate reductions should be viewed in association with the cost of living, subject, of course, to the possibility of drastic economic difficulties intervening to prevent this. Since the armistice the controlling authorities on the costs of production had been the Government and those who had led trade union policy. It was obvious that that control should have been exercised by the two real authorities, the employers and their men. The Government had practically abolished its control. Those who guided the workers' policy had not. The industrial performance of the country was now a lamentable one. Labour as a political movement looked to the Government to revive trade. They would be disappointed, because no Government could revive trade. On the employers and the workers rested the main responsibility of trade restoration, and on their combined performance employment depended. He believed that were the Government to declare what it already knew—that the power of trade unionism used by the men who now controlled it for purely political purposes had become a tyranny and a menace to the workers themselves, that it was bidding fair to ruin the industrial position, and with it the well-being of the people of this country, and that recognising this it had determined that the exercise of this power for evil should be curtailed and restricted—that it would rally to its support and assistance multitudes who were silently suffering at this moment and looking for a banner under which to struggle for their freedom.

INDUSTRIAL RESEARCH.

THE Progress Report of the British Electrical and Allied Industries Research Association for the September quarter gives particulars of the several important industrial researches carried out under the direction of that body. The work of the Association is conducted by committees under eleven sections, and the Report indicates progress in each of these.

In Section A (Fibrous Insulating Materials) the results of the classification of users' requirements have shown that two grades of treated fabric are sufficient to meet all ordinary demands. For fabrics of the higher grade, which have hitherto been purchased on a basis of price, breakdown voltage, and appearance, the Committee is developing better technical criteria. Tests under working conditions are yielding data which will define the fundamental constants of these materials. Improved test methods for untreated papers have been evolved as a result of experiments, and these are to form the basis of a specification. Researches on fibres and boards have been undertaken under three heads—press-board (including presspahn), varnish-paper products, and vulcanised fibre. Experiments on press-board have indicated the best methods for testing, and these will form the basis of a forthcoming specification. The corresponding work on the two other classes of material is scarcely so advanced.

The experimental work on composite insulating materials (Section B) has so far progressed as to enable a specification to be drafted. This embodies the results obtained on the important mechanical and electrical properties, but inflammability, machining qualities, and certain other properties are still under investigation. A comprehensive research on porcelain, with particular reference to insulation resistance, improvement of surface, and dielectric strength is being pursued, with the co-operation of the G.P.O. and of the manufacturers. Samples have been obtained from the former showing surface deposits which adversely affect the insulating properties, whilst the latter are invited to submit samples for resistivity and electric strength tests, including resistivity tests at high temperatures.

In the section dealing with mica, classification is completed, and the Committee will carry out further detailed researches on the various qualities, in co-operation with the Committee of the new Section L. A report will shortly be ready on the use of mica for commutators and condensers; the experimental work on the abrasive hardness of mica is not yet completed, however.

Numerous researches on insulating oils, referred to in the

last report, are still under way. The study of resistivity in relation to moisture content and dielectric strength has necessitated complete research, particularly as certain new facts arising from the investigations require further consideration. The provisional specifications for insulating oils drawn up and submitted to the B.E.S.A. has called forth suggested improvements which are being dealt with.

In Section F (Conductors), work on buried cables at the N.P.L. and at Newcastle will shortly be reviewed. There has been some delay, due to the necessity of carrying out tests on finished cables instead of component parts, as originally intended. The work on overhead line conductors, and on the strength of wooden poles, is nearing the report stage.

The Committee of Section G (Electric Control Apparatus) has several most important researches in hand. The work on the rupturing capacity of oil circuit breakers has been mapped out, and an adaptable model switch and certain sensitive recorders have been specially designed for this programme. The Home Office at Eskmeals, and the N.P.L., still continue the research on the pressures developed in switch chambers by gaseous explosions and the rupturing of electric circuits. From the critical examination of available data on heavy duty fusible cutouts, a research programme on these heavy-duty fuses is being built up.

Direct-current circuit breakers have been the subject of extensive inquiries, which only emphasise the lack of fundamental data on this subject. However, with such material as is available, it is hoped to make a commencement of practical tests. The electrical engineers of the L.C.C. and L. and N.W. Railway, and other users and manufacturers are co-operating in this work. The extensive work on joints and contacts already done at the N.P.L. and elsewhere is being supplemented by a study of heavily loaded joints existing in various installations.

The Association is participating in the research on the corrosion of condensers by the Corrosion Committee of the Institute of Metals. It is expected shortly to issue an explanatory report of the results so far obtained, and steps are being taken to bring manufacturers into closer touch with the investigators during the experimental work. In the same way, it is intended to keep manufacturers in close touch with the experimental work on turbine nozzles (under Section J) now proceeding at the College of Technology, Manchester. It is hoped to extend this work to the question of temperature distribution on turbines, and to new investigations on the properties of steam. Blading materials are already being tested under working conditions by manufacturers co-operating with the N.P.L.

A conference of the Committee of Section K (synthetic resins) has been held with various Government Departments, through the instrumentality of the Department of Scientific and Industrial Research, and a good understanding of the requirements for different purposes arrived at. Other aspects of the use of synthetic resins, with which this Committee is dealing, are: the provision of adequate supplies at all times, moulded synthetic resins, and the properties of materials of synthetic resin with a fibrous support. The work of all the Committees dealing with insulation is being reviewed and co-ordinated by the Committee of Section L, which deals with dielectrics in general, and supersedes the old Joint Committee on Dielectric Losses and Allied Phenomena.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR SEPTEMBER, 1921.

THE returns of electrical business during September show increased totals in all sections. In the case of the exports the value increased from £1,284,511 in August to £1,305,550 in the month under review, while the imports reached a total of £178,900, as compared with £140,334 in the previous month. The re-exports total of £17,900 is an advance of £2,800 on the August figures.

In the export section the business in telegraphic and telephonic material and apparatus showed an increase of £55,000. Batteries, meters, and insulated wire also reached higher values, but there was a falling off in the sections for electrical goods (£17,000), in lamps (£10,000), and in electrical machinery (£2,800).

In the imports increased values are recorded in all sections with the exception of meters.

The accompanying tables of electrical exports for the first nine months of 1913, 1920, and 1921 show gross totals of £1,284,511 for 1913, £1,305,550 for 1920, and £1,429,881 for 1921; the monthly averages are £603,000 for 1913, £1,067,000 for 1920, and £1,538,320 for 1921. The total number of electric glow lamps exported during the first nine months of 1913 was 2,329,587, as compared with 3,387,688 in 1920 and 3,683,407 for the same period in 1921.

The total weight of electrical machinery exports for January to September of 1913, 1920, and 1921 were 20,167 tons, 7,621 tons, and 14,195 tons respectively.

TOTALS OF ELECTRICAL EXPORTS FOR THE FIRST NINE MONTHS OF 1913, 1920, AND 1921.

	1913.	1920.	1921
	£	£	£
Electrical goods and apparatus	678,727	1,366,347	1,633,607
Insulated wire	750,303	2,773,116	2,661,565
Glow lamps	114,453	193,602	368,268
Arc lamps and posts	39,875	25,803	17,574
Batteries	185,887	399,191	558,276
Meters	132,956	294,072	386,991
Carbons	8,239	80,158	56,595
Electrical machinery	1,669,287	1,690,903	3,846,238
Telegraph and telephone material, apparatus, &c.	1,853,949	2,780,087	4,765,767
	5,433,676	9,603,279	14,294,881

VALUES OF ELECTRICAL EXPORTS AND IMPORTS FOR SEPTEMBER, 1921.

	Exports.	Imports.	Re-exports.
	£	£	£
Electrical goods and apparatus	£111,669	£35,046	£3,645
Insulated wire	227,784	15,893	98
Glow lamps	25,282	16,419	604
Arc lamps and parts	880	507	354
Batteries	55,507	6,548	10
Meters	42,601	3,243	618
Carbons	1,767	14,746	1,376
<i>Electrical machinery:—</i>			
Railway and tramway motors	19,304	—	—
Other motors and generators	212,430	—	—
Switchboards (not telegraph or telephone)	27,703	8,346	—
Electrical machinery (unenumerated)	149,049	55,187	3,693
<i>Telegraph and telephone cable and material:—</i>			
Telegraph and telephone wires and cable (not submarine)	175,899	4,598	—
Submarine telegraph and telephone cable	56,502	—	—
Telegraph and telephone instruments and apparatus	195,627	18,367	6,902
Totals...	£1,305,550	£178,900	£17,900

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Principles of Wages Determination.

In your leader on the above subject you advocate Whitleyism as the most likely method for arriving at a fair division of profits between Capital and Labour. Quite right, but let us first look at facts and see what margin there is for readjustment. Mr. F. Deutsch, Director of the A.E.G., of Berlin, presented to the Berlin Chamber of Commerce some two years ago statistics collected between 1908 and 1917 from 66 industrial companies, and he found that the average share of the profit obtained by the workers, both manual and professional, amounted to 76.7 per cent., taxation absorbed 11.7 per cent., and the capitalists' share was 11.6 per cent. Not much margin here for improving the workers' reward! But the position has worsened since the Armistice. Mr. Deutsch (as you will find in the *E.T.Z.* of October 6th) has now extended his investigations to 152 industrial companies, and finds the following ratio of division:—

Wages and salaries	84.9 per cent.
Taxes and rates	11.7 per cent.
Capital	3.4 per cent.

Practically no margin for re-adjustment. I have no similar figures for English conditions, but it seems unlikely that here the margin will be appreciably greater. Before we can talk of fair division there must be something to divide amongst State, Capital, and Labour. This means that we must remove all restrictions to the production of wealth. There are many, but I will only mention one, and that is the most potent, namely, the private ownership of the land. Wealth can only be produced by applying mental and manual labour to the natural resources found on and in the earth, which is the storehouse from which every man either directly or indirectly draws his sustenance. Free access is therefore the primary essential for improving our social conditions. By free access I do not mean that the workers should simply rob the landlord of the land he claims unconditionally to control. The cure would be worse than the evil, as we see by the present conditions of Russia. What I mean is that the holding of land should be subject to the payment of a tax assessed in relation to its value in the open market, whether the land is left idle or let or worked by the owner himself. Such a

tax can be imposed by Parliament, and in fact the 1909 Budget was a half-hearted attempt at such a policy, but it was dropped by the Liberals, and the complicated nature of the proposal with its many exemptions and restrictions would have made it unworkable. A tax if universally applied regardless of the size of the holding would not interfere with private enterprise, and would leave existing contracts undisturbed. It is true that it will require some time to get into working order, but if the nation were assured that it would be imposed without unnecessary delay, the public would very readily agree to provide (with the security of future prosperity) the necessary funds to help all industries to tide over the present time. Land value taxation is the true remedy for the social malady, and when this is achieved it will be time to talk of Whitleyism, co-operation, municipal trading or private enterprise and the fair remuneration of Capital and Labour.

Gisbert Kapp.

Birmingham.
October 22nd, 1921.

[We are inclined to think that the conciliatory spirit engendered by the practice of Whitleyism would be more likely to lead to an agreement as to equitable division of profits than would controversy on the taxation of land values.—EDS. ELEC. REV.]

"Grinding" versus "Turning" of Commutators.

Your contributor (Mr. Joseph T. Towison) on page 461 of the ELECTRICAL REVIEW, October 7th, commenting on Mr. Owen Linley's article, appears to favour turning as against grinding. When we read Mr. Linley's opinion in favour of grinding we thought that he was pushing at an open door, and that he was recommending a method already approved by every electrical engineer.

As inventors and makers of machines for grinding commutators and slip rings in position, we may be prejudiced, and it might be alleged that we desire a cheap advertisement in addition to our usual advertisement appearing regularly in your paper. But we think your readers are entitled to some "statements of facts" other than those given by Mr. Towison. We therefore give you the following:—

(1) Leading manufacturing electrical engineers are our best customers.

(2) Leading electrical undertakings grind their commutators, as do leading collieries and large steel works.

(3) A commutator grinder was recently installed at Lots Road generating station.

(4) Although trade is bad, we have sold more commutator grinders during the past year than in any previous year.

(5) Our motor-driven grinder was designed at the suggestion of the Admiralty, and the four battle cruisers about to be built are to be equipped with commutator grinders.

(6) Leading electrical engineers have adopted the grinding method after trying the turning.

On the respective merits of grinding and turning it would not be decent for us to enter into controversy, although we could urge several convincing reasons in favour of the former in addition to those stated by Mr. Linley. But we think that the above "statements of facts" will be conclusive proof of the opinion held by electrical engineers.

John Phillips & Co.

London.
October 13th, 1921.

A.C. Organ Blowers.

Having had charge of several organ-blowing equipments, I have followed with much interest the correspondence on the above, but there is one type of motor which I have not seen mentioned; it really deserves to be better known. I refer to the "Bandy." The regulations as to limitation of starting current are strictly enforced here, and this motor complies with them in every respect.

There are in this town some 14 organs blown electrically, some with two, others with three feeder bellows operated by means of fast and loose pulleys, but of course the rotary blower makes much the best job. Going away from the subject for a moment, one of the characteristics of the above-mentioned motor is its wide range of speed variation, invaluable in such cases as driving printing machines.

In conclusion, while on this subject of motors, while the machines themselves are really good sound jobs, the controllers or starters leave much to be desired.

A. Brown.

Eastbourne.
October 24th, 1921.

Supply Without Statutory Powers.

Regarding Mr. Barber's doubts, the statements made were absolutely accurate. The barrowful meant 1 cwt., and the coal merchant supplying it will confirm what was written. There is nothing miraculous about it. Details herewith:—

Engine, Davey-Paxman automatic expansion, built in 1883. Maximum h.p. 14, economic h.p. 10 to 11. Running at one-third cut-off generally. Grate area 52 sq. ft.

Coal used daily in raising steam 33 lb. (average of many

careful tests). Time run, 14 hours on 79 lb. Just at random, the coal used June 12th-25th, 1915, was 14½ cwt. in 14 days. Total coal in 1915, 45 tons. Average per kWh actually sold, 17 lb.; per kWh at generator terminals, 12 lb.

The other figures referred to, taken simply as published, are 17 and 18 lb. per unit.

I hasten to disclaim any intention of making the ridiculous suggestion that this small plant would normally come anywhere near the efficiency of a modern station of a million units annual output.

It may be of interest to add that this village supply grew up from a home-made ½-kW overtype generator installed in a small local works in the days of the old carbon-filament lamp. The advent of the Osram lamp made it possible for the villagers to pay the inevitably high cost per kWh and still obtain cheap light, and the opportunity was immediately seized. The first engine on the job was an A type vertical steam engine, bought for £5 twenty years before.

I am sure Mr. Barber's experiences will interest many readers.

A. O. G.

October 24th, 1921.

A Suction-gas Problem.

With reference to "O. N. E. Morequy's" inquiry about the deodorising of the waste gases of a suction plant, I think if he will make inquiries of Messrs. Crossley Bros. he will get particulars of a device which they used to make for fitting on the waste-pipe chimney of producers which keeps the waste gases continually deodorised by means of a weak solution of permanganate of potash, doing away with neighbours' complaints. The great advantage of permanganate over most deodorisers is its cheapness and its lack of any smell, many deodorisers only substituting one smell for another.

He might also try the same stuff in the overflow sumps if it is worth while, it being generally considered unnecessary to consider the olfactory (or any other) sensitiveness of the engineers who look after the plant.

If your inquirer has any trouble in getting particulars of the above device, I think I can send him a sketch.

Napoleon.

October 22nd, 1921.

The E.T.U. and Station Engineers.

It may interest your readers to learn that after an investigation by the National Executive Committee of the Electrical Trades Union into the control of the London Station Engineers' Section by the District Council, they have decided to set up a Committee composed solely of station engineers with full powers of control for that section, apart from the London District Council, and subject only to the National Executive Committee.

Delta.

Cleaning Enamelled Slate.

Replying to your inquirer on the above question, I can supply a mixture that will clean and polish enamelled slates or other highly polished surfaces, and will not finger-mark. The only precaution to be taken in its use is that the surface must be cleaned with soap and water first, to remove any grease or furniture cream that has been used on it.

Rotherham.

R. E. Smith.

October 17th, 1921.

The Contractor's Future.

Writing as a contractor, I think the last paragraph of Mr. Jeary's letter is the crux of the whole matter. To give you an instance, I was called in to undertake some wiring work for a well-known institution which is more concerned with the spiritual welfare of the people than their electrical requirements, and to my surprise, when I offered to supply lamps, I found the E.L.M.A., with its usual generosity, had graded this institution at 4 per cent. over the usual trade terms. It seems to me that in a great many cases discounts are given to users without any apparent reason, the excuse generally being that they employ an electrician on the premises; the "electrician" is often a hall porter or the boots, who can replace a fuse occasionally, and when the manufacturers wake up to the fact that the contractors will not assist them by stocking and showing goods unless these trade discounts are stopped to users, neither Mr. Hawkins nor any other factor will have much to complain of.

London.

A. G. Hudson.

October 19th, 1921.

The Municipal Tramways Conference.

Your Editorial and your report of the above in the REVIEW of the 7th inst. are particularly valuable at the present time when tramways are being made the target of so many ill-informed attacks, but it appears to me that very much more is needed to deal effectually with the situation.

May I quote my position—it is typical of many. As a member of a County Council owning tramways I am keenly interested in the battle of trams v. buses. Which is the

most economical, the safest, the least obstructive, the best in the public interest, from all points of view? These are the questions we have to decide, but decision is difficult. The 'bus companies loudly acclaim their vehicle, and disparage the tramcar. In this the lay Press blindly follows them. The tramway authorities mildly point out the advantage of tramcars. Two things are certain; first, the rates are being saddled with a heavy burden of road costs due to the destruction caused by 'bus traffic, whilst the tramways are unfairly burdened with heavy charges for road construction and maintenance; secondly, tramways undoubtedly keep down fares; this in these days of gigantic traffic trusts is something. But the point is that we want something more. We need straight, skilled and unbiased information. Cannot the Institution of Electrical Engineers do something? I suggest that it set up a committee, one capable of going right to the root of the matter, and issue a report in terms of passenger-miles—not vehicles—get at all the costs, hidden and otherwise. What does a 'bus cost in road destruction? What is the true cost of running a tramway, including fair road charges? What are the relations of the 'bus companies to the trusts, and how would these operate if tramcars were withdrawn? These and many other points need clearing up, and if the Institution could see its way to undertake such a work it would undoubtedly serve a great public need.

William B. Pinching, A.M.I.E.E.,

London. Member Middlesex County Council, &c.
October 17th, 1921.

The Durability of Lead-covered Wiring.

If "W. T. J." had given the reasons advanced (if any) by his practical electrician friend, as to what was likely to cause the deterioration of the lead covering in six or seven years' time, one could have dealt with his question better. Vague statements are always difficult to controvert or confirm. I cannot imagine anything in an ordinary private-house installation which would bring about such a condition, provided the wiring was properly installed and efficiently bonded. Apart from mechanical strength, lead is surely one of the most durable metals—if not the most durable. It is used for roofing, stained-glass windows, and in many similarly exposed situations. Hundreds of examples probably exist to-day in ancient buildings, where the original lead is intact after being so exposed for anything from a century upwards. The lead composition water pipes in my house are about 30 years old, and are as good to-day as when they were first put in. In the large suite of offices where I write this letter, the staff lavatory—an eternally moist place—is wired with the Henley wiring system, the sheathing of which is lead composition. That installation was put in nine years ago, and the sheathing is as good to-day as it ever was. It shows not the slightest signs of any deterioration, and, from its appearance, seems likely to rival Tennyson's babbling brook, which, your readers will remember, "goes on for ever."

I have personal knowledge of many other installations on the Henley wiring system which were put in 10 years ago, when this system was introduced, and which are perfect to-day, and these installations comprise a great variety of types of buildings embracing all sorts of conditions. For many years before then, lead-covered wires and cables were installed, and are still in use. In tunnels, cellars, and such places, where there is no risk of mechanical damage, unprotected lead-covered cables, large and small, for all sort of amperages and pressures, have been in use for very many years.

It would be interesting to have some evidence adduced by "W. T. J.'s" practical electrician of where, and under what conditions, lead-covered cables or wires are reputed to fail in a few years. If such is not forthcoming, one can but assume that the statement has been made, as are many others of a like nature, on mere supposition and from personal prejudice.

October 19th, 1921.

Othello.

"W. T. J." asks, in your issue of the 14th inst., for opinions on the durability of this wiring. I can tell him that I have used it in several large buildings in Calcutta with complete success. These installations have been in use for seven years at least. In cases where trouble has occurred I have always found it due to failure (or omission) of the earthing connections. This earthing is a *sine qua non* for metal-sheathed (especially lead sheathed) systems, and is provided for in the I.E.E. Wiring Rules, Nos. 66 and 68.

Teddington.

A. K. Taylor, M.I.E.E.

October 18th, 1921.

This system properly installed forms one of the most durable and cheapest house wiring installations that can be devised. The lead casing is ordinarily incorrodible and immune from chemical and electrolytic attack, neither is it affected by damp or exposure to the atmosphere.

The weak points (as with most other systems) are at the ends of the wires, as at the fittings, &c., and therefore suitable connection boxes should be provided wherever these occur

in damp places, but they are usually not necessary in small house installations.

Efficient bonding and earthing is a vital factor of success, and unfortunately this is very often scamped in the smaller wiring installations; also a number of cases have been found where the wiring has been very carefully bonded, but no connections (or very inefficient ones) have been made to earth.

In cases where this has been neglected and small leakages have occurred, faults have been caused by the current travelling along the lead casings to the nearest earths (usually damp places), and electrolytic action has thus been set up at these places (there being generally enough acid drawn from the building materials), the lead casings being eaten away, thus allowing the v.i.r. to be attacked and breakdowns caused. The above actions can be very easily and cheaply avoided by careful attention to the bonding and earthing of the installations. These actions have been probably the cause of the majority of the failures that have occurred on lead wiring installations.

Fred. T. Alldread.

London.

October 22nd, 1921.

Referring to the above subject, it is quite possible that the practical electrician referred to by "W. T. J." was quite correct in his estimation. With regard to Mr. C. Skidmore's "ten minutes' practical thinking," it is obvious that not more than ten minutes has been given to this very important subject. Thus: (1) Lead piping used for gas lighting is not subject to electrolytic action, due to stray currents. (2) If the G.P.O. did not take particular care to bond the lead sheathing to some good earth connection, the lead would deteriorate accordingly. (3) If particular care was not taken with the e.h.p. mains, the action of stray currents would occur. It is understood that little trouble is experienced in this country from this effect, but that does not signify that it does not happen.

In my experience, corrosion only occurs at the points at which the leakage current leaves the cable, and not at the entering points; the lead being as it were carried away by the current.

G. White.

Bendby.

October 22nd, 1921.

With reference to your correspondent's inquiry, having had considerable experience of various systems of wiring, I would by no means condemn high-grade lead-sheathed cable for house wiring purposes, but would say that the sheathing should consist of pure lead and not be alloyed with other metals.

I have just carried out some minor repairs in a large building in which lead-sheathed cable had been used almost throughout; on examination the sheathing showed no signs of deterioration, and the insulation test on the cable was good.

In view of the fact that the wiring referred to was installed in 1903, it cannot be said that six or seven years is the life of lead-sheathed cable; but in my opinion solid-drawn conduit and high-grade v.i.r. cable are undoubtedly the most reliable job.

However, lead-sheathed cable is a good alternative, and it is much easier to install than conduit; so I would advise "W. T. J." to go ahead with his installation, but let him be sure to use high-grade material, as it is cheapest in the long run. I quite agree with Mr. O. Skidmore's observations.

Contractor's Foreman.

October 24th, 1921.

Gas v. Electricity.

We should be very pleased if any of your readers could supply us with information concerning the cost of running gas-heated furnaces for the heat-treatment of steel.

What we desire to know is what the number of cubic feet of gas amounts to per pound of steel treated.

We have already some information upon this point, and so far have found that the cost of gas heating invariably exceeds the cost of heating by electricity.

There may, however, be on the market a gas furnace more economical than any that we have yet met with, in which case we should like to hear of it.

E. P. Barfield.

Managing Director,
Automatic & Electric Furnaces, Ltd.

London.

October 20th, 1921.

Battery Carbons.

In the "Business Notes" column of your issue of 21st inst. you reproduce an article which appeared in the *Evening Standard* of the 14th inst. on the subject of "Making Industry Safe." We could afford to ignore the article in your lay contemporary, because everyone makes charitable allowance for the shortcomings and inaccuracies of articles on technical subjects in the lay Press. When, however, the *ELECTRICAL REVIEW* gives publicity to a statement that the

pocket battery trade depends upon imported small carbon rods, it is time we entered a protest.

Immediately upon the outbreak of the late war we took up the manufacture of these small carbon rods, and achieved an enormous output, running into a million a week. Our carbons are at least as good as anything that can be imported, and our prices bear comparison with those of foreign goods.

We have facilities for producing sufficient carbons to meet the entire home demand and providing a substantial surplus for export.

Under these circumstances, you will agree that the statement appearing in the *Evening Standard* is quite inaccurate.

S. Beeton,

Director, Morgan Crucible Co., Ltd.

London.

October 24th, 1921.

[On reference to the note, it will be seen that we said the secretary of the Electrical Importers' and Traders' Association was credited with the remarks in question; and the later quotation on the same subject emanated directly from a Committee of the London Chamber of Commerce, not from the *Evening Standard*. It is part of our duty to acquaint our readers with public statements which are of vital importance to their interests, and to enable them to refute inaccuracies; and we are glad to know that British manufacturers are so well equipped to cope with the demand for battery carbons.—EDS. ELEC. REV.]

Keeping in Touch with Consumers.

In your issue of the 14th inst. an article on "Increased Revenue from Small Consumers" appears under the *nom de plume* of "Interested," in which the writer refers to the want of interest which is too often shown by electricity supply undertakings in their consumers when once they have been connected to their mains. We think, however, we can claim that this stigma does not apply to this company.

We have for some time past recognised the necessity of "introducing" ourselves to our new customers, and after allowing them three or four weeks in which to settle down, we send them a suitable letter of inquiry trusting the supply is giving them every satisfaction, reminding them of the possibilities of electricity for heating and cooking purposes as well as for lighting, and suggesting that our representative would call if desired.

We have found that this inquiry frequently brings a response, often leading to further business, and we cannot but feel that it has the effect of creating the impression in the mind of the new consumer that his interests are to some extent at least the concern of the supply authority.

E. G. Nicholson,

Secretary.

Woking.

The Woking Electric Supply Co., Ltd.

October 18th, 1921.

[Many letters, received too late, are unavoidably deferred to a later issue.—EDS. ELEC. REV.]

BUSINESS NOTES.

Bankruptcy Proceedings.—ERNEST EDWARD MATHERS, 10C, High Street, Doncaster, Yorkshire, electrical engineer.—The public examination of this debtor was held on October 20th at the County Court Hall, Bank Street, Sheffield. The ranking liabilities were returned at £552, while the assets were estimated to realise £84. Debtor stated that he started business in April, 1921, with £150 capital, borrowed from his mother. He had never been successful. The examination was closed. The following are creditors:—

Bassett Murray	£	12	Rickard, Wright & Dean	£	15
Mrs. Sarah Ann Mathers	..	..	..	..	..
Mrs. Sarah Ann Mathers	..	..	..	..	..
Mrs. Sarah Ann Mathers	..	..	..	..	..
Mrs. Sarah Ann Mathers	..	..	..	..	..

M. WATKINSON, H. WATKINSON, and A. WATKINSON, trading as Watt & Co., 22 and 24, Palmer Road, Sheffield, electrical engineers.—The public examination of this debtor was held recently at the County Court Hall, Bank Street, Sheffield. The liabilities were returned at £870, while the assets amounted to £330. It appeared that the debtor Harold Watkinson commenced the business with between £40 and £50 capital in August, 1917, and was joined by his father, Matthew, and his brother Arthur a few weeks afterwards. They were successful until last year, but subsequently trade had been bad, and a number of orders had been cancelled since March last. The failure was attributed to defective material and insufficient capital.

CHARLES PHILIP MANNERS DOWNIE, trading as and described in the receiving order as Philip Downie, 355A, Westborough Road, and 88, Ronald Park Avenue, Southend-on-Sea, Essex, electrical engineer and factor.—The application for discharge of this debtor was heard on October 17th at the Shire Hall, Chelmsford. The Deputy Official Receiver stated that a first and final dividend of about 4s. 9d. in the £ was expected to be paid on liabilities of £520. The receiving order had been made in May last. Debtor had traded in a small way at first, and then became associated with a company formed by his father, and he had been later pressed by the creditors of the company. The discharge was granted, subject to a suspension of two years.

W. DRYSDALE, electrician, 24, Paxton Street, Barrow-in-Furness.—Second dividend of 1s. in the £, payable at 4, Ranesden Square, Barrow.

ARTHUR ERNEST BLOWER, electrical engineers' merchant, lately trading as "Blower & Cooper," 1, Paul's Bakehouse Court, Godliman Street, E.C.—The first meeting of creditors under this failure was held on October 25th before Mr. W. P. Bowyer, Senior Official Receiver, at the London Bankruptcy Court. The debtor, in his preliminary examination, stated that in September, 1917, Mr. Ashley Cooper joined him in the purchase of an electrical supplies business at the above address for £780, payable in instalments. They carried on the business in partnership successfully until December, 1920, when Mr. Cooper, being unable to devote his whole time to it, retired from the partnership. A balance of £400 was then owing in respect of the purchase money. The debtor continued the business alone until last August, when he closed down in consequence of the general depression and bad trade. He further stated that the partnership assets, which he held as trustee for the partnership, had depreciated in value, and he doubted whether they would realise more than £120, and as against that, £300 was still due to the vendor of the business.

He returned his personal debts at £345, and valued his separate assets at £102. The estate was left with the Official Receiver to be wound up in bankruptcy.

Trade Announcements.—MR. OWEN A. WHITTAKER has commenced a maintenance and contracting business at 1, King's Walk Chambers, Parliament Street, Nottingham, and he desires to receive copies of manufacturers' catalogues. He will continue to be responsible for the maintenance of the plants of the printing and newspaper firms for which he has been chief electrical engineer for the past ten years.

THE SALCOMBE MOTOR & ENGINEERING CO., LTD., has opened a branch of its electrical department in Rock Road, Torquay, with Mr. W. Lawrence as manager.

MR. JOHN RUSS has removed from Stoke Newington to 22, and 23, Verulam Street, Gray's Inn Road, Holborn, E.C.

MESSRS. SIMPLEX CONDUITS, LTD., announce an alteration of the address of their branch at Newcastle-on-Tyne. This was recently at 61-65, High Bridge, but these premises have been closed, and the business is now being carried on at 72, St. Mary's Place, under the same management (Mr. A. G. Robson). The telephone number and telegraphic address are as before (Central 2615 and "Simplex, Newcastle-on-Tyne").

Company Liquidations.—THE T.B.S. ELECTRICAL CONSTRUCTION CO., LTD., 63, Victoria Street, Westminster, London, S.W.—In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of the creditors of this company was held on October 20th, at Winchester House, London, E.C. The chair was occupied by Mr. F. Clifford Goodman, C.A., who had been appointed to act as the liquidator in the voluntary liquidation of the company.

The Chairman said that all connected with the company regretted the position which had arisen. The company had been struggling against adversity for some little time, and recently a conference of the creditors was held at the Charing Cross Hotel. The creditors then decided to hold their hands for a period of six months in the hope that the company would turn the corner. The trading, however, had not improved, and as a result some three weeks previously the shareholders passed the usual resolution in favour of voluntary liquidation. Proceeding, the Chairman submitted a statement of affairs, which disclosed liabilities to the trade of £1,595, while there was a sum of £2,494 owing to the bank. The assets were set down at £1,289, and comprised book debts, £79; stock, machinery and fittings, £925; and furniture, £285. In addition, there was stationery, &c., valued at £62, but under a liquidation it would not realise anything. He was afraid that all the book debts were not good, while a claim which the company had to the extent of £474 was regarded as bad. No value had been placed on the goodwill, although something might be obtained if the business could be sold as a going concern.

In answer to a question, the Chairman stated that the bank held a guarantee from one of the directors of the company. The latter was registered in August, 1919, with a capital of £1,000, subsequently increased to £20,000. With regard to the trading of the company during the 13 months to September 30th last, the sales amounted to £8,806, with a gross profit of £2,573, but after paying all the expenses, there was a net loss of £2,457. The purchases during the 13 months totalled £5,597.

In the course of the discussion which ensued it was stated that the present position of the company had been brought about by the state of trade. The liquidator said he intended to advertise the business as a going concern in the trade Press. The landlord of the premises had held his hand, and not distrained. If a suitable tenant was found there would be no difficulty in sub-letting the premises.

A suggestion was made that the creditors should be represented in the liquidation, but eventually it was decided to confirm the appointment of Mr. Goodman as the liquidator of the company, and an informal committee was appointed consisting of the representatives of Messrs. Siemens Bros., Ltd., the English Electric and Siemens Supplies, Ltd., and the *Mark Lane Express*. The following are creditors:—

The Alliance Electrical Co. ...	4	Mark Lane Express ...	4
Potter Bros. ...	10	The Field Press ...	12
B.E. Transformer Co. ...	13	Our Homes and Gardens ...	24
Society of the Land Agents' ...	28	D.P. Batteries ...	50
Scholey & Co., Ltd. ...	39	Crow, Logghead & Co. ...	20
Edison Swan Electric Co. ...	45	F.W. Berk & Co. ...	24
English Electric & Siemens Sup-		Journal of the Ministry of Agri-	
plies, Ltd. ...	47	culture ...	36
B.T.H. Co., Ltd. ...	19	Venue Time Switches ...	25
Siemens Bros. ...	353	J. & W.B. Smith ...	25
Siemens, Ltd. ...	30	De Martins Accumulators ...	88
A.C. Cussor, Ltd. ...	31	Huttons ...	11
Odhams, Ltd. ...	32	F. S. Bennett ...	134
		W. Norris & Co. ...	34

MESSRS. HALL BROS. (MANCHESTER), LTD.—Liquidation resolved upon on August 5th. Receiver and liquidator: Mr. J. R. Atkins, 14, St. Ann's Square, Manchester.

PHONOPORE CONSTRUCTION CO., LTD.—A petition for winding up has been presented to the Berkshire County Court by Mr. T. C. Cox, and will be heard at Windsor on November 10th.

AMPERE ELECTRICAL ENGINEERING & PLATING CO., LTD.—Meeting at the offices of Messrs. Eales & Hammond, North-Eastern Bank Chambers, Fowler Street, South Shields, on November 30th, to hear an account of the winding-up from the liquidator, Mr. T. L. Hammond.

SELSON ENGINEERING CO. (FRANCE), LTD.—Meeting of members November 24th at 85, Queen Victoria Street, E.C., to hear an account of the winding-up from the liquidator.

Catalogues and Lists.—MESSRS. FALK, STADELMANN & Co., LTD., 83, 85 and 87, Farringdon Road, E.C. 1.—Catalogue No. 467, a fully priced and illustrated list of "Elesca" lanterns for gasfilled and vacuum tungsten lamps, brackets, electric signs, cast-iron lamp columns, and reflectors.

Mr. HARRY MOSS, 82, Leeds Road, Bradford.—An illustrated pamphlet giving prices of "Cosmos" fires, irons, and kettles.

MESSRS. E. W. FARROW & SONS, 37, Berners Street, W. 1.—An illustrated booklet describing 50-kW "Aster-Siemens" generating sets with voltages ranging from 20 to 550 d.c. and a.c. (50 cycles, 3 phase).

MESSRS. JOHN JARDINE, LTD., Deering Street, Nottingham.—A large well-illustrated and priced catalogue of power transmission appliances, as bearings, pulleys, Plummer blocks, couplings, clutches, brackets and stands. Fully priced.

THE "ZOTOZELL" FIRE CO., 11, Strand Street, Liverpool.—A card advertising some new electric fires.

MESSRS. JOHN PHILLIPS & Co., 166, Walworth Road, S.E. 17.—A pamphlet illustrating three commutator grinders—pillar type and friction driven.

AUTOMATIC MACHINERY Co., 23, New Union Street, Ancoats, Manchester.—An illustrated leaflet dealing with the "Right-way" 10-ton pulley drawer. Priced.

THE WHOLESALE FITTINGS Co., LTD., 23, 25, and 27, Commercial Street, E.C. 1.—Supplement No. E 103, an illustrated price list of pocket lamps, torches, dry batteries, accumulators, bells, &c.

THE FALKIRK IRON Co., LTD., Falkirk, N.B.—Leaflet No. 264, describing the "Falko" electric cooker. Catalogue No. 268, giving illustrations and details of "Falko" electric fires and heaters. Both publications are priced.

THE MELVIN ENGINEERING Co., LTD., 5, Old Compton Street, W. 1.—A leaflet setting forth the advantages of "Alubon" aluminium solder.

KOHLER Co., Kohler (Wis.), U.S.A.—An illustrated booklet describing the "Kohler" automatic 1½-kW power and lighting set.

MATRIHEL ELECTRIQUE ALEX LEFEBVRE, 9, Rue Arsène Houssaye, Paris.—A price list of generating plant, motors, transformers, and prime movers for sale.

THE BRITISH THOMSON-HOUSTON Co., LTD., 77, Upper Thames Street, E.C. 4.—Leaflet L 209, illustrating and describing a colour attachment for use with "X-ray" reflectors. Priced.

MESSRS. SPENCER-BONECOURT, LTD., Parliament Mansions, Victoria Street, S.W. 1.—"Modern Steam Generation," a catalogue of numerous types of patent water-tube vertical boilers of standard, "squat," launch, and high-duty patterns. Several illustrations of these boilers and their applications are included, and the use of waste heat is dealt with.

MESSRS. BRINTONS, Wire Mills, Musselburgh, Scotland.—Illustrated booklet fully describing Prof. Haigh's high alternating stress testing machine, and including instructions for operating it.

Attracting the Consumer.—As part of its "campaign" for educating the public in electrical matters, the General Electric Co., Ltd., has issued a booklet in which the advantages of the use of electrical heating and cooking apparatus in the home are attractively set forth. While its direct object is to popularise "Magnet" appliances, the booklet will no doubt benefit the industry in general. An excellent idea of the company's has been to leave the inner cover blank and to offer to print particulars of local electricity supplies and charges on it free of charge.

The Electric Lamp Manufacturers' Association concerns itself not only with the efficiency and reliability of lamps and the stabilisation of prices, it acts also, as a direct stimulus to the spread of electric lighting. The publicity work undertaken by individual lamp firms has an indirect effect upon the general popularity of electric lighting, and its success led the Association to attempt, two years ago, to supplement it by a combined effort to set forth, not the advantages of any particular lamp, but the broad advantages of electric light and of the lamps which bear the hall-mark of the Association. The results were so far promising, that the Association has arranged for another national publicity campaign during the season upon which we have now entered. This campaign has two phases. One is to arrest the attention of the world and his wife, and to create a livelier demand for electric light and E.L.M.A. lamps in the home, the office, the factory, and the public building. The second is to invite the active co-operation of the electrical trade. In pursuit of the first phase the newspaper and general Press is being utilised; and for the second phase the trade and technical journals form the first line of approach. Series of advertisements have been arranged in London daily and evening papers, and in provincial daily and weekly newspapers and in the specialist Press. The type of advertisement will, of course, be adapted to the class of user reached by each medium of publicity. A campaign on such an extensive scale should lead to a material increase in the demand for E.L.M.A. lamps, and doubtless the wholesale and retail electrical trade will be ready to satisfy that demand immediately it arises. Increased sales of lamps should also bring an augmented demand for reflectors and fittings, for numerous accessories, and for installation work in general.

Manufacturers' Conference.—It is announced in the daily Press that the National Union of Manufacturers will hold a conference on Tuesday afternoon, November 1st, at the Cutlers' Hall, Sheffield, Mr. George Terrell, M.P., presiding.

Lead.—Messrs. James Forster & Co. report (October 22nd):—"The position is decidedly interesting. Germany has lately bought a large quantity of lead, which has diverted much of our supplies both from Spain and from Burma. With the mark at over 600 to the £, it is difficult to believe that she is buying this lead for export in sheets, pipe and cables, as one authority asserts. Is it due to premature fears of the result of the Silesian settlement? Fears which may have no foundation, in fact, as the published details rather suggests. The result is short arrivals here and a run on warehouse lead, the stocks of which have been greatly depleted. Short supplies seem to be assured for the time being, but, on the other hand, there is no improvement in the position here—neither the domestic nor the electrical trades are better, indeed we hear of consumers with stocked warehouses of both sheet and pipe unsold who are still manufacturing to keep their men employed."

Copper and Lead Prices.—Messrs. F. Smith & Co. report (October 26th): Copper (electrolytic) bars £74 10s., 10s. decrease; ditto sheets, no change; ditto wire rods, £90 10s., 10s. decrease; ditto H.C. wire, 10 15/16d., 1/16d. decrease.

Messrs. James & Shakespear report (October 26th): Copper bars (best selected), sheet, and rod, £101, £2 decrease; English pig lead, £25, 5s. increase.

Patent Applications.—Application has been made by the restoration of patent No. 12,709 of 1912 for "Improvements in telegraphic photography" granted to Curt Stille.

A petition for the extension of the term of patent No. 6,224 of 1906 for "Improvements in alternating-current dynamo-electric machines," and patent No. 15,711 of 1906 for "Improvements in windings for alternating-current dynamo-electric machines," both granted to Louis John Hunt and The Sandycroft Foundry Co., Ltd., will be heard by Mr. Justice Sargent in the High Court on December 14th.

Cable Requirements and Unemployment.—The National Joint Industrial Council for the Cable Making Industry has issued a circular letter to municipal electricity committees pointing out that the lack of orders has caused serious unemployment in the industry. It is requested, therefore, that future extensions shall be considered immediately and orders placed, instead of being held over until the extensions become urgent.

Duty-Free Imports in Brazil.—The Norwegian Legation at Rio de Janeiro reports that Brazil has exempted from import duties machinery and plant for the production of hydro-electric power, electric locomotives, electric automobiles, electric motors, electric machinery and parts thereof, including those for sub-stations for the transmission of power and material for the transmission and distribution of power. The same concessions will be made for plant for steam generating stations using coal or fuel oil of national origin.

The Export Trade Facilities Bill.—The Trade Facilities Bill, introduced in the House of Commons last week by the Prime Minister, is described as a Bill to authorise the Treasury to guarantee the payment of loans to be applied towards the carrying out of capital undertakings, or in the purchase of articles manufactured in the United Kingdom required for the purposes of any such undertakings, and to amend the Overseas Trade (Credits and Insurance) Act, 1920, and the Overseas Trade (Credits and Insurance) Amendment Act, 1921. It provides as follows (among other things):—

"If the Treasury are satisfied that the proceeds of any loan proposed to be raised, whether within or without the United Kingdom, by any Government, any public authority, or any corporation or other body of persons, are to be applied towards or in connection with the carrying out of any capital undertaking, or in, or in connection with, the purchase of articles manufactured in the United Kingdom required for the purposes of any such undertaking, and that the application of the loan in the manner proposed is calculated to promote employment in the United Kingdom, the Treasury may, subject to the provisions of this section, guarantee in such manner and form and on such terms and conditions as they think proper the payment of the interest and principal of the loan or of either interest or principal—provided that the aggregate capital amount of the loans, the principal or interest of which is guaranteed under this section, shall not exceed the sum of £25,000,000."

No guarantee will be given by the Treasury under this section after the expiration of 12 months from the commencement of the Act.

A Local Exhibition.—Another local exhibition of domestic electrical appliances, of the kind which is doing a great deal to acquaint the public with the advantages of electricity, is being held at Harrow during the present week. It has been arranged at the Station Road Kinema by Messrs. Symper and Evershed, electrical contractors, with the co-operation of the General Electric Co., Ltd., and large crowds are being attracted to the show by means of extensive local advertising.

The usual range of domestic apparatus is present, and in addition there are several more spectacular devices without which no popular electrical display would be complete. Among these are a representation of a burning building "worked" by means of a screen revolving round an electric lamp. There are one or two colour changing signs on the same principle, and interest is also attracted by a small portable X-ray set which is used to send a long arc between a pair of electrodes. The centre of the hall is occupied by a large stand upon which are arranged irons, bowl fires, kettles, pocket lamps, lighting fittings, &c., as well as samples of telephone sets. One side of the building is taken up by representations of furnished rooms. A local firm has furnished these, and the G.E.C. has supplied the electrical fittings and appliances.

In the entrance hall demonstrations are being given of a "Time-Saver" washing machine, and in a corridor are numerous lighting fittings, shades, bowls, &c. By arrangement with the proprietors of an adjacent cinema, a film showing the manufacture of "Osram" lamps is being run concurrently with the exhibition. Refreshments are provided at an electric buffet, and an orchestra is present to enliven proceedings. Mr. J. W. Beauchamp has promised to deliver one or two lectures during the week.

Railway Electrification.—In the House of Commons on October 24th, Colonel Newman asked the President of the Board of Trade whether he was aware that the electrification of the suburban portions of the trunk lines leading out of London was urgently needed, but was hung up owing to the inability of the companies to raise the necessary capital; and would he say if a railway company would be eligible for a grant to carry out such work under the terms of the Trade Facilities Bill? Sir Robert Horne replied that the electrification was postponed, not because the companies could not raise the necessary capital, but because present prices rendered the work unremunerative. These schemes would come within the scope of the Trade Facilities Bill.—*Financial*.

Annual Social.—Members of the Blackpool Electricity and Tramway Employés' Institute held their annual social on October 20th, Mr. C. Furness, general manager, presiding. The Lumb Silver Cup for inter-departmental competition was won by the E. & T. team.

A Works Souvenir.—Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne, have recently published an illustrated "Souvenir of a Visit to Hebburn." This contains some good illustrations of the firm's works and products.

For Sale.—Messrs. A. Goodman, Sons, Pollard & Braybrook are instructed by the liquidator to invite offers for the whole of the undertaking of the T.B.S. Electrical Co., Ltd. (in liquidation), including the right to use the name, certain concessionary rights, stock, &c.

Wigan Borough Council Electricity Department invites offers for four Willans & Robinson compound engines, coupled to G.E.C. generators, and three Belliss & Morcom triple expansion engines, coupled to Dick, Kerr generators.

Fuller, Horsey, Sons & Cassell will offer by auction on November 8th, at Edmonton, surplus plant and machinery including generating sets, motors, &c.

(For full particulars see our advertisement pages to-day.)

Tramwaymen's Wages Reduction.—In accordance with the agreement adopted by the Joint Industrial Council for a sliding scale based on the cost of living, tramway workers, nationally, from the first full pay period in November will have their wages reduced as follows: Employees aged 15 and over by a further 2s. per week, making a total reduction of 5s. per week; employees under 18 by a further 1s., making a total reduction of 2s. 6d. per week. These reductions, which are based on the latest index figure of 110, will apply to all tramway authorities who have given full effect to the decision of the Industrial Council regarding wages.—*Morning Post*.

Glasgow Hiring-out Scheme.—The Falkirk Iron Co., Ltd., informs us that the Glasgow Corporation has ordered over 100 "Falco" cookers for its apparatus hiring-out scheme; further orders are anticipated from this source.

The Engineers' Ballot.—A joint conference of the Unions affected by the engineering dispute is to be held in London to-day (Friday) to receive the result of the ballot. The question at issue is the withdrawal of the 12½ per cent. bonus. The employers have offered to effect the withdrawal in three stages—on November 1st, December 1st, and January 1st respectively. In the event of the terms being rejected, the men will be locked out from next Tuesday—November 1st. Present indications, however, are that the terms will be accepted. The voting in the North is said to show a considerable majority for acceptance, but a feature of the ballot is the large number of abstentions both in the engineering shops and in the shipyards.—*Morning Post*.

Birmingham Footballers.—Two of Mr. George Ellison's employees, Messrs. Smith and Spate, have been selected to represent the Birmingham and District Works Amateur Football Association in their match against the Victoria League on November 5th. Mr. Smith will captain the team.

Book Notices.—The Choice of Motors for Industrial Work. Small Motor Applications, 34 pp. Ironclad Park, Manchester: Metropolitan-Vickers Electrical Co., Ltd. (Special Publication 1000/2).—This useful little handbook is designed for the use of those who, with little or no electrical training, contemplate the employment of motors in their establishments. As a preliminary the characteristics and construction of the several types of electric motor are described in succinct detail. Diagrams explaining windings, and curves of performance are given for each type. Methods of computing the size of motor required are simply explained, and such points as mounting, speed, voltage, power factor, &c., are briefly dealt with. A number of applications of motors for various industrial purposes are illustrated.

"Statement respecting the Relation of Water Power to Canada's Fuel Problems," prepared by the Dominion Water Power Branch, Department of the Interior.—This publication has been prepared to show the necessity for the fullest use of water power in view of the high cost of coal and uncertainty of supplies. Statistics of outputs and fuel consumption in various countries reveal surprising inefficiencies, but it is gratifying to see that Great Britain appears in a comparatively favourable light in this respect. The financial saving effected by the use of hydro-electric power is illustrated by a number of concrete examples.

"General Physics and its Application to Industry and Everyday Life," by E. S. Ferry. Pp. xvi+732, figs. 591. London: Chapman & Hall, Ltd. Price 24s. net.

"Science Abstracts A. & B." Vol XXIV, Part 9. September 30th, 1921. London: E. & F. N. Spon, Ltd. Price 2s. 6d. each.

We have received the first part of Cassell's "Practical Metal Worker," which is to be completed in 24 fortnightly parts, published at 1s. net. The work, which is to be written by experts and well illustrated, will be a comprehensive guide to the working of metal.

"Blue Printing and Modern Plan Copying," by B. J. Hall. Pp. ix+130, figs. 62. Price 6s. net. "Factory Administration in Practice," by W. J. Hiscox. Pp. x+211, 88 figs. Price 8s. 6d. net. London: Sir I. Pitman & Sons, Ltd.

"Finsbury Technical College and Old Students' Magazine," Vol. IV, No. 2, October, 1921. London: The College. Price 2s. 6d. (free to members).—Containing reports of meetings, and notes of interest to old students.

"Journal of the American Institute of Electrical Engineers," Vol. XL, No. 10, October, 1921. New York: The Institute. Price \$1.

British Empire Rubber.—The Secretary of State for the Colonies has appointed a committee to report upon the present situation with regard to rubber in the British Empire. The committee is asked for suggestions for improving existing conditions. The chairman is Sir James Stevenson, Adviser to the Colonial Secretary, and among the members is the chairman of the Rubber Growers' Association, Sir Stanley Bois.

New Works in Canada.—The Eugene F. Phillips Electrical Co., Ltd., a large manufacturer of copper electric wire, announces that it will erect a plant at Brockville at a cost of \$3,000,000, utilising 3,000 e.h.p., and employing 600 hands. The Somet Solway Co. plans to erect a gas and coke oven plant at Hamilton next spring at a cost also of \$3,000,000.—*Reuter's Trade Service*.

German Subterfuges.—Melbourne Customs officials declare that German manufacturers are unsuccessfully trying all sorts of subterfuges to circumvent the Customs and place goods on the Australian market. *Financial Times*.

Porcelain Insulators in Finland.—The Arabia Porplins fabrik A.B., of Helsingfors, has just brought into operation plant for the testing of high-pressure insulators up to 300,000 volts.

Trade Conditions in South Africa.—The general managers of the Standard Bank of South Africa report that there is some improvement in the demand for electrical goods, and prices are unchanged. Mining material and machinery business is restricted and prices tend downward. *Reuter's Trade Service* (Cape Town), October 24th.

Ability in Industry.—The fifth of the series of industrial lectures organised by the Industrial League and Council will be given at Caxton Hall, S.W.1, on Wednesday evening, November 2nd, at 7.30 p.m., when the lecturer will be Mr. E. C. de Segundo, A.M.I.C.E., who will speak on "Ability as a Factor in the Production of Wealth."

Machinery Import Exemptions in Ecuador.—The Government of Ecuador has passed a law exempting the import of all raw materials and machinery from duties and taxes in an effort to attract manufacturing enterprises and foreign capital. *Reuter's Trade Service*.

Trade Revival?—The *Financial Times* quotes Mr. Hugo Hirst, managing director of the General Electric Co., Ltd., as saying that so far as the engineering trades were concerned he was of opinion that if only foreign buyers would take full advantage of the benefits under the Government credit scheme a considerable industrial revival might take place. The task of supplying material for such work as building new railways would give employment to large numbers and would result in the re-employment of many hands who were at present stood down.

Chinese Notes.—The electricity and waterworks in Hanchow will be under the management of the Hanchow municipal administration.

The Liyang Telephone Co., of Liyang, Kiangsu, proposes to install telephone wires as far as Nantu. The Ministry of Communications has given its approval.

The Ministry of Communications has registered the Chouchen Telephone Co., of Chouchen, Shantung.

It is reported that General Chen Chung-ming has decided to install wireless plants in Wuchow and Canton.

Lantern Slides.—Messrs. E. Bennis & Co., Ltd., have a large number of lantern slides of mechanical stokers and coal and ash elevating and conveying plant available for lecture purposes. Those interested can obtain a booklet giving particulars from the company at 28, Victoria Street, London, S.W.1.

LIGHTING AND POWER NOTES.

Blackburn.—OPENING OF NEW STATION.—The new generating station at Whitebirk (described in our last issue) was formally opened by Lord Derby on October 21st. It has cost the town £850,000, and Lord Derby expressed the opinion that the investment was a good one. Over 150 guests from all parts of the North were conveyed by special train from Blackburn to the new works at Whitebirk, where a tour of inspection was made, in the course of which Lord Derby started the first set. His lordship was presented with a silver casket, appropriately inscribed, from the contractors, in commemoration of the event, the gift being presented by Sir Charles Ellis, chairman of the English Electric Co. Among those present were Mr. P. P. Wheelwright, the borough electrical engineer, to whose design the construction of the works was carried out; Sir Charles Ellis, G.B.E., K.C.B., and Mr. P. J. Pybus, managing director, representing the English Electric Co. Mr. J. Meadowcroft, J.P., said that when completed the station would be one of the largest and most efficient in the country, and would be a lasting credit to the town, and particularly to the Electrical Engineer. Lord Derby said that Blackburn had set a good example. They had had the best of everything, and it would be the cheapest in the end.

The English Electric Co., Ltd., distributed a handsome souvenir to those present at the ceremony, embodying a description of the plant and a number of views of the station.

Bradford.—ANNUAL ACCOUNTS.—An abstract of accounts for the year ended March 31st, 1921, and the annual report of the Electricity Committee of the City of Bradford (electricity supply undertaking (of which Mr. Thomas Roles is engineer and manager) show that the output proved to be 55,683,518 kWh, the greatest recorded in the history of the department, being 6,887,451 kWh in excess of the output for the year ended March, 1920.

Bulk supply increased by 2,576,856 to 25,477,916 kWh;

private lighting by 906,559 to 4,772,329 kWh; domestic supply by 520,689 to 1,717,608 kWh; power and heating by 687,746 to 10,391,732 kWh; public lighting by 5,057 to 117,393 kWh; and tramway supply by 1,690,594 to 13,203,480 kWh.

The income of the department from all sources for the year was £435,692, this sum being £106,459 more than for the preceding financial year. The working expenses totalled £331,972, an increase of £36,708. The gross profit amounted to £103,720; interest and sinking-fund charges absorbed £93,117, leaving a surplus on the year's working of £10,603, as compared with a deficit of £3,419 for the preceding twelve months.

The number of consumers increased by 1,283 to 7,712, and the b.h.p. of motors from 32,516 to 37,001. The capacity of the plant rose from 18,150 to 28,390 kW, and the cost was 1.779d. (including capital charges), and the average price obtained was 1.78d. per kWh sold.

The completion of certain items of extension which have been in progress for some time at the generating station is recorded; the first of the 12,000 kW turbo-alternators (No. 5) was put into commission in September, 1920, and has since been in practically continuous service with highly satisfactory results, not only as regards its operation, but from the point of view of coal economy. The erection of the second 12,000-kW turbo-alternator is now practically finished, and it is hoped that the plant will be in service in time to assist in carrying the coming winter's load.

A third turbo-alternator of about 12,000 or 15,000 kW rating will eventually be installed, and an order was placed last October with Messrs. Babcock & Wilcox, Ltd., for a new boiler house and equipment. The contract comprises, in addition to the buildings, four water-tube boilers of marine type of large size, complete with superheaters, travelling grate stokers, and economisers, feed pumps, coal-handling plant, and piping system. The design of this boiler house incorporates the very latest features in connection with boiler-house practice; it is not anticipated that the work will be completed before the summer of next year, but the department is not likely to be inconvenienced to any great extent by this delay. The e.h.p. switchgear at the Valley Road works is in course of extension to provide for the control of additional feeders to different parts of the City. The new gear is of the totally-enclosed ironclad type manufactured by Messrs. A. Reyrolle & Co., Ltd.

ELECTRICITY SUPPLY EXTENSIONS.—The Electricity Committee has decided to supply electricity to the Idle and Thackley districts at an estimated cost of £21,800, and to Clayton, particulars of which are not yet to hand. The object of the scheme is to provide work for the unemployed.

Brierfield.—INCREASED CHARGES.—The Urban District Council has decided to increase the charges for electricity by 1d. per unit for lighting and 1d. per unit for power, to date from the September quarter.

Canada.—TORONTO.—The report of the Toronto Electric Commissioners upon their department for the year ended December 31st last shows that the total receipts amounted to \$3,150,847, an increase of 25.8 per cent. The cost of the bulk supply from the Hydro-Electric Power Commission of Ontario, was \$974,838, and operating costs, depreciation, improvement charges, &c., \$988,748, making a total expenditure of \$1,963,586. Of the gross balance, \$1,187,270, capital charges absorbed \$1,064,543, leaving a net balance of \$122,727. The general manager (Mr. H. H. Couzens) states that the connected load increased by over 18,500 h.p. and the energy consumption by over 34,000,000 kWh.

China.—ELECTRICAL UNDERTAKINGS.—Subscriptions have been raised in Weihsien and Fengtze (Shantung) for the purpose of installing an electric supply in these districts. Land has been purchased, premises erected, and machinery ordered from abroad.

The Yungting Hydro-Electric Co., organised by Yu Yue-tang, recently petitioned the Ministry of Agriculture and Commerce and the Ministry of Communications for registration.

Derry.—REDUCED CHARGES.—The Corporation has decided to reduce the charges for electricity by 25 per cent., on the basic rate for long-hour lighting, and 18 per cent. for short-hour lighting.

Emsworth.—ELECTRICITY SUPPLY.—Steps are being taken to provide the district with electricity, and negotiations have been opened with the Portsmouth Corporation for laying the cables and distributing electricity.

Electricity District.—SOUTH-EAST LANCASHIRE.—We have received very full details of the scheme for the reorganisation of the supply of electricity in the above-named area which has been submitted to the Electricity Commissioners on behalf of the local authorities and companies that are supporting the scheme. We hope to outline the scheme in our next issue. Copies of the scheme, at the price of 5s. each, are obtainable from Mr. A. H. Banks, secretary pro tem., Town Hall, Manchester.

Faversham.—LOAN.—The Town Council has applied for sanction to borrow £1,000 to meet the cost of a Petter oil plant installed at the electricity works.

Hornsey.—EXTENSIONS.—£20,000 is to be spent on electricity undertaking developments.

Huddersfield.—LOAN.—The Electricity Committee is applying to the Electricity Commissioners for sanction to the borrowing of £100,000 for mains extensions, &c.

Leominster.—MINIMUM CHARGES.—The Rural District Council has consented to the following charges being inserted in the Order applied for by the Hereford Town Council for the rural area: Quarters ending March 31st and December 31st, any amount up to 15 units, 17s. 6d., and 1s. 2d. per unit over 15; quarters ending June 30th and September 30th, up to 10 units, 11s. 8d., and 1s. 2d. per unit over 10.

Liandrinod Wells.—PRICE REVISION.—The Ministry of Transport has made an Order empowering the Electric Light Co. to charge for a period of ten years a maximum of 1s. 2d. per unit, with a minimum charge for the winter quarters for 10 units or less.

Londonderry.—PROPOSED PRICE REDUCTION.—Having regard to the satisfactory position of the electricity undertaking, the Corporation electrical engineer recommends that when the shipyard tariff is brought into line with the charges to other consumers a general reduction should be made. In some cases the proposed reduction will amount to as much as 37 per cent.

Oldham.—LOAN.—The Electricity Committee has decided to apply to the Electricity Commissioners for additional borrowing powers to cover an over-expenditure of £6,382. The total expenditure on mains up to March, 1920, and during the year 1920-21 was £60,482.

Rugby.—MUNICIPAL TRADING PROTEST.—The Local Building Trades Employers' Association has written to the Urban Council complaining that the electricity department competes with contractors for the installation of lighting systems and plant on private property, which it is contended is illegal. The matter has been referred to the Electricity Committee, and the Association has been asked to particularise cases of alleged municipal trading.

Salford.—NEW STATION.—The Electricity Committee reports that the scheme for the erection of a new power station at Agecroft is not yet ready for submission, but it recommends the expenditure of a further £10,000 upon the preparation of the site, as a means of absorbing unemployed labour.

Stoke-on-Trent.—LOAN.—The Electricity Committee has applied to the Electricity Commissioners for sanction to borrow £20,000 for mains extensions and £10,000 for transformers, switchgear, and equipment, to be expended within the next two or three years.

Stogness.—ELECTRIC LIGHT SCHEME ABANDONED.—The Town Council has decided not to take any further steps in the matter of providing electricity for the town. According to Mr. C. H. Wordingham, an effective scheme would cost £40,000, and as the town's outstanding debt is already £102,000, it was considered inadvisable to proceed further.

Southport.—PRICE REDUCTION.—The Electricity Committee has decided to reduce the charges for electricity by 25 per cent. This is the outcome of the installation of new plant, by which a saving of 30 per cent. will be effected in the consumption of coal.

South Shields.—NEW PLANT.—On October 19th a new generating set was started up at the Corporation electricity works. This consists of a Metropolitan-Vickers 3,000 r.p.m. impulse turbine direct coupled to a 3,000-kW, 3-phase, 50-cycle, 2,250-V generator with exciter mounted on an extension of the main shaft. The air and extraction pumps are driven by a 26-h.p., 550-V, d.c. motor running at 1,440 r.p.m. The condenser water is circulated by a 90-h.p. variable-speed motor coupled to a centrifugal pump capable of dealing with 192,000 gallons per hour.

A 1,000-kW, 6-phase rotary converter has been installed, which will convert the supply to d.c. at from 500 to 550 V for traction purposes. In conjunction with this a 1,100-kVA transformer has been installed. The circulating water culverts are designed to deal with 1,250,000 gallons per hour, and about 290 tons of concrete was used in their construction.

Swansea.—COUNTERACTING EXTRAVAGANCE.—The Council has approved a recommendation of the Electricity Committee that the weekly payment for electricity used in the Corporation workmen's dwellings should be increased from 1s. to 1s. 6d., that meters be installed, that the Corporation should pay for the initial cost of lamps only, and that any consumer using more than 100 units per annum should pay the ordinary rates. The reason given for the recommendations was that the consumers were not using electricity economically.

Tegmouthe.—ELECTRICITY SUPPLY SCHEME.—A meeting was recently held to explain the electricity supply proposals and the formation of a company was decided upon. A small committee was formed to take the necessary steps.

Ystradgynlais.—PURCHASE OF UNDERTAKING.—The Urban District Council has decided to purchase the Glangawe electric supply works at a cost of £18,000, and application has been made to the Electricity Commissioners for a Provisional Order.

TRAMWAY AND RAILWAY NOTES.

Bradford. TRACK RENEWALS.—In order to provide work for the unemployed, the Tramway Committee has decided to re-lay the Ecclehill line from Idle road to the terminus, at an estimated cost of £16,623, and the Wyke tramway near Odsal Top, at a cost of £9,523.

Edinburgh. REDUCED FARES.—The Council has decided to introduce lower fares on the various tramway routes in the city. The new fares are expected to be in operation within a few days.

Track Renewal.—A portion of the Portobello track is to be renewed at a cost of £54,000, in order to provide work for the unemployed.

Halifax. TRAMWAY IMPROVEMENTS.—The Tramway Committee proposes to construct an additional loop near the Cavendish Hotel, between Catherine Slack and Ambler Thorn, at a cost of £1,000.

Luddersfield. TRAMWAY EXTENSIONS.—The Town Council has decided to proceed with the construction of a portion of the new tramway route to Brighouse. It is estimated that the scheme will provide work for 400 men.

London. PROPOSED UNDERGROUND EXTENSIONS.—According to the *Daily Mail*, extensions involving the expenditure of about £8,000,000 are contemplated by the Underground Railway Companies. The proposals include the reconstruction of the City and South London Railway, the building of a surface line from Golder's Green to Edgware, and one or two linking-up schemes.

Tramway Extension.—The London County Council tramway Service 35 has been extended along the whole length of Holloway Road, terminating at Highgate.

Middlesbrough. NEW TRACK.—A double tramway track is to be laid along Stockton road from the Middlesbrough boundary to the old river bridge, at an estimated cost of £19,500.

Newcastle. UNEMPLOYMENT RELIEF.—Discussing measures for relieving unemployment in the district, the chairman of the Transport and Electricity Committee stated recently that it was expected that the rails for the Barras Bridge-Gateshead extension would be delivered in the course of a month. The Committee had been given to understand that the Gosforth Light Railway Order had been approved, and it had been decided, therefore, to proceed with the work in anticipation of the receipt of the Order.

The preliminary work in connection with the extension of the Byker car sheds was also to be commenced forthwith.

Salford. YEAR'S WORKING.—The report of the general manager of the Corporation tramways (Mr. G. W. Holford) for the year ended March 31st, 1921, records receipts amounting to £542,747, as against £495,025 in the previous year. Working expenditure amounted to £426,284, as compared with £375,497, leaving a gross profit of £116,463 (£119,528). The payment of all capital charges left a net profit of £17,038, a considerable decline from the profit of £37,610 made in the preceding year, when £20,000 was contributed towards rate relief. The number of passengers carried fell from 80,581,359 to 78,143,501, although there was an increase in the car miles run from 5,961,197 to 6,019,067.

South Shields. YEAR'S WORKING.—The total revenue of the tramway department for the past financial year was £102,086, as compared with £76,301 in 1919-20. Working expenses amounted to £98,708, as against £71,224, leaving a gross profit of £3,378 (£5,077). After the payment of capital charges, the net result was a profit of £549. The surplus was due to increased fares put into force during the year, a debit balance of nearly £6,000 having been anticipated prior to the increases. The charge for power was increased from 1½d. to 2½d. per kWh. There was a loss on the omnibus services.

United States. NEW ELECTRIC RAILWAY.—The Dallas Railway Co., of Dallas, Tex., is completing plans for the construction of an addition to its interurban railroad system from Dallas to Terrell, Tex., a distance of about 30 miles, estimated to cost \$1,800,000, including rails, line equipment, electric stations, electrical and mechanical apparatus. Nearly all of the right-of-way has been obtained and orders for materials are being placed.

The city of Rochester, N.Y., is planning to build a fourteen mile rapid transit and industrial electric railway in the abandoned bed of the Erie canal. The cost of the project is to exceed \$4,000,000.—*Railway Review*.

TELEGRAPH AND TELEPHONE NOTES.

Australia. LONG-RANGE WIRELESS.—In his address at the annual meeting of shareholders in Australasian Wireless (Australasia), Ltd., Sir Thomas Hughes, chairman of the directorate, reminded his hearers that the company had placed before the Federal Government an offer to provide a direct commercial wireless service between Australia and England, and to extend that service locally so that each State would

derive equal advantages from it. That offer, he said, had been favourably considered by the Federal Government, but owing to the English scheme the Federal Government did not proceed with the company's. They had learned since that there was considerable doubt whether the English scheme would ever be completed because there were so many objections to it. From the Australian point of view, continued Sir Thomas Hughes, the scheme appeared to be quite unsuitable because every message between Australia and England would have to pass over a chain of five stations, which introduced five points of weakness, and adding to the expense. The cost of every message would have to be divided among five stations. The committee itself had estimated that Australia would lose a large sum per annum on this scheme. He understood that neither the British Admiralty, the War Office, nor the Air Ministry had been consulted in reference to that committee and its scheme, and furthermore, it was a fact that the committee was formed, and made its report without reference to any of the Dominions. He claimed that the experimental work which the company had done in Australia during the past few years had proved beyond a doubt that it was possible to have direct wireless communication between Australia and any other part of the world, and that the only logical application of such knowledge was to erect a high power main overseas station, with local or feeder stations at each capital, to work directly with the main trunk station. Such a scheme the company was prepared to carry out, and to finance, either entirely on its own account, or in conjunction with the Federal Government. The company was in a position to supply one of the greatest needs Australia had ever felt, and to offer reasonable prospects of a good return on the capital needed for the purpose. Furthermore, the company hoped to be able to conduct the services at reduced rates.

Belgium.—WIRELESS TRAIN CONTROL.—The Belgian Nord Railway Co. is experimenting with a new signal system by which the chief of the train service organisation communicates with the signal cabins by wireless telephone.—*The Times*.

Night Telegraph Service.—The Newspaper Conference, representing the Press of the United Kingdom outside London, has adopted the subjoined resolution: "That in the view of the Newspaper Conference the strongest protest should be made in the public interest against what is obviously the policy of the Post Office to cease the all-night telegraph service in various provincial towns. The conference is of opinion that this restriction, or the attempt to exact a special payment to prevent it, is contrary to the spirit of the Post Office administration—that the service should be regarded as a whole. The conference directs attention to this matter lest undisputed acceptance of the present official scheme may be treated as a precedent to be applied to other provincial towns."—*Daily Telegraph*.

Russia.—NEW RADIO STATION.—In Moscow, on September 25th, the foundation stone of the principal building of the trans-Atlantic wireless station was laid. The station will be of 500 kW, and it will be able to communicate with all the radio stations in the world. It will be built by Russian engineers, following and using all inventions and improvements by Russian engineers. All the equipment will be prepared exclusively in Russian factories. It is intended to put the station to work next year, says a Moscow message to a North Russian journal.

The Toll Telephone Exchange.—When the "Toll" telephone exchange was opened by the Postmaster-General in London on September 17th last, Mr. Kellaway pointed out that its chief advantage, apart from the very substantial benefit of affording relief to the London "Trunk" exchange, which was being taxed to the limit of its capacity, was that in most cases it might be possible to secure connections to the provincial towns served by the exchange on demand. The records which have been taken since show that only about 5 per cent. of the total calls made throughout the day in London fail to secure immediate connection and have to be booked for completion later. The average number of outgoing calls is 5,000 daily, and the incoming traffic reaches about 6,000 calls per day.

Experience has already shown that some of the towns included in the "Toll" area require even greater facilities than were provided by the original disposition of the circuits, and steps are being taken to provide them.

Some 500 calls are still being passed daily by telephone users to "Trunks," whereas the wanted numbers are within the "Toll" area. It will add to the success of the "Toll" service if subscribers will, before applying for calls to places outside the London local area, ascertain whether "Trunks" or "Toll" should be asked for.

Wireless Telegraphy.—FACSIMILE REPRODUCTION.—The *New York World* on October 18th published facsimile reproductions of messages in the handwriting of M. Briand and General Pershing, transmitted from Paris by wireless to America. The achievement is a step in advance of the work of Edouard Belin, inventor of "telegraphic photography." M. Belin received the facsimile messages through the United States naval wireless station at Annapolis, and enthusiastically predicts that it will be only a short time before pictures will be wirelessly across the Atlantic as easily as they are now transmitted by cable.—*Daily Telegraph*.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Australia.—MELBOURNE.—Victorian Government Railways. January 4th. 159 electric train stops operated by a single-phase induction motor. One set of electrical pyrometer equipment for measuring temperatures of from 350 to 2,000 degrees Fahrenheit.—*Reuter's Trade Service* (Melbourne).

City Council. February 20th. One 2,000-kW rotary converter with transformer, also 6,600 V, 50-cycle, 3-phase switchgear.—*Reuter's Trade Service* (Melbourne).

NEWCASTLE (N.S.W.).—December 22nd. City Council. One 25-kW motor-generator set. Electrical engineer and manager, Watt Street, Newcastle (N.S.W.).

Aylesbury.—November 11th. Town Council. Electric motors and pumps. (October 21st.)

Belgium.—November 14th. The Société du Canal et des Installations Maritimes de Bruxelles (59 Rue du Canal, Brussels). Electrically-operated pump capable of delivering 650 cubic metres of water per hour.

India.—CALCUTTA.—November 9th. Calcutta Electric Supply Corporation, Ltd. One 15,000-kW turbo-alternator and condensing plant. Two water-tube boilers with an evaporation of 60,000 lb. per hour. (October 7th.) Paper-insulated, lead-covered cables, bitumen-sheathed cables, v.i.r. cables, and joint boxes (Spec. 72). (October 21st.)

London.—L.C.C.—November 28th. Water-tube boilers, superheaters and economisers. &c. (October 21st.)

New Zealand.—WELLINGTON.—November 21st. Post and Telegraph Department. 750 red and 750 white switchboard cords, 3 conductor. (Spec. No. 87.)*

Portsmouth.—November 18th. Corporation. Four centrifugal pumps, direct coupled to 3-phase, a.c. motors, sludge pump and motor, and various small motors, switchboard cables, lighting, and other apparatus. (October 21st.)

Sheffield.—November 26th. Health Committee. Plant and machinery for refuse disposal works, including cranes, switchboard, pumps, &c., steam-driven electrical plant and condensers, motors, and starters, &c. (See this issue.)

South Africa.—JOHANNESBURG.—November 7th. Rand Water Board. Two 350-kW steam-driven electrical generating sets, complete with switchboards and all accessories.*

DURBAN.—Municipal Council. 250 single-pole, or 125 double-pole ironclad fuses, 25 amperes, 200 volts; 500 combined double-pole enclosed switches and fuses, 35 amperes, 200 volts, suitable for house service use; 144 single-pole switch fuses, unmounted, 100 amperes, 200 volts; 50 single-pole switch fuses, of the "Brush" or other similar type, 50 amperes, 275 volts, suitable for sub-station use. One 3-phase transformer, 25 kVA capacity, 50 cycles.*

Warrington.—November 15th. Electricity and Tramways Committee. Motors and transformers. (October 21st.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—Fifteen firms—Belgian, German, Austrian, Swiss, Italian and British—competed for the contract to supply 16,500 metres of armoured cable of different sizes for the municipal authorities of Schaerbeek, Brussels. The lowest offer—337,707 fr.—was submitted by F. Lemoine, of Dison, Belgium.

Bradford.—Tramways Committee.

Fifteen tons of steel fishplates, at £285.—North-Eastern Steel Co.

Electricity Committee.

Soot blower installation for four boilers for No. 4 boiler house at Valley Road works.—Babcock & Wilcox, Ltd.

Glasgow.—Tramways Department. Recommended:—

Trolley wire.—Thomas Bolton & Sons, Ltd.

Three-way switches.—Edison Swan Electric Co., Ltd.

Corporation. Recommended:—

Three cinematograph operating machines complete, for £110 each, for Corporation halls.—Chalmers, Ltd.

Markets Committee. Accepted:—

Electric lighting installation at Cheese Market.—Grindley, Ross & Co., Ltd.

Electricity Committee. Recommended:—

Construction of No. 2 circulating water inlet at the Dalmarnock generating station.—John Train & Taylor, £17,386.

For providing screens for the inlet.—Brackett & Sons, £24,210

Government Contracts.—The following Government contracts were placed during September, 1921:—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT.)

Accumulator cells.—Fuller's United Electric Works, Ltd.; London Battery and Cable Co., Ltd.
Lampholders.—Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.; W. Metcalf & Co., Ltd.
Wireless telegraphy masts.—C. F. Elwell, Ltd.

WAR OFFICE.

Automatic dust control with motor.—J. M. Adam & Co.
Generating set spares.—A. Lyon & Co., Ltd.
Electric wires.—British Insulated & Helsby Cables, Ltd.

AIR MINISTRY.

Electrical equipment.—General Electric Co., Ltd.
Ignition sets.—British Thomson-Houston Co., Ltd.
Electrically-driven pumps.—Kees Roturbo Manufacturing Co., Ltd.
Switchboard.—Erskine Heap & Co., Ltd.

POST OFFICE.

Laying conduits, Norwood Road and Palace Road: J. Mowlem & Co., Ltd. Lewisham (Loampit Hill): J. Mowlem & Co., Ltd. Limehouse (Three Cull Street): J. Mowlem & Co., Ltd. Higher Green: J. Mowlem & Co., Ltd. Kensington, Paddington, and St. Marylebone: J. Mowlem & Co., Ltd. Camberwell (Southampton Street): Roads and Public Works, Ltd. King's Cross (Albion Street): Roads and Public Works, Ltd. Brighton-Worthing (Section I): H. Farrow, Waltham Cross-Clipping Shop's Stafford (Section II): H. Farrow, Edinburgh (E) and Trarant: R. Thorburn & Son, Brockley: Greig & Matthews, Brighton-Rodean, &c.: Greig & Matthews, Waltham Cross-Epping-Bishop's Stafford (Section I): J. A. Ewart, Ltd. St. Pancras: J. A. Ewart, Ltd. Huddersfield-Hallifax: E. E. Jeavons & Co., Ltd. Oldham-Huddersfield (Section II): W. Pollitt & Co., Ltd. Horbury: W. Pollitt & Co., Ltd. Upton: Martin & Element, Ltd. Stanmore-Chesham (Section II): W. & C. French, Stanmore-Chesham (Section I): W. & C. French, St. Helens: G. Percy Trenham, Ltd. Port Talbot: G. Percy Trenham, Ltd. Blackwood, Mon.: G. Percy Trenham, Ltd. Manufacture, supply, drawing-in, and jointing cable.—Elizabeth Terrace-Widnes-Kuncun: W. T. Glover & Co., Ltd. Trafford Park, Manchester, Weybridge-Woking, &c.: W. T. Henley's Telegraph Works Co., Ltd. Glasgow-Paisley: British Insulated & Helsby Cables, Ltd. Birmingham-Dudley-Tipton, Dudley-Stourbridge-Cradley Heath: Firelli-General Cable Works, Ltd.

Telephone exchange equipment.—Chorlton-cum-Hardy: Automatic Telephone Manufacturing Co., Ltd. Sub-contractors for batteries: Chloride Electrical Storage Co., Ltd.; for charging machine: Crompton and Co., Ltd.

Telephone apparatus.—Phoenix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.

Testing, protective apparatus, &c.—Automatic Telephone Manufacturing Co., Ltd.; British Thomson-Houston Co., Ltd.; S. G. Leach & Co., Ltd.

Telegraph and telephone cable.—British Insulated & Helsby Cables, Ltd.; Enfield Edison Cable Works, Ltd.; Firelli-General Cable Works, Ltd.; Union Cable Co., Ltd.

Loading coils.—Western Electric Co., Ltd.

Ducts.—Albion Clay Co., Ltd.

Charging panels.—Power Equipment Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Accumulator Cells.—Tudor Accumulator Co., Ltd.
Control apparatus.—Western Electric Co., Ltd.
Motor-driven fan, &c.—Babcock & Wilcox, Ltd.
Generating set.—Norris, Henty & Gardners, Ltd.
Oil-cooled transformers.—Metropolitan-Vickers Electric Export Co., Ltd.
Wireless sets.—Marconi Wireless Telegraph Co., Ltd.

HIGH COMMISSIONER FOR INDIA.

Batteries.—Chloride Electrical Storage Co., Ltd.
Generating sets.—Laurence Scott & Co., Ltd.
Lamps.—British Thomson-Houston Co., Ltd.
Switchboards.—Peel-Conner Telephone Works, Ltd.
Telephones.—Peel-Conner Telephone Works, Ltd.
Telephone equipment.—Relay Automatic Telephone Manufacturing Co., Ltd.

H.M. OFFICE OF WORKS.

Engineering services.—Additional plant, National Physical Laboratory: Bruce Peckib & Co., Ltd.
Pantryrid housing scheme.—Electric wiring: D. G. Ball.

PUBLIC WORKS, DUBLIN.

Electrical works and supplies, Dublin.—Handley & Robinson, Ltd.

London.—HAMMERSMITH.—Electricity Committee. Recommended:—

Two 200-kW oil-cooled transformers, £494.—Hackbridge Electric Construction Co., Ltd.

STEPNEY.—Borough Council. Electricity Department. Accepted:—

Half mile 3-in. earthenware pipes, £135.—Sutton & Co.
One mile 3-in. earthenware pipes, £269.—Albion Clay Co., Ltd.

Manchester.—Education Committee. Accepted:—
Electric lamps.—Princess Manufacturing Co.

Swansea.—Town Council. Accepted:—
6,600-V switchgear, £185.—Metropolitan-Vickers Electrical Co., Ltd.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, October 28th. At the Institution, Storey's Gate, S.W. At 6 p.m. Discussion on Eleventh Alloys Report. Friday, November 4th. Thomas Hawksley Lecture on "Power Transmission by Oil," by Dr. H. S. Hite-Shaw, F.R.S.

Junior Institution of Engineers.—Friday, October 28th. At Caxton Hall, S.W. At 6 p.m. Paper on "Water Gas Manufacture," by Mr. F. Collinson.

Electrical Power Engineers' Association (Southern Division).—Saturday, October 29th. At the Hotel Cecil, Strand, W.C. At 5.30 for 6 p.m. Third annual dinner.

Bristol Association of Engineers.—Tuesday, November 1st. At the Royal Hotel, At 8 p.m. Address by the President, Prof. D. Robertson, on the "Centenary of the Continuous Current Machine."

Institution of Civil Engineers.—Tuesday, November 1st. At the Institution, Great George Street, S.W. At 6 p.m. Inaugural address by the President, Mr. W. B. Worthington.

Roentgen Society.—Tuesday, November 1st. At the Institution of Electrical Engineers, Victoria Embankment, W.C.2. At 8.15 p.m. General meeting.

Royal Society of Arts.—Wednesday, November 2nd. At Jerm Street, Adelphi, W.C. At 8 p.m. Address by the Chairman of the Council, Mr. A. A. Campbell-Swinton, F.R.S., on "Wireless Telegraphy."

Institution of Railway Signal Engineers.—Wednesday, November 2nd. At the Midland Grand Hotel, St. Pancras, S.W.1. At 6 p.m. Paper on "Inter-position Signalling," by Mr. A. L. Latheside.

"Dynamicals."—Wednesday, November 2nd. At the Engineers' Club. At 7.30 p.m. Dinner, Mr. J. S. Haggood in the chair.

Industrial League and Council.—Wednesday, November 2nd. At Caxton Hall, S.W.1. Lecture on "Ability as a Factor in the Production of Wealth," by Mr. E. C. de Sologno.

Société des Ingénieurs Civils de France (British Section).—Wednesday, November 2nd. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 5.30 p.m. Paper on "The Effects of Fire on the Reconstruction of the Devastated Regions," by the Marquis de Castell-Loubat.

Institute of Cost and Works Accountants.—Wednesday, November 2nd. At the Hall of the Institute of Chartered Patent Agents. At 7 p.m. Lecture on "The Human Element in Keeping Costs," by Mr. G. E. Whitehouse.

Chemical Society.—Thursday, November 3rd. At Burlington House, Piccadilly, W.1. At 8 p.m. Ordinary scientific meeting.

Institution of Electrical Engineers.—Thursday, November 3rd. At the Institution, Victoria Embankment, S.W. At 6 p.m. Presidential address, by Mr. J. S. Haggood.

(East Midland Sub-Centre).—Tuesday, November 1st. At the Technical College, Derby. At 7 p.m. Paper on "Electric Traction," by Mr. J. Dalziel.

(Liverpool Sub-Centre).—Monday, November 7th. At the Liverpool University. At 7 p.m. Chairman's (Mr. G. H. Nisbett) address.

(Liverpool Students' Sub-Centre).—Thursday, November 3rd. At the University, Liverpool. At 7 p.m. Paper on "Transformer and Switch oils," by Mr. H. Butterworth.

Wednesday, November 2nd. Visit to the works of British Insulated and Helsby Cables, Ltd., at Helsby, Cheshire.

(Western Centre).—Monday, November 7th. At the South Wales Institute of Engineers, Park Place, Cardiff. At 6.30 p.m. Inaugural address by the Chairman, Mr. A. C. MacWhirter.

Chelmsford Engineering Society.—Thursday, November 3rd. At the East Anglian Institute of Agriculture, At 7 p.m. Paper on "Einstein's Theory," by Mr. T. L. Eckersley.

International Motor Exhibition.—November 4th to 12th. At Olympia, W., and the White City, Shepherd's Bush, W.

NOTES.

Educational.—UNIVERSITY OF LONDON.—The University College Calendar for Session 1921-22 gives an outline of the history of the college, by the late Dr. G. Carey Foster, as a preface. The personnel of the College Committee, Professorial Board, and details of departments and staff are given in full, as well as a list of Fellows. Following these are particulars of admission, scholarships, degrees, and courses. A list appears of post-graduate courses of lectures in numerous subjects. A catalogue of original papers emanating from the College is included, and, following a list of students, is the Provost's report for 1920-21 and proceedings at the Assembly of the Faculties.

Electrical Boilers.—Mr. J. D. Troup, M.I.Mech.E., in an article recently contributed to the *Manchester Guardian*, gave some details of electrical boilers based on the experiences of the Ateliers de Construction Oerlikon, of Zurich. The type of boiler preferably employed in dyeworks, breweries, &c., for heating water is multitubular, the elements being within the tubes while the water passes over the outside. The boiler cover and tubes form one piece, easily removed when cleaning becomes necessary. If the loading exceeds 300 kW, two or more boilers may be connected to work in parallel. The space occupied by these boilers is small. The 100-kW size is only 20 in. in diameter and 50 in. high. The boiler for steam raising is usually built with a loading of 500 kW. The heating elements are placed in a bunch in the lower part of a horizontal cylindrical shell which forms the boiler proper. The boiler shell in normal working is about three parts filled with water, and carries a steam dome. The Swiss authorities insist upon a margin of safety 50 per cent. above working pressure.

The Revel boiler, which utilises the heating effect of an electric current, takes the form of a vertical cylinder in which electrodes are immovably fixed. It may be supplied with power at 3,000 volts, and its efficiency is approximately 95 per cent. One advantage claimed for this type of boiler is that it can be switched on to the line, taking but a small starting current, which increases slowly to normal working.

The Electrical Industry and Unemployment.—The Joint Industrial Councils of the Electrical Industry, acting for the cable-making, electricity supply, and contracting branches, together with representatives of the Association of Electrical Manufacturers, the Wholesalers, and the Electrical Development Association, held a Conference on Monday, October 24th, to discuss the present conditions of unemployment in relation to the electrical industry, and to formulate measures which might be taken to secure the restoration of finance and trade within the industry and bring about alleviation of unemployment.

Sub-Committees were appointed to investigate details and collect information, and a further Conference will be held at the end of the week, when it is hoped to submit to the Cabinet Committee on Unemployment practical schemes on behalf of the electrical industry.

Fuel Economy.—The second issue of the *Fuel Economy Review* of the Federation of British Industries contains several articles of particular interest to manufacturers and others who utilise fuel for industrial purposes.

Although the *Review* was only issued for the first time in April in the nature of an experiment, it has met with such a favourable reception that its quarterly publication is assured, and this fact, in conjunction with its very moderate cost, should ensure its circulation amongst the management and technical staff of manufacturing establishments.

Our position as an industrial nation in the markets of the world is mainly governed by the price of coal, and the interests of the electrical industry in particular are dependent upon supplies of cheap fuel, the basic raw material for the production of energy.

The present cost of industrial coal is about three times the pre-war figure, and there is little hope of any very appreciable reduction in the near future, so that the more efficient utilisation of coal is absolutely essential if manufacturing costs in industrial establishments are to be maintained at an economic level.

In the current issue of the *Review*, Prof. Henry Louis contributes a valuable article on the economics of coal production, showing clearly the present unstable condition of the mining industry and the necessity for cheaper coal supplies as a vital factor of our national existence. The official statistics of production and costs are analysed by Dr. Louis, and it certainly appears that the official data published leaves much to be desired from an accountancy point of view. The article is most opportune, and should certainly be of great interest to boards of directors, works managers, and others responsible for the purchase of coal for industrial purposes.

The "water side of the boiler" is an article contributed by Mr. J. H. Paul, B.Sc., who is an expert in this particular subject, and demonstrates clearly the importance of correctly treating the feed water prior to its entrance into the boiler.

The first of a series of articles on fuel control in works deals with the methods employed at a typical soap and chemical factory, and it is intended to discuss the practice adopted in various types of works from time to time.

The purchase of coal under specification of calorific value forms the subject of an article dealing with American practice, and in this respect the U.S.A. authorities are certainly to the fore. When one considers the waste and inefficiency entailed in transporting millions of tons of dirt, stones, and water from the Midlands to the London area alone under the title of industrial coal, it seems almost absurd to think that our coal supplies are more or less controlled by a State department, and that factories and power stations are handicapped as a consequence and our transport systems congested.

An interesting article on the utilisation of waste heat is contributed by Messrs. Robert Nelson and A. H. Human, and the developments on the North-East Coast and in Yorkshire are briefly outlined. Further developments in the conservation of surplus heat from industries are necessary, and if co-operation with electric power supply authorities can be arranged, very appreciable economies in fuel will result.

The present issue concludes with a *résumé* of three typical investigations carried out upon steam-raising plant by the expert staff attached to the Fuel Economy Department of the F.B.I. It is hoped to publish practical data relating to the efficient operation of boiler plants from time to time, and the information thus given should prove useful to works managers and engineers.

The Fuel Economy Committee is also undertaking educational propaganda, and has already published several useful pamphlets and diagrams for the guidance of boiler-house staffs, whilst the chart showing the sensible heat loss in flue gases under various furnace conditions should prove useful in this direction.

Although this is only the second issue of the *Fuel Economy Review*, we feel convinced that it will attain a large circulation both in this country and overseas, and we should like to congratulate the Fuel Economy Committee on the excellent work it is doing for the benefit of our industries and the welfare of the nation.

The Petrol Electric System.—At a conference of the Institute of Transport held in connection with the Commercial Motor Exhibition, Olympia, on October 17th, Mr. Percy Frost Smith read a paper on "The Evolution of the Motor Vehicle for Goods and Passenger Service." After a review of developments, the speaker said, according to a *Daily Telegraph* report: "Much is said about 'safety first,' and I can state confidently that the petrol-electric system is the acme of this; for example, if a vehicle is being driven in exceptionally dangerous country, as in some parts of Wales, Cornwall, or Devon, a driver may at his discretion put his controller in the reverse position, and crawl down a hill at a rate of about two to three miles per hour, without having recourse to his mechanical brakes. Equally, if the engine should fail in the centre of a dangerous hill, the vehicle cannot run backwards at a greater speed than that mentioned above, because the electric motor automatically becomes a dynamo for the time being. We are waiting for engines which will 'turn' faster, or preferably the internal-combustion turbine, which will then permit of the production of much lighter electrical sets for a given output. The present hand control of the dynamo field resistance will become automatic, an electric brake control, if one cares to use it, through the transmission shafts, can be

easily provided, and if to-day the system cannot be considered absolutely fool-proof, it soon will be. My opinion is born of a strong conviction, the result of many years' experience of various forms of transmission. I believe that, in the absence of a force not yet known, or of a force not yet harnessed, in a few years from now petrol-electric transmission will occupy the position which the 'gear drive' holds to-day, and that is the end to which I, personally, am working."

The Swedish Housewives' Union.—The servant problem is as difficult in Sweden as here. But Sweden has an abundant supply of water-power, and her housewives are agitating for a provision of cheap domestic electric power and cheap electric labour-saving appliances. The matter has been taken up by the Swedish Housewives' Union, which is very practical in its methods. It realised that if it got the supply of electric power for cooking, sweeping, and ironing it would not be of much use unless it could also get the irons, stoves, and sweepers at a lower rate than the manufacturers were asking. So it called a conference to which it invited representatives of electric appliance makers. Eleven firms sent representatives, and the Union asked their help in the labour-saving scheme. It wanted them to make cheap appliances, and send them to an exhibition to be held in six months. Then the Union enlisted the help of a big housecraft school, whose experts examined the articles submitted. "This," they said, "is good. That one is wrong and must be altered to suit us." As a result a very large exhibition of electric appliances was held in Stockholm, and if they were not as cheap as the Union hopes they will become they were much cheaper than anything that had been shown before. In the following year one of the exhibitors recorded the sale of 800 electric appliances, and the scheme is now going well.—*Manchester Guardian*.

A Model Electric Restaurant.—On Tuesday last the directors of the Brompton & Kensington Accessories Co., Ltd., entertained a large party of visitors to dinner at the "B & K" Electric Restaurant, Earl's Court, London, with a view to demonstrating the capabilities of the magnificent new electric kitchen, which prepares 1,000 meals a day. The guests, who included Mr. J. S. Highfield, president of the Institution of Electrical Engineers, and Mr. A. Page, Electricity Commissioner, were conducted through the handsome restaurant, the well-equipped electric kitchen, and the workshops, by the chairman, Mr. H. R. Beeton, the chief engineer, Mr. R. S. Downe, and other members of the directorate and staff.

After the dinner—which, needless to say, was admirably cooked and efficiently served—Mr. Beeton, who presided, claimed that the B. & K. Co. was a pioneer in the promotion of the domestic accessory load, and had a ripe experience in respect of electric cooking. Thirty years ago he presided at a banquet on the occasion of the inauguration of the electricity works, the first high-pressure generating station in London; it was a purely residential area, and the improvement in the efficiency of glow lamps resulted in stagnation of revenue, compelling the company to embark on the missionary enterprise of educating the British public to the possibilities of electricity. It had secured 80 per cent. of the electric lighting possible in the area, and had 8,000 domestic consumers, but only 500 had as yet adopted electric cooking; consequently there remained an immense field, and 10 times the present output could be attained. The cooking load was highly profitable; heating was a seasonal load, overlapping lighting, and power was restricted to 47 hours a week, but cooking was always in progress, and overlapped lighting by only 10 per cent. in winter. Starting a restaurant was a bold step, but they did not regret it; by becoming cooks they learnt how best to design the apparatus. The present kitchen, one of the most complete and efficient in the world, was the third in succession. At 1½d. a kWh for cooking they were not losing money; the average cost to a householder was 5s. a week—very cheap, considering the quality of the service, and the excellent merits of the electrical method of cooking.

Mr. PAGE, in proposing success to the company, pointed out that the B. & K. system of distribution facilitated the use of heavy currents by consumers, and he believed that the method of distributing at a semi-high pressure and transforming on consumers' premises might have to be adopted elsewhere. The main concern of the Electricity Commissioners—reorganisation of areas and centralisation of generation—could only be successfully met by the co-operation of all parties interested and the wholehearted support of the industry.

Mr. HIGHFIELD said the company had undoubtedly adopted the right course. Other authorities had continuously reduced the price, but the whole income of the industry was collected from the public by the supply authorities, and they should increase the revenue by educating the consumers in electric cooking, &c., as that company had done. He had used electric cooking himself for 25 years.

Mr. DOWNE described the development of the restaurant from small beginnings, and its success, due to the excellent results obtained by electric cooking. The way to sell electricity was to supply the means of using it, and show consumers how to use it. Their undertaking was a centre of electrical activity, and a vast development of sales was anticipated.

A description of the equipment of the restaurant must be deferred to a later issue.

Speculative Construction of Electricity Works.—What appears to be a new method for the promotion of the construction and equipment of electricity supply works has just been proposed in Finland by three members of the Finnish Parliament, although the principle involved was common in Great Britain years ago before legislation put an end to speculative house building, and helped to bring about the present comparative scarcity of housing accommodation. The members in question have presented a petition to Parliament pointing out that the existing legislation of April, 1902, and April, 1909, in respect of electrical installations is very incomplete and antiquated having regard to the technical development which has taken place in the meantime. In particular, emphasis is laid on the absence in the orders of the year in question of any authority to mortgage electrical installations, except in certain cases, as security for loans or other obligations. As a consequence it is extremely difficult, if not quite impossible, to raise credit for electrical undertakings. Under these circumstances the petitioners ask Parliament to adopt a resolution instructing the Government to introduce a Bill to authorise the mortgaging of electrical installations, and at the same time to appoint an expert committee to inquire into and prepare a scheme for the amplification and amendment of the orders governing such installations.

The Law and Economic Committee of the Finnish Parliament, after an examination of the question, has associated itself with the proposal put forward by the petitioners, and states that recent economic development certainly demands legislative measures of the kind suggested. In the opinion of the committee the possibility of offering electrical installations as security for loans or other obligations necessary for the erection of works would increase in a high degree the opportunities for the establishment of such installations which would be calculated to facilitate the efforts for the electrification of the country. This circumstance is of all the more importance in Finland in consequence of the abundant resources in water power, which could be appropriately utilised for the production of light and power, but which cannot be fully utilised in another manner. Besides the supply of light and power the extension of such works would render the country independent of foreign sources for fuel, and would permit of the utilisation of credit in connection with fixed property, now so little used in Finland. The committee finally endorses the views of the petitioners and recommends Parliament to act in the matter as speedily as possible.

"Welcome Stranger."—Not for some considerable time has a new play been greeted with the complete favour which was accorded to Mr. Aaron Hoffman's comedy "Welcome Stranger" at the Lyric Theatre, Shaftesbury Avenue, W., on the night of October 19th. It is a clever enough play, says the *Daily Mail*, which does not make the mistake of being too clever. Its story is the old but ever-popular one of a man who succeeds with every man's hand against him.

Mr. Harry Green, that very amusing Hebrew comedian, is the man. In the character of Isidor Solomon he comes to a narrow-minded New England town with the object of opening a general store and making his fortune. It is New Year's Eve, and his reception in the town is as cold as the time of the year. But Isidor is not downhearted; he stays on, joins forces with a man who has a concession in respect to the local water fall, and ends up by transforming the place into a veritable electric city. Our contemporary says Mr. Green is immensely amusing in a quiet, unassuming way, and his performance is one of the most genuinely humorous ones on the stage at the moment. He is full of comic and witty sayings; for example, "They didn't want electric light here because I am an Israelite." Mr. George Elton, as the inventor, also gives an admirable performance; and Mr. Frank E. Petley, Mr. Sydney Paxton, Mr. Paul Arthur, and Mr. Robert Blythe help the piece along capably.

Miss Margaret Bannerman is the girl in the play, and a very pretty, sympathetic girl she is.

A New Aluminium Solder.—We recently witnessed a demonstration of the soldering of aluminium by means of "Alubon" solder, a product of the Melvin Engineering Co., Ltd. This solder is supplied in three grades—soft, medium, and hard, according to the size and nature of the joint or repair to be made; cracks, blow holes, &c., in castings can be repaired in the same manner, and no flux whatever is required. "Alubon" is simplicity itself to use; the heating medium may be a blow-pipe flame or ordinary soldering iron. The surfaces to be joined are first cleaned and rough filed, heated, and then tinned with "Alubon" separately, using a coarse scratch brush to ensure perfect tinning and to clean off any excess solder. Next, the parts are set up in position, reheated, and more solder is run over the tinned parts, which completes the operation. Care must, however, be exercised to ensure that no movement of the parts will take place while soldering or until the joint has set. When set, the job can be cooled off in water without weakening or disturbing the joint, and it will withstand the test of boiling in distilled water. We attempted to fracture several joints which we saw made, but only succeeded in breaking the parent metal, the joints themselves remained good in each case. It should be mentioned that besides soldering aluminium and all of its alloys, the new solder is applicable to the soldering of copper or brass to aluminium.

An Electric Car for Factories.—The latest American novelty is a small single-seated electric motor-car for use in factories which cover a large area, so that the officials may be quickly transported from point to point. The car, which has been put on the market by the Automatic Transportation Co., 2,333, Main Street, Buffalo, N.Y., has the battery of running a distance of 50 miles on one charge—under a bonnet in front of the driver. The wheel-base of the vehicle is only 5 ft. 5 in., and the track 2 ft. 11 in., so that it is small enough to pass through doorways and along the works' aisles without difficulty. It is also claimed that the car will effect a saving of time in the distribution of written instructions to various parts of large establishments.

INSTITUTION NOTES.

Institution of Electrical Engineers.—The programme for the first part of the 1921-22 session is as follows: Ordinary meetings: November 3rd, Mr. J. S. Highfield (president), inaugural address; November 17th, Mr. E. S. Byng, "Telephone Line Work in the United States." Wireless Section, November 9th, Dr. G. W. O. Howe (chairman), address. Informal meeting, November 7th, discussion on "How best to speed up electrical progress" (opened by the President).

NORTH-EASTERN CENTRE.—The opening meeting of the session was held at the Armstrong College, Newcastle-on-Tyne, on October 24th, when Prof. W. M. Thornton, O.B.E., D.Sc., delivered his inaugural address on "Electricity in Gases as a Branch of Engineering." The subject was illustrated with a series of experiments.

WESTERN CENTRE.—The first meeting of the session will be held in Cardiff (South Wales Institute of Engineers) on November 7th, when Mr. A. C. McWhirter will deliver his inaugural address as chairman of the Centre.

Faraday House Old Students' Association.—The annual dinner of the Association was held at the Holborn Restaurant on October 21st, Mr. C. C. Paterson, O.B.E., the president, being in the chair. The toast of "Faraday House and Its Old Students" was proposed by Mr. L. B. Atkinson, and replied to by Dr. Alexander Russell. Mr. Partridge proposed the "Guests" in a very happy speech. He said that the industry had not yet fully recognised the debt it was under to Dr. S. Z. de Ferranti for his invaluable pioneering work in the early days. The toast was replied to by Dr. Ferranti and Sir John Snell.

Royal Society of Arts.—The new session will be opened on Wednesday next, at 8 p.m., when Mr. A. A. Campbell Swinton, F.R.S., chairman of the Council, will deliver an experimental address on "Wireless Telegraphy." Among the papers fixed for the meetings up to Christmas are the following:—

D. R. Wilson, secretary of the Industrial Fatigue Research Board, "The Work of the Industrial Fatigue Research Board."

Prof. J. A. Fleming, F.R.S., "The Coming of Age of Long-distance Wireless Telegraphy and some of its Scientific Problems" (Sir Henry Trueman Wood lecture).

Sir W. B. Townley, K.C.M.G., Minister to the Netherlands, 1917-19, "Trade with the Netherlands East Indies."

F. C. Wade, B.A., K.C., Agent-General for British Columbia, "British Columbia: The Awakening of the Pacific."

Association of Mining Electrical Engineers.—The Lothians Branch of the Association opened the new session in Edinburgh with a social evening, when there was a large gathering of members and friends, including representatives from the West and East of Scotland, and Fife Centres. Mr. Henderson, in the absence of Mr. Milligan, the retiring president, was in the chair and presented by Mr. G. A. McLennan with prizes awarded by the Association for the best paper of the session, "Power Factor Control in Practice." Mr. F. Sims, the new president, gave his inaugural address.

Association of Consulting Engineers.—The annual dinner of the Association, which was postponed owing to the coal miners' strike, will be held on November 24th at the Engineers' Club, Coventry Street, W.

Chelmsford Engineering Society.—The opening meeting of the Society took place on October 13th under the chairmanship of Mr. G. F. Barrett, O.B.E., managing director of the Hoffmann Manufacturing Co. Mr. G. B. Petter, A.R.C.S., read a paper on the Vickers-Petter oil engine, in the course of which he gave some very interesting facts and data. The lecture was illustrated by lantern slides. Mr. Petter explained that the engine worked on the two-stroke cycle with hot-bulb ignition, and was made in the vertical type only for marine and land use. A useful discussion followed, and Mr. Petter replied to the questions raised.

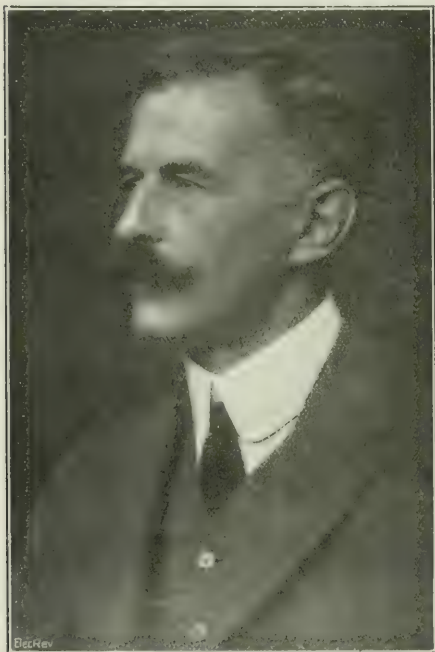
Edinburgh Electrical Society.—At a meeting on October 14th Mr. R. W. J. Stark read a paper on "Electrochemistry." Various processes for extracting gases from the air were described, and the lecturer dealt with electrolysis as applied to the manufacture of industrial chemicals. The processes of electro-plating, electro-typing, and the refining of copper were described.

On October 22nd the Society visited the Niddrie and Benhar Colliery at Newhailes. After inspecting the power house, the party descended a shaft and visited some of the hauling and pumping stations.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

MR. VICTOR LIONEL HICHENS, whose views on industrial problems have been expressed with frankness during the last few years, and have so frequently formed the subject of articles in the pages of the ELECTRICAL REVIEW, has been the chairman of Messrs. Cammell, Laird & Co., Ltd., since 1910, and he is to-day also vice-chairman of the English Electric Co., Ltd. At the recent meeting of the British Association for the Advancement of Science he presided over the Economic Science Section, and his contributions to the proceedings there aroused widespread interest and formed the basis for comment in our editorial pages last week and they do so again to-day. During the war Mr. Hichens was outspoken and thorough in his criticisms of Government control of industry, the dangers that were inevitable if it continued, and the fallacies underlying the advocacy of nationalisation. The subject of wages in



MR. W. L. HICHENS.

(Vice-chairman of the English Electric Co., Ltd.; Chairman of Messrs. Cammell, Laird & Co., Ltd.)

relation to industry was dealt with in a useful paper read by him at the Royal Society of Arts a year or two ago, and he has welcomed opportunities for debating industrial matters with labour leaders on the public platform. As a layman he has addressed meetings of men in the churches on the problems which, as a manufacturer and industrial leader, he has made his own. He was one of the engineering manufacturers who recently went North to confer with the Prime Minister on the industrial situation, unemployment problems, and trade revival. Born in the year 1874, Mr. Hichens was educated at Winchester and at New College, Oxford. He was a member of the Egyptian Ministry of Finance, Colonial Treasurer of the Transvaal, and Treasurer of the Inter-Colonial Council of the Transvaal and Orange River Colony. In 1907 he went to India as a member of the Royal Commission on Decentralisation. He acted as chairman of the board of inquiry held into the public service of Southern Rhodesia in 1909. In addition to his interests in industrial undertakings already mentioned he is a director of the London & North-Western Railway, a member of the Advisory Committee to the Department of Overseas Trade, deputy chairman of the Disposals Board, and a member of the Carnegie Trust.

Mr. R. W. HAYMAN, A.M.I.E.E., manager of the export department of Messrs. Simplex Conduits, Ltd., paid a visit to South Africa in the early part of the year to investigate the possibility of increased business. We are informed that the results were so satisfactory that Mr. Hayman is returning in charge of the Simplex permanent interests throughout the Union.

The marriage took place on October 18th, in London, of Mr. HENRY NIMMO, M.I.E.E., electrical engineer, Public Works Department, Burma, to Miss Anna Kathleen Barron, elder daughter of Mr. and Mrs. R. B. Barron, of Quendon, Essex.

Mr. A. E. DAVIS, of 5, Cavell Road, Dudley, has joined the permanent staff of Price's Electrical Supplies, Ltd., 56, Great Charles Street, Birmingham, as their representative in the Black Country.

Mr. W. A. TOPPIN is leaving the Chesterfield Corporation electricity department shortly, after four years as assistant manager, to start in business on his own account. He was previously 12 years with Greenock electricity department, and six years with large contractors.

Major CHARLES MITCHELL has been appointed a director of Sir W. G. Armstrong, Whitworth & Co., Ltd.

Mr. T. R. WHITEHEAD, manager of the Coventry Corporation Tramways, who has completed 25 years' service, has been presented by the Tramway Committee with an inscribed silver fruit dish.

Mr. J. J. SMITH, who resigned the appointment of borough electrical engineer at Stockton-on-Tees last June, has been presented with a silver tray by the officials and electricity works staff.

Col. O. C. ARMSTRONG, D.S.O. (chairman of Messrs. Greenwood & Batley, Ltd.), has been recommended by the Grand Council for the position of president of the Federation of British Industries, in succession to Sir W. Peter Rylands, who retires from the office at the annual meeting on November 23rd, after two years in the presidential chair. Col. Armstrong, who saw many years' military service in the South African war on the staff of Lord Kitchener, became a managing director of Messrs. William Beardmore & Co., Ltd., in 1909, on his retirement from the post of financial adviser at Headquarters in India. In 1914 he left his Beardmore position to become chairman of Messrs. Greenwood and Batley, Ltd., Leeds, which office he now holds. Among other positions he has held are the following: Vice-president of the Federation of British Industries; chairman of the British Engineers' Association; chairman of the Mechanical Engineering Group of the Federation of British Industries. The following members of the F.B.I. have been recommended to the annual general meeting for election as vice-presidents of the F.B.I.:—Lord Weir and Sir John Hunter (Glasgow District); Sir Tom Callender (Electrical Industry); Sir Harris Spencer (Birmingham District); Sir Wilfred Stokes (chairman, De-Controlled Firms Committee); Mr. Lennox Lee (chairman, Manchester District); Mr. Peter MacGregor (chairman, Sheffield District); Mr. Clive Cookson (chairman, Newcastle District); Mr. Alex. Johnston (chairman, Edinburgh District).

Obituary.—SENATOR FREDERIC NICHOLLS.—The death occurred on Tuesday, at the age of 65 years, of Senator Frederic Nicholls, president of the Canadian General Electric Co., and connected with many other important manufacturing, power, traction, and other undertakings in Canada.

NEW COMPANIES REGISTERED.

Cesco, Ltd. (177,314).—Private company. Registered October 17th. Capital, £6,000 in £1 shares. To adopt agreements with A. H. Smith and G. W. Matthew (1) for the acquisition of the business of the Commercial Electrical Supplies Co., and (2) relating to their appointment as permanent joint managing directors, and to carry on the business of electricians, mechanical engineers, suppliers of electricity for light, heat, motive power, or otherwise, &c. The permanent joint managing directors are: A. H. Smith, 13, Stanger Road, Penarth; G. W. Matthew, 37, Hamilton Street, Cardiff. Solicitors: R. W. Nicholas, 31, Queen Street, Cardiff.

Broadbents Patents Co. (Southport), Ltd. (177,273).—Private company. Registered October 15th. Capital, £2,000 in £1 shares (1,000 preference). To adopt an agreement with D. L. J. Broadbent, and to carry on the business of electricians, mechanical engineers, suppliers of electricity, &c. The permanent governing directors are: W. Teague, 18, Pilkington Road, Southport; engineer; D. L. J. Broadbent, 26, Scarsbrick Avenue, Southport; engineer. Qualification, £1,000. Remuneration, £50 each per annum. Registered office: 7b, King Street, Southport.

"A. O." Reflector Co., Ltd. (177,345).—Private company. Registered October 19th. Capital, £3,000 in £1 shares. To adopt an agreement with C. H. Keane, to acquire the "A. O." reflector referred to therein, and to carry on the business of manufacturers of and dealers in light reflectors and diffusers, &c. The subscribers (each with one share) are: F. W. Stevenson, 18a, Leinster Terrace, W.2; director; C. H. Keane, 22, Prad Street, W.1, sales manager. The first directors are: F. W. Stevenson, C. H. Keane, and S. J. Frost. Qualification: £250. Remuneration: £30 each per annum. Registered office: 18a, Leinster Terrace, W.2.

Davis Electrical Co., Ltd. (177,301).—Private company. Registered October 15th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers, exporters and importers of, agents for and dealers in gas and electric light and heating apparatus, and in light reflectors are: J. Davis, 37, Froisher Road, Hornsey, N.8; Mrs. Madge Davis, 37, Froisher Road, Hornsey, N.8. J. Davis is permanent, subject to holding 200 shares. Registered office: 6, Warwick Court, Gray's Inn, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Technical & Electrotechnical Wholesale Trade, Amsterdam, Ltd. (Telga, Ltd.) (2,017F).—Particulars filed October 15th. Capital, fl. 100,000 in 100 shares of fl. 1,000 each. Registered in Holland on November 14th, 1919, to trade in electrotechnical machinery and requisites, metal goods, and all products of the technical industry, &c. British address: 4, Union Street, Wells Street, Oxford Street, W.1, where E. C. Beman is authorised to accept service. Directors: W. A. P. F. L. Meis (senior), P. J. Schut, T. A. H. Stom, and F. A. Wolf, all of Amsterdam.

New Welding Co., Ltd.—Particulars of £500 debentures, authorised October 10th, 1921; present issue, £130; charged on the company's undertaking and property, present and future, including uncalled capital.

Torquay Tramways Co., Ltd.—Satisfaction to the extent of £1,100 on September 30th, 1921, of charge dated March 6th, 1911, securing £60,000.

Bastian Electric Co., Ltd.—Particulars of £1,500 debentures, authorised July 11th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Threadgill Electro Deposits, Ltd.—Particulars of £3,000 debentures, authorised October 1st, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Wimbledon Electrical Co., Ltd.—Particulars of £800 debentures, authorised October 12th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Mersey Power Co., Ltd.—Issues on various dates from March 23rd to October 5th, 1920, of £80,000 debentures, parts of a series (notice filed October 15th, 1921). Satisfaction in full on October 4th, 1921, of debentures dated January 28th to October 5th, 1920, securing £100,000 also notified.

General Electric Co., Ltd.—Four land registry charges on certain land and premises at Brook Green, Hammersmith, dated October 12th, 1921 (supplemental to trust deed dated July 22nd, 1921, securing £3,500,000 debenture stock). Trustees: London City & Midland Executor and Trustee Co., Ltd.

Edison Swan Electric Co., Ltd.—Deed dated October 8th, 1921 (supplemental to trust deed dated June 19th, 1900), to secure £100,000 additional second debenture stock, charged on property, comprised in prior deeds of June, 1900, and November, 1909. Trustees: London Trust Co., Ltd.

Yale Electric Power Co., Ltd. (60,493).—Return dated October 12th, 1921. Capital, £30,000 in 3,000 preference shares of £1 each and 668 ordinary shares of £25 each; 300 preference and 668 ordinary shares taken up; £15,300 paid; £1,700 considered as paid. Mortgages and charges: £6,000 debentures as security for bank overdraft.

Spanish Telephone Co., Ltd. (41,589).—Return dated July 14th, 1921. Capital, £81,000 in 65,600 ordinary shares of £10 each and 1,250 preference shares of £20 each; 5,600 ordinary and 671 preference shares taken up; £53,420 paid; £16,000 considered as paid. Mortgages and charges: Nil.

Walters Electrical Manufacturing Co., Ltd. (94,300).—Return dated September 7th, 1921. Capital, £18,000 in £1 shares; 16,875 shares taken up; £6,875 paid; £10,000 considered as paid. Mortgages and charges: Nil.

Delhi Electric Tramway & Lighting Co., Ltd. (88,758).—Return dated June 30th, 1921. Capital, £170,000 in £1 shares (140,000 preference and participating and 30,000 ordinary); 100,000 preference and participating and 29,000 ordinary shares taken up; £100,000 paid, £29,000 considered as paid. Mortgages and charges: £20,000.

Marconi International Marine Communication Co., Ltd. (65,729).—Return dated August 18th, 1921. Capital, £1,500,000 in £1 shares; 1,182,726 shares taken up; £1,087,726 paid; £105,000 considered as paid. Mortgages and charges: £61,120.

Sheerness & District Electric Power & Traction Co., Ltd. (65,749).—Return dated June 21st, 1921. Capital, £75,000 in £10 shares (5,000 ordinary and 2,500 preference); 5,000 ordinary and 2,473 preference taken up; £74,750 paid. Mortgages and charges: £28,380.

CITY NOTES.

German Companies.

The directors of the *Elektrotechnische Fabrik Rheydt* (*Mar Schorch & Co.*), of Rheydt, recommend the payment of a dividend for 1920-21 at the rate of 10 per cent., as in the previous year.

The *Kabelwerk Rheydt*, of Rheydt, report net profits of 9,124,000 marks for 1920-21, as compared with 8,705,000 marks in the preceding year. The dividend is at the rate of 20 per cent on capital of 24,000,000 marks, as against 30 per cent. on less capital in 1919-20.

The *Export-A.G.*, of Berlin, which is engaged on the sale of electrical manufactures in England and in countries outside Europe, reports net profits of 824,000 marks for 1920-21, contrasting with 563,000 marks in the previous year. The share capital is now being increased to 3,000,000 marks. It is stated in the annual report that the company has formed closer relations in England, has gained a firm footing in South Africa and the Levant, and has entered upon the new financial year with orders on hand of the value of 6,000,000 marks.

The report of the *Wotan Werke A.G.*, of Leipzig, states that it was possible in particular to increase the export sales in 1920-21. Orders in the final months of the year were inconsiderable, but business has greatly improved in the new financial year, and the contracts on hand will fully occupy the works for several months. After making provision for depreciation the accounts show net profits of 3,080,000 marks, as compared with 1,714,000 marks in 1919-20, and the dividend is at the rate of 40 per cent., as in the previous year, on share capital increased from 3,500,000 to 7,500,000 marks.

Stock Exchange Notice.—Applications have been made to the Stock Exchange Committee to allow the following to be officially quoted:—

Lancashire Electric Light and Power.—Partly-paid scrip for £400,000 seven-and-a-half per cent. prior lien debenture stock.

Herbert Morris, Ltd.—A further dividend on the ordinary shares is recommended, making 10 per cent., free of tax, for the year ended July, 1921. £25,000 to reserve. £20,294 carried forward. The stocks have been written down.

Erinoid, Ltd.—In their report for the year ended August, 1921, the directors state that to ensure sufficient supplies of raw material to keep the factory going in 1920 the general managers thought it necessary to make substantial forward contracts. Cancellation of orders and reduction in sales arising out of the unprecedented slump which began to affect the company in December last left the company with an accumulation of raw material which was totally unexpected and unavoidable. A drastic policy in writing down the whole of the stocks (manufactured and unmanufactured) to present cost has been adopted. According to the *Financial Times* the trading profit for the year, bringing in the stock at original cost, amounted to £16,717, and after allowing for company charges, depreciation on plant and machinery, and losses of a capital nature, the net loss of £12,387 has been carried to balance-sheet. Deducting the credit balance brought forward, the net loss to carry forward is £9,718.

The Electric Supply Co. of Victoria, Ltd.—The report for the year ended March, 1921, shows that the lamps connected increased from 268,544 to 312,520; the passengers carried on the tramways advanced from 5,316,136 to 6,096,269. The trading account shows that the revenue advanced from £105,053 to £124,994, the expenditure from £69,712 to £85,295, and the gross profit from £35,341 to £39,699. The balance to credit of profit and loss is £35,825, plus £32,604 brought forward, making £68,429. Out of this, debenture interest absorbs £5,568; debenture stock redemption account £8,325; and there is written off cost of debenture issue £450, leaving £54,085. After paying £10,500 on account of arrears of 6 per cent. cumulative preference dividend, £43,585 is to be carried forward. The amount still in arrear and due on preference shares is £10,500. The preference capital is £175,000. The total debenture stock redeemed to date is £90,287. The meeting was held in London on October 13th.

Montreal Companies.—A dividend of \$1.25 per share has been declared by the Montreal Light, Heat & Power Consolidated Co., and one of \$2 per share by the Montreal Light, Heat and Power Co.

Calcutta Electric Supply Corporation, Ltd.—An interim dividend of 8 per cent. per annum, less tax, on the ordinary shares is announced for the past half-year.

Callender's Cable & Construction Co., Ltd.—The directors announce an interim dividend of 1s. per share, less tax, on the ordinary shares.

American Telephone & Telegraph Co.—According to a *Times* report from U.S.A., this company is asking for authority to issue \$50,000,000 of 20-year six-and-a-half per cent. refunding bonds.

Shanghai Mutual Telephone Co., Ltd.—This company announced an extraordinary general meeting for October 17th, at which an increase of the company's capital to 2,000,000 taels by the creation of 20,000 new shares of 50 taels each, in addition to the 20,000 like shares already existing, was to be proposed.—*Reuter's Trade Service.*

Belgian Companies.—The report of the *Société d'Electricité de l'Est de la Belgique* for the year ending June 30th last shows a profit of 212,746 fr., as compared with only 67,820 fr. in the preceding twelve months.

The balance sheet of the *Société de l'Electricité de la Dendre*, of Brussels, for the year ending June 30th last shows a profit of only 15,274 fr., as compared with 17,952 fr. in the preceding twelve months.

Marshall, Sons, & Co., Ltd.—In view of the continued trade depression no interim dividend on the ordinary shares is to be paid.

Brampton Bros., Ltd.—Dividend of 10 per cent., free of tax, on the ordinary shares, £10,000 to reserve, and £8,608 carried forward.

Calcutta Tramway Co.—According to the *Financial Times*, the usual interim distribution on the ordinary shares is not to take place, the question of dividend being left over until the result of the complete year is known.

West African Telegraph Co., Ltd.—The loss for the year 1920 was £27,636. The debit balance is £26,777, which has been charged against general reserve.

Monte Video Telephone Co., Ltd.—Final dividend of 5 per cent., free of tax, making 8 per cent., free of tax.

Babcock & Wilcox, Ltd.—Dividend of 7 per cent., free of tax, for the half-year ended June.

STOCKS AND SHARES.

TUESDAY EVENING.

It may be said at once that there is no particular activity in any of the Stock Exchange markets, excepting those concerned with gilt-edged stocks. Investment continues to make itself felt in various directions, though there is not sufficient of this class of trade to keep things moving. Ireland, Hun-

gary, and Silesia are quoted as a trio of reasons for imposing fresh caution on the part of the public with regard to their Stock Exchange adventures. The Government's scheme for unemployment has evoked an ambitious scheme of extension from the London and Electric Railways of London, a scheme which has been read with keen interest by everyone concerned with railway work. It has had, however, no effect in making Underground stocks any better. Indeed, prices are slightly lower than they were a week ago.

Creation of new capital on a large scale would be the natural sequel if the Government were to fall in with the plan proposed by the Underground company. This would mean placing new obligations in front of the stocks and shares at present issued, and the latter have accordingly weakened in price. The Stock Exchange market, however, is inclined to regard the company's proposal as scarcely likely to commend itself to the Cabinet. This is a matter, of course, for which attention will wait upon the Cabinet's decision. Meanwhile, some of the electric lighting companies are bestirring themselves to see whether they also cannot claim some share of the Governmental assistance, for the lightening of the unemployment burden, through the medium of obtaining capital at reasonable rates that shall enable them to put in hand the various plans of extension which have been more or less held in suspense owing to the incidence of the war and its aftermath.

One of the principal firms of Stock Exchange jobbers steps into the breach at this psychological moment with the issue of a circular, sent round to many Stock Exchange brokers. In this it draws attention to the securities of the electric lighting and power companies as being amongst those which, it contends, offer many favourable opportunities for investment at the present time, not only as compared with other securities in the industrial market, but intrinsically in themselves. The restrictive nature of the early electricity legislation, due to the municipalising views of the Government of that time, led to slowness of growth in the industry, in that it involved an uncertainty of tenure which retarded the initiative development that would otherwise have taken place. Of recent years, however, great changes have occurred, and, during the war, the value of electric energy as an active power was fully recognised. The firm argues that the passage of the Electricity Supply Act of two years ago manifested the Government's aim to help the electric supply industry. The result of the Act, according to its view, will make it possible for companies to arrange to undertake reasonable capital expenditure, with sufficient security against being bought out by a local authority before adequate return on the expenditure has been received.

So far as price changes on the week go, there are few to be noted in the list of London shares. It is timely, while people are investing money much more in fixed-interest shares than those of the ordinary class, to show what the market offers in the way of preference issues at the moment. The following examples give a representative idea of what can be obtained, and in each case there is a reasonable supply of stock for those who care to buy it:—

Preference.	Div.	Due.	Price.	Yield.
	£ s. d.			£ s. d.
Calcutta Elec. Supply	5*	M. & S.	149 0	8 10 0
City of London Elec. 2nds	8	M. & S.	23 3	6 17 6
Clyde Valley 2nds	8	J. & D.	10	8 0 0
County of London Electric	6	M. & S.	7 1	7 10 0
Lancashire Power 1sts	6*	M. & N.	17 6	7 15 0
Melbourne Electric	8	F. & A.	3 4	7 17 6
North Metropolitan Electric	6	A. & O.	14 8	8 15 0
St. James and Pall Mall Elec.	7	F. & A.	14 3	7 2 6
Westminster Electric	11	J. & J.	3 3	6 5 0
Indian Electric	7	J. & J.	14 9	8 5 0

Free of tax.

Dividends on the above are cumulative, except in the cases of the North Metropolitan, St. James's and Indian shares.

Marconi shares are flat at 50s., and Marconi Marines have fallen to 17s., the wireless group as a whole being decidedly off-colour in consequence of a slight pressure to sell. The tendency amongst investors becomes more and more pronounced in favour of fixed-interest stocks and shares, debentures, preference, notes, &c., and with so small a measure of support accorded to ordinary capital, it takes very little offering of stock to put prices down. This is the main reason for the weakness in the Marconi lists, and it can also be applied to other stocks and shares, depression in which may lead to perpetuity in the minds of shareholders as to the reason for the constant fall in values.

Electrical manufacturing shares are mainly heavy. In the dullness which has spread over the market, a few of the preferences have also eased off. General Electrics, for instance, giving way to 16s. 6d. or 6½ per cent. and 7½ per cent. shares alike. The ordinary have fallen to 15s. English Electrics dropped to 8s. 3d., the preference to 11s. 3d. Transactions in the latter have been marked at half-a-guinea. British Aluminium at 14s. 3d. are 9d. down; shares changed hands at 13s. 4½d. India-Rubber shares weakened to 13s. 9d., and

Siemens to 20s. Babcock & Wilcox are unchanged at 24. An interim dividend is declared of 7 per cent., being the same rate as that of a year ago. Iron, coal and steel shares are generally heavy, in consequence of the opinion that, with so many men out of work, companies must be badly hit as regards their profits. It is the continual selling of such shares by people tired of holding them, and the diversion of the money thus obtained into war stock and similar securities, that accounts for the strength shown by the gilt-edged group.

Mexican bonds and shares are generally lower, and Brazilian Tractions at 27 show a drop of 2 points, owing to the manner in which the value of the milreis has receded. No changes worth mentioning have occurred in the British Columbian group. Anglo-Argentine Tramway second preference at 2 11/16 are 1/16 down.

The cable group is inclined to droop. Westerns at 16½ have lost the 5s. which they added to their quotation of last week, and Great Northern at 24 are 10s. lower. Globes at 16½ are ½ down; United River Plates at 5½ are similarly weaker. Cuba Submarines at 7 have shed 5s., Anglo-American Telegraph deferred shows ½ fall, and the preferred is 2 points down at 85.

The rubber share market is disposed to be a little better, owing to the efforts which are being made to obtain control of the selling price, and of the output of the produce. It cannot be said, however, that business in rubber shares displays any inclination to improve, and the Stock Exchange market is fain to content itself with saying that there is more tone than trade. Amongst new issues, the principal feature is a rise to 5 premium in County of London 7 per cent. debenture. Lancashire Power debenture remains steady at 3 premium.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.						
		Dividend		Price	Rise or fall.	Yield.
		1919.	1920.	Oct. 25, 1921.		
Brompton Ordinary	..	12	12	63	—	29 8 2
Charing Cross Ordinary	..	7	8	42	—	9 2 4
do. do. do. 4½ Pref.	..	4½	4½	94	—	7 4 4
Chelsea	..	4	5	84	—	9 4 8
City of London	..	13	14	17½	—	10 18 4
do. do. 8 per cent. Pref.	..	6	6	17 6	—	6 17 9
County of London	..	8	8	87	—	9 10 4
do. do. 6 per cent. Pref.	..	6	6	71	—	7 10 0
Kensington Ordinary	..	7	9	42	—	9 14 6
London Electric	..	2½	2½	1	—	7 10 0
do. do. 8 per cent. Pref.	..	6	6	3	—	10 0 0
Metropolitan	..	6	7	82	—	9 0 0
do. 4½ per cent. Pref.	..	4½	4½	24½	—	7 13 2
St. James' and Pall Mall	..	12	12	68	—	9 1 4
South London	..	6	7	25	—	10 18 2
South Metropolitan Pref.	..	7	7	15 9	—	8 17 10
Westminster Ordinary	..	10	10	52	—	8 13 10
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	..	6	6	86	—	7 1 2
do. do. do. 1½	..	1½	1½	17½	—	8 12 6
Chile Telephone	..	6	6	52	—	6 14 8
Cuba Sub. Ord.	..	7	7	77	—	10 0 0
Eastern Extension	..	10	10	168	—	8 1 0
Eastern Tel. Ord.	..	10	10	168	—	8 1 0
Globe Tel. and T. Ord.	..	10	10	16½	—	6 10 0
do. do. Pref.	..	6	6	94	—	6 9 9
Great Northern Tel.	..	22	24	24	—	10 0 0
Indo-European	..	10	10	30	—	8 8 8
Marconi	..	25	15	14	—	10 0 0
Oriental Telephone Ord.	..	12	12	9	—	26 0 0
United R. Plate Tel.	..	8	8	51	—	8 17 10
West India and Panama	..	Nil	Nil	5½	—	Nil.
Western Telegraph	..	10	10	16½	—	26 1 0
HOME RAILS.						
Central London Ord. Assented	..	4	4	49½	—	8 1 8
Metropolitan	..	12	12	28½	—	6 7 8
do. do. do. 1½	..	Nil	Nil	164	—	Nil
Underground Electric Ordinary	..	Nil	Nil	13	—	6 18 8
do. do. do. "A"	..	Nil	Nil	5½	—	Nil
do. do. Income	..	4	2	69½	—	24 6 4
FOREIGN TRAMS, &c.						
Anglo-Arg. Trams, First Pref.	..	5½	12½	28	—	10 9 6
do. do. 2nd Pref.	..	Nil	5½	21½	—	10 4 8
do. do. 5½ Deb.	..	5	5	68½	—	7 17 0
Brazil Tractions	..	Nil	Nil	27	—	6 11 0
British Columbia Elec. Ry. P. Co.	..	6	6	60	—	8 6 8
do. do. Preferred	..	6	98½	65½	—	28 14 2
do. do. Deferred	..	8	12½	60	—	11 8 6
do. do. Deb.	..	4½	4½	60	—	7 8
Mexico Trams 5 per cent. Bonds	..	Nil	Nil	67	—	Nil
do. do. 6 per cent. Bonds	..	Nil	Nil	27	—	Nil
Mexican Light Common	..	Nil	Nil	9	—	Nil
do. do. Pref.	..	Nil	Nil	28	—	Nil
do. 1st Bonds	..	Nil	6	57½	—	9 10 6
MANUFACTURING COMPANIES.						
Babcock & Wilcox	..	15	16	24	—	7 2 3
British Aluminium Ord.	..	10	10	14 8	—	10 0 0
British Insulated Ord.	..	15	15	14	—	10 0 0
Callenders	..	15	15	14	—	10 0 0
do. 4½ Pref.	..	5½	5½	64	—	6 18 8
Crompton Ord.	..	10	10	14 6	—	13 15 10
Edison-Swan	..	10	10	48	—	7 7 1
do. do. 6 per cent. Deb.	..	5	5	48	—	16 17 0
Electric Construction	..	10	10	16 9	—	19 8 0
English Electric	..	8	8	8 3	—	10 18 4
do. Pref.	..	6	6	11 8	—	7 8 6
Gen. Elec. Pref.	..	5½	5½	107	—	18 6 8
do. do. do.	..	10	10	157	—	10 5 0
Henley	..	15	16	14	—	6 18 6
do. 4½ Pref.	..	4½	4½	32	—	8 16 8
India-Rubber	..	10	10	1	—	8 16 8
Max. Vickers Pref.	..	8	8	1	—	10 0 0
Richmond Ord.	..	10	10	1	—	26 11 9
Telegraph Gen.	..	20	20	21½	—	26 11 9

* Dividends paid free of Income Tax.

ELECTRICAL ENTERPRISE IN SPAIN.

Scheme for Railway Electrification Adopted.

A Market for British Electrical Goods Available, but Recent Legislation may adversely affect Foreign Contracts.

By PERCY F. MARTIN, F.R.G.S.

THE possibility and practicability of the construction by the Spanish Government, directly or indirectly, of a national system for the distribution of electricity has long engaged the attention of the responsible authorities. As far back as 1919, a permanent Spanish Electric Commission was appointed for the purpose of drawing up a report, which was also to embrace expert conclusions regarding the utilisation of fuel of an inferior quality and low price, or of coal which occurs in regions incapable of being exploited owing to their remoteness from consuming centres. That the recommendations submitted have not been carried into effect is largely due to the paucity of funds. Although strongly endorsed by the late Minister of Public Works, whose grandiose scheme for public enterprises brought about his political downfall, Congress incontinently refused to sanction the various undertakings, among them a wide electric system.

As conceived by the Commission, this system would be a series of transmission lines passing through all, or nearly all, the important consuming centres found on the north or south coast, with radial lines to Madrid, the capital, and practical geographical centre of the country. Power would be generated at the larger waterfalls, and also at mines where coal of too low a grade to be exploited commercially could be used to produce energy cheaply by being burned at the mine-shaft. These steam central stations would be used principally during the droughts which occur at certain seasons in all parts of Spain, one of the worst having been experienced this summer, and, in this manner, there would be an abundance of power during the entire year.

Although rejected in its entirety, the Commission's scheme for a national electric system is about to be adopted in part, the necessary funds having been raised by means of a foreign loan, and work will be commenced this winter mainly for the purpose of finding employment for the immense army of distressed labourers who, as in other countries of Europe, find themselves without work. It is recognised that one of the great advantages to be derived from a national system of electric transmission, apart from the continuous supply of cheap power to all users, both large and small, would be the unification of the frequency and voltage. The former is now standardised at 50 cycles, 3-phase, throughout Spain, and the latter will be regulated after further study of the needs of the principal industries. For the main branches of the transmission line it is recommended that the pressure be not less than 120,000 volts.

It would appear that there are available some 2,000,000 kilowatts, without taking into consideration waterfalls of less than 2,000 kW. The most important of the rivers to be exploited are found upon the slopes of the Pyrenees; the number of kilowatts is put at 490,000. Next in importance is the Duero river, on the Portuguese frontier, expected to give 150,000 kW, while the Ebro, from Saragossa to the Mediterranean, should give 130,000 kW, and the Tagus 110,000 kW. The importance of the Duero river may be gauged from the fact that apart from the 150,000 kW derived from the stream on the Portuguese frontier, tributaries provide a further 50,000 kilowatts, and the river, in its course through Spanish territory, a further 90,000 kW. Other rivers of importance are the Guadalquivir and smaller Andalusian streams, contributing 40,000 kilowatts, while various falls of minor importance are expected to make available a further 500,000 kW.

With regard to the estimated cost of lines, it is thought that there will be 888 miles of wire, having a cross-sectional area of 50 square millimetres (0.08 sq. in.), and 1,100 miles of wire with a cross-sectional area of 100 square millimetres (0.16 sq. in.). The lines will be laid in duplicate throughout, protected by an earth wire, and provided with four telephone circuits. In all probability the posts will be of concrete and steel, spaced at an average distance of 410 ft., while the type of insulator considered best for the purpose is the suspension type, six elements in series.

The engineering plan to make the river Guadalquivir productive of energy calls for the construction of 11 dams of the Stoney gate system, such as have been constructed on the Rhine and upon rivers in France and Switzerland. The 11 installations proposed will be as follows: Alcalá del Río, Cantillana, Alcolea del Río, Peña de la Sal, Lora del Río, Peñafior, Palma del Río, Posadas, Guadiato, Villarrubia, and Córdoba. With these installations an annual power production of 202,000,000 kWh could be realised. The chief engineer (Señor José García Otéro) calculates that the maximum time required for the completion of the vast Guadalquivir river works will be 20 years; but he believes this may be shortened by the increasing demand for electric power.

In the meantime, it has been decided to proceed with the electrification of the railway lines owned by the Compañía de los Ferrocarriles de Santander à Bilbao, extending between Bilbao, Las Arenas, and Plencia, a distance of approximately 26 kilometres. Power is available at three points—Bilbao, Luchana, and Las Arenas—for the supply of power to the Bilbao-Algorita division, and sub-stations will be established at all of them, while an additional sub-station will be required between Algorita and Plencia to furnish energy to that division. Power will be purchased from the Hidro-electrica Iberica, S.A., consisting of 3-phase, 50-cycle current at 3,000 volts. Passenger trains upon this line are ordinarily run on a 30-minute schedule; but under electrification the time will be reduced to a 15-minute schedule, and the running time materially lessened. Additional services are provided on holidays and feast-days. All passenger trains consist of a locomotive and five cars, each car weighing empty 10 tons, and when loaded 12 tons. The track-gauge is 1 metre throughout, double-tracked between Bilbao and Las Arenas, and single-tracked between Las Arenas and Plencia. Between Bilbao and Algorita situated between Las Arenas and Plencia, rails 7.6 and 8 metres in length, weighing 30 kg. per metre, and between Algorita and Plencia rails 9 metres in length weighing 22 kg. per metre, are used.

Another electrically-operated line, the Corunna-Sada, at present consisting of 11.4 miles of track, is to be extended to Betanzos, thus completing the distance to a total of 18.64 miles. The owners propose to run their service every 24 minutes to El Carbarro, situated halfway, and every 62 minutes to Sada, the line being divided into various zones. It is believed that the construction of this inter-urban track will mark the beginning of an important era of street railway construction in the district, where a line is considered necessary both for the accommodation of the large passenger traffic and for the furtherance of commercial intercourse between the various industrial centres of the province of Corunna. By the time these lines appear in print the enterprise should be nearing realisation, since one of the largest capitalists of Galicia, associated with an

engineer who is also an enthusiastic promoter of the Corunna-Santiago electric line, has become possessed of an important waterfall near Santander for the erection of the power station to supply the necessary current.

Apart from the favourable market offered by Spain to-day for electrically-driven rolling stock, the country offers an important market for most kinds of electrical goods. As will be seen, there will be a constantly increasing use of power: and as the people become more familiar with the benefits and conveniences of electrical devices, a greatly augmented demand for all kinds of equipment is confidently expected. Although the present exchange rates are slightly unfavourable to Spain (and correspondingly advantageous to us), there is very little doubt that British electrical goods would be welcomed on account of the high reputation which they enjoy throughout the Iberian Peninsula, as, indeed, in all parts of the world. The proximity of Spain to our markets renders this opportunity still more attractive. Quite recently an important opportunity presented itself in connection with the supply of 16 electric cranes required by the Seville Board of Harbour Works. While British manufacturers of these machines were duly notified, through the energies of the Commercial Secretary to the British Embassy at Madrid, the information came rather too late to be of very much value, inasmuch as both German and United States manufacturers had gained knowledge of the opening, and were quickly on

the spot, although no tenders had at that time been called for.

The recent imposition of drastic import and export taxes upon machinery and equipment, among other articles of almost every description, may, on the other hand, have a deterrent effect upon the prosecution of further British enterprise. The wisdom of this new legislation is questioned alike in Spain and abroad, and it is not improbable that the pressure of commercial interests may result in a considerable modification of the decree. Similar observations apply to a Royal Decree, issued in June last, modifying the application of a previous law of June, 1879, regarding concessions for the exploitation of hydro-electric power and industrial uses of water. The new decree, which consists of seven clauses, too lengthy to allow of reproduction in these columns, should be studied with close attention by foreign contractors who propose to associate themselves with Spanish hydro-electric enterprises. While the new ordinance will not affect the exploitation of hydro-electric energy now in force, the terms will apply to these installations should they be in any way modified or amplified in the future. One of the most important clauses is the compulsory purchase of all materials and machinery in Spain or of Spanish production, or machinery made exclusively of Spanish materials. A clause covering these regulations will be introduced into all contracts for the future, including concessions now pending.

UNEMPLOYMENT AND THE CURE.

MR. ARTHUR NEAL, Parliamentary Secretary to the Ministry of Transport, recently stated that the cure for unemployment was the restoration of our industries. Stated in that way, it amounts to nothing more than a platitude, as obvious as that the cure for a cold is to get rid of it.

Nevertheless, it is evident that if our industries were restored there would be a great diminution of unemployment, and the long-run cure for the present situation lies in the revival of trade. In the different stages of acuteness of a disease, various measures become necessary, and unemployment is a disease of industry. There are preventive measures which are suitable for use when the patient is in perfect health. When there is no unemployment, as was the case a couple of years ago, it is possible to refrain from meddlesome interference in the form of control. It is possible to undertake constructive measures whereby trade can be encouraged, instead of destructive measures which upset the normal flow of business. Workpeople ought in such circumstances to keep level heads, and not to listen to the agitator who destroys prosperity by forcing strikes. Wholesome, natural work—that is the best preventive medicine for unemployment, as it is for most physical ills.

When the patient is ill, steps must be taken to cure him, to build up his constitution so that the disease may be thrown off, and that he may be the better able to resist its onset on another occasion. The eventual cure for unemployment being the revival of trade, it follows that it is necessary, in fact vital, to do everything possible to obtain and encourage business. Obstructions to the natural flow of trade must be removed, and new channels must be provided. The work of selling must be energetically carried on, and helped, not hindered, in every way that can be devised. The fatuity of that type of anti-waste that seeks to economise by reducing the selling price, is manifest.

Profitable trading is carried on when the sale price is such as to exceed the cost of production, while not exceeding the value in use. The value in use, or demand value, is what the customer is prepared to pay for the goods. If the price asked is in excess of that of a reasonably efficient substitute, the customer will be inclined to make use of the substitute. The con-

ception of ability to pay, which underlies, among other things, the income tax, the rates, and doctors' bills, plays its part here, and when the exchange runs riot, and it is not possible to think consecutively for two days together in any two currencies, it is necessary to have recourse to methods which have been considered unnecessary for a very long time, such as barter and the exchange of commodities, so that the poorer party may be enabled to buy, and the richer may not run risks. By the poorer party we mean the country against whom the exchange is said to operate, such as Germany, and by the richer, the country in whose favour the exchange is said to operate, such as Great Britain or America.

Costs of production, then, must be kept low. Wages must be so proportioned to output as to help, and not to impede, production. Output must be so proportioned to overhead charges that the amount to be borne by the product is not such as to prejudice sales. Economy must be practised, and *ca' canny* must go, once and for all. Profits need hardly be mentioned at the present time. We believe all manufacturers are prepared to forego profits in order to keep their shops and workpeople employed, and a glance at the stock exchange prices will show immediately to what an unprecedentedly large extent this policy is being carried out.

The value to the user must be kept high. He must be satisfied with his bargain, in order that he may be induced to place more business. The time of delivery must be short. If, then, we have a cheap, good article, obtainable quickly, the main difficulties in the way of selling are removed; but it must not be supposed that this is the end of the story. It is good, so far as it goes, but it is not enough. The customer must be found, the advantages of using the article must be explained to him, his goodwill must be created, and, when created, maintained. This is the work of a selling organisation. No doubt we have all come across manufacturing men and designers who have expressed views which may be summarised as that when plenty of work is coming in salesmen are not needed, and when there is nothing doing it is because the selling men cannot get business. The truth is, of course, that co-operation between all parties concerned is essential, and that does not mean that they are to co-operate by doing what one of them

decrees. In times of depression the salesman must take more pains than ever to keep in close touch with the customer. The salesman is the ambassador of his firm, and ambassadors have similar duties in creating and maintaining a friendly atmosphere in international matters. If this is done well, then as soon as the customer sees the least chance of placing business, he will place it.

For the purpose of overcoming exchange difficulties, barter is one means, the use of which could be considerably extended. There is in existence, however, an Act of Parliament which was intended to encourage and facilitate export business by enabling the Board of Trade to grant credits for that purpose. This is the Overseas (Credits and Insurance) Act, 1920, and it was amended and extended by Parliament during the present year. The Board of Trade was authorised to grant credits not exceeding £26,000,000 at any one time. The money was to be available for guaranteeing drafts against shipments to all parts of the British Empire and to certain countries named in the schedule. The Board was empowered to make new guarantees up to September 8th, 1922, to renew old guarantees up to September 8th, 1924, and all guarantees were to be terminated by the same date in 1925.

The Board of Trade issued, on October 14th last, a return showing that advances were made, during the three months ending September 30th, 1921, to the extent of £316,661. This total is in respect of Finland, the Baltic Provinces, Poland, Czecho-Slovakia, Jugo-Slavia, Rumania, Bulgaria, and Austria. The total for these countries over two years amounts to £1,276,030. Applications sanctioned but not actually made amount in the quarter to £63,646, and in the two years to £2,706,381. The guarantees given during the quarter, covering transactions with Australia, New Zealand, Cyprus, Rumania, Jugo-Slavia, and Hungary, come to £43,962; and sanction was given to other guarantees totalling £221,672. The sum of all the totals amounts to £4,248,042, or less than a sixth of the amount sanctioned by Parliament. Either those who prepared the memorandum of expenditure likely to be incurred when the Bill was before the House of Commons must have greatly over-estimated the requirements, or the plan is not being pushed as it should be; we incline to the belief that the latter is the case. Possibly if the same patience and ingenuity that discerns in a doll's eye a menace to British trade were devoted to the use of means already in existence for the furtherance of that trade, we might hope, in time, to get somewhere.

The subject of the revival of trade, considered as a curative measure for unemployment, has left us insufficient space to do more than mention the necessity when the disease is at a crisis, and the state of the patient immediately dangerous, of applying palliative treatment. No revival in trade can prevent the necessity of providing work or maintenance for the unemployed during the coming winter, on a scale previously unknown. Suggestions, varying in value, are offered on all hands, but the fact is that relief works are generally uneconomical, and doles are definitely demoralising. The problem seems to resolve itself into the choice or the least of a number of evils.

The measures proposed on October 19th by the Prime Minister in the House of Commons are necessarily of a palliative character, but they seem to contain the seeds of improvements which should grow permanently. The most important suggestion is that of the assistance of public enterprises by the guaranteeing of the payment of principal or interest. The other measures are: Relief works, in the form of afforestation and the reclamation of land; the assistance of emigration; the extension and improvement of the export credits scheme, with which we have dealt above; loans for Guardians in the poorer areas; and the establishment for six months of a contributory fund for the dependents of unemployed workers.

Since the chief difficulty of buying and of manufacturing nowadays is of a financial nature, we regard the pro-

posal to guarantee loans up to a total value of £25,000,000 as likely to be the most helpful, as it is the most novel, of them all. *The Manchester Guardian*, in its leading article on the day following Mr. Lloyd George's speech, asks if we can assume that the money in the hands of a railway company will provide more employment than it would have done in the hands of individuals with whom it would otherwise have remained? Quite simply, yes! It is true that if, by artificial assistance, the carrying on of an industry is rendered more easy than is the case when no assistance is rendered, there is a tendency for capital to be diverted from uses which would normally be more profitable, in order to employ it in the assisted industry. But there are industries and industries, and if a leading economist can openly advocate a subsidy for the purpose of cheapening coal, then surely the transport industry, to take the *Guardian's* own example, being of equal importance, can legitimately be assisted by a financial guarantee. Moreover, if the money, by remaining in the hands of those to whom it now belongs, will provide employment, why isn't it doing so? The answer is, because it is not, and cannot be, properly applied to that purpose while it remains scattered, but it can be so applied when it is concentrated on the object to be attained. There will be difficulties in the application of the scheme. We have shown that there are evidently difficulties in the way of the export credits scheme. They must be overcome. An expert financial committee will be appointed to advise the Government, and we venture to express the hope that room will be found upon it for Mr. McKenna. The speech of Mr. Llewellyn Atkinson at the B.E.A.M.A. dinner on October 20th was the speech of a genius, and such men as he could be more helpful in the revival of trade and the general advancement of industry than the somewhat one-sided committees that have from time to time been created by the Government to deal with other matters.

If the revival of industry is to be achieved in the minimum time, all must co-operate to that end. The question of wage reduction has already received considerable attention, as have the closely allied questions of efficiency and the use of the most modern plant, for instance, in coal extraction. Lord Weir, addressing the British Engineers' Association on October 19th, made some very pertinent observations on the network of restrictive regulations that has been spun about industry by the trade unions. There is no freedom for the individual worker to-day. He has to do as he is told. His union rules him more absolutely than did ever his employer. But Motley has noted that "in all human history the vivifying becomes the dissolving principle," and the history of trade unionism provides no exception. The principle of collective action, once so necessary, has brought in its train restrictions which bid fair to hamper, if not to destroy, the very means of livelihood of employers and workers alike. The frank discussion of these restrictions would, Lord Weir believes, have the effect of reducing costs of production, while permitting wages, and consequently purchasing power, to remain unchanged. We all have one great end before us, and must work together to achieve it. What is wanted, more than anything else, is the common will to serve the common weal.

Electric Ploughs in Petrograd.—The Petrograd metallurgical factories are delivering this month (October) the second parcel of electric ploughs made by them. The number to be ready by March 1st, 1922, is 50.

The Curative Powers of Radium.—Sir Thomas Parkinson, an eminent surgeon, recently gave it as his opinion that radium as a curative agent was a failure. Not only was it ineffective as a remedy, but its burning effects often aggravated instead of curing. Several authorities upon the subject, among them being Prof. Lazarus-Barlow, do not agree with this view. Prof. Lazarus-Barlow, who is head of the Middlesex Hospital Cancer Research Laboratories, believes that radium and X-rays will one day be recognised as more effective than the knife, and will be found efficacious in checking the growth of cancer.

ELECTRICITY SUPPLY IN THE UNITED KINGDOM.

REPORT OF THE ELECTRICITY COMMISSIONERS.

THE annual report of the Electricity Commissioners was issued last week, as mentioned in our pages (H.M. Stationery Office, price 3s. net). It embraces the period from January 31st, 1920, to March 31st, 1921, and comprises 102 pages, with a coloured map showing the approximate boundaries of the Electricity Districts provisionally determined up to March 31st.

The report commences with a review of the position of electricity supply in this country prior to the enactment of the Electricity (Supply) Act, 1919, and the events leading up to the passing of the Act. It is noted that up to the outbreak of war, the largest output in any one year from the whole of the British power stations (about 500) was some 2,000 million kWh; the total capital invested in public supply undertakings up to the year 1916 was approximately £91,000,000, of which local authority undertakings accounted for £55,000,000 and company undertakings for £36,000,000 (including £10,000,000 expended by power companies under special Acts).

During the war the electrical output from public supply stations more than doubled, amounting to 4,628 million kWh in 1918. It was recognised to an increasing extent that an abundant supply of cheap power was almost as essential as labour and materials for rapid and economical production in all forms of industry.

The report states that the general position at the end of the year 1918 with regard to the generation of electricity for public supply purposes other than traction is illustrated by the figures given in Table I.

TABLE I.—GENERATION OF ELECTRICITY IN UNITED KINGDOM.
(Approximate position at December 31st, 1918.)

Undertakings.		Generating plant installed.	Capital expended on lands, buildings, sidings, wharves &c., and generating plant, excluding distribution items.		
Class.	Number.		Total.	Average per kW. installed.	
<i>Local Authorities.</i>			kW.	£	£
London	11	...	131,791	3,775,396	25'6
Rest of Great Britain	214	...	1,210,133	16,312,862	20'3
Ireland	11	...	28,625	621,853	21'8
Total	239	...	1,451,649	30,311,111	20'9
<i>Companies.</i>					
London	15	...	216,037	6,282,071	29'1
Rest of Great Britain	162	...	135,645	4,310,586	31'8
Ireland	5	...	2,801	128,428	45'9
Total	182	...	354,483	10,721,085	30'2
<i>Power Companies.</i>					
	17	...	370,053	7,258,840	19'6
Totals	438	...	2,175,155	48,293,036	22'2

On March 31st, 1921, the staff of the Electricity Commission consisted of 19 established officers and 23 temporary officers (including typists, messengers, &c.), numbering 42 in all.

The Commissioners' estimate of their receipts and expenditure in respect of the period ending March 31st, 1921, showed an excess of estimated expenditure over estimated receipts amounting to £43,550. The actual excess of expenditure over income for the period, including amounts outstanding on March 31st, 1921, was £40,958. A comparison under main heads of the estimated and actual expenditure and receipts is given in Table 2, and a detailed statement of expenditure and receipts is set out in an appendix.

The amount actually advanced out of moneys provided by Parliament to meet payments by the Commissioners during the period was £30,901.

Reorganisation of Electricity Supply.—As there already exists an extensive and heterogeneous development representing the unco-ordinated growth of many years, the problem of re-organisation resolves itself into the determination of the best method of adapting, modifying and expanding the existing development with the view of ensuring as speedily as possible an improvement in the supply of electricity. The Commissioners point out that progress can only be gradual; even if the problem could be reduced to engineering considerations alone, the present financial stress would constitute a barrier to the speedy development of schemes. They are, however, confronted with a problem of a much more difficult and complex character.

It is only after thorough investigation at all stages, with the fullest opportunity afforded to all interested parties to make representations at each stage, that a scheme for the re-organisation of supply in any district can become of statutory effect through the medium of an Order of the Commissioners, confirmed by the Minister of Transport and approved by Parliament. Even in the most favourable circumstances, it is apparent that considerable time must elapse between the provisional determination of a district and the approval by Parliament of a scheme for the district.

TABLE 2.—EXPENSES OF ELECTRICITY COMMISSIONERS.

(From date of appointment to March 31st, 1921.)

Items.	Estimate. £	Actual. £
<i>Expenditure.</i>		
(i) Salaries and remuneration of Commissioners and staff	36,000	35,876
(ii) Other expenses of administration (less amounts recovered)	7,250	5,232
(iii) Interest on advances from H.M. Exchequer	800	970
Total	44,050	42,078
<i>Receipts.</i>		
Fees for Special Orders, &c.	500	1,120
Excess of expenditure over receipts	43,550	40,958

As soon as possible after their appointment, the Commissioners made a preliminary survey of the present and prospective electrical requirements of a considerable portion of the country, which has served to emphasise:—

(a) The wastefulness and inefficiency of the present organisation for the supply of electricity;

(b) The urgent need for co-ordination among the existing supply authorities; and

(c) The advantages in conservation of capital and of coal and in increased efficiency to be derived from joint action.

The Commissioners came to the conclusion that the existing organisation for the supply of electricity in a number of districts should be improved, and published Notices of Provisional Determination of 13 districts. The titles and approximate areas of the districts are given in an appendix, together with a map of England and Wales showing the approximate boundaries of the 13 electricity districts so far provisionally determined.* The Commissioners have also made preliminary surveys of other portions of England and of certain districts in Scotland, and at the date of this report had under consideration the question of provisionally determining further districts.

With the view of assisting the promoters of schemes, the Commissioners issued a memorandum indicating in broad outline the main headings under which proposals for the re-organisation of supply and for the setting-up of a Joint Electricity Authority should be formulated; this is reproduced as an appendix to the report.

Up to March 31st, 1921, schemes had been submitted to the Commissioners in respect of five districts, and in three cases the Commissioners had held local inquiries.

In respect of the Lower Severn Electricity District, a scheme was submitted to the Commissioners by an Organising Committee, and the Local Inquiry was commenced at Bristol on January 11th, 1921, but the Commissioners found it necessary to adjourn the Inquiry, owing to the fact that particulars were not generally available to all interested parties, and also on account of certain difficulties of procedure. The scheme was lodged prior to the issue by the Commissioners of their memorandum for the guidance of the promoters of schemes, and the Organising Committee, in its pioneer efforts towards the framing of the first concrete proposals for the constitution of the new Joint Electricity Authority contemplated by the Act of 1919, had been faced with many difficulties, and had no precedent to guide it. Eventually the scheme was not proceeded with by the Organising Committee.

In respect of the Mersey and West Lancashire Electricity District, two schemes were deposited with the Commissioners. The Local Inquiry was commenced at Liverpool on January 25th, and adjourned on January 29th; it was resumed on March 8th, and brought to a conclusion on March 10th.†

In respect of the North Wales and Chester Electricity District, two schemes were submitted; the Local Inquiry was

*A map showing these districts, as then determined, was published in the ELECTRICAL REVIEW of January 7th, 1921.

†A communication embodying the conclusions and decisions of the Commissioners was issued to all the interested parties on April 19th, 1921. (See ELECTRICAL REVIEW, April 22nd, p. 513.)

commenced at Llandudno on February 15th, and ended on February 22nd.*

In respect of the West Riding (Aire and Calder) Electricity District, two schemes were lodged, and a local Inquiry was to have been held at Leeds on April 12th, but was deferred to May 18th.

In respect of the London and Home Counties Electricity District, six schemes were lodged, and the Local Inquiry was opened on June 14th.

With the object, primarily, of keeping the costs of Local Inquiries within reasonable limits, the Commissioners issued a memorandum in December, 1920, drawing attention to the desirability of securing as large a measure of agreement as possible prior to an Inquiry, pointing out that separate representation of parties by counsel or otherwise appeared to be unnecessary unless the interests of such parties were divergent, and referring to the extent to which witnesses should ordinarily be necessary, and the necessity for avoiding duplication of evidence. It was also pointed out that when a scheme had been approved by the Commissioners as the result of a Local Inquiry, the proceedings at the further Local Inquiry should ordinarily be more or less formal. They have decided to publish a draft Order embodying the decisions arrived at as the result of the principal Inquiry, and to invite observations upon its clauses before holding the further Inquiry.

Generating Stations and Main Transmission Lines.—Before establishing a new, or extending an existing generating station or main transmission line, it is necessary to obtain the consent of the Commissioners thereto. In dealing with applications, the Commissioners have followed a policy which has been governed by the following broad considerations:—

(a) The necessity for facilitating the development of electricity supply in any district and for avoiding any sterilisation during the period between the enactment of the Act of 1919 and the coming into operation of a scheme for the re-organisation of supply.

(b) The effect of the establishment of any new station, or of any extension of an existing station, upon the ultimate development of supply in the district concerned.

(c) The undesirability of extending a badly placed station in one district when a better situated station in the same or an adjacent district could be extended and thus enabled to assist the first-named station.

(d) The necessity for avoiding the extension or establishment of small and uneconomical stations in cases where the balance of advantage was in favour of taking a bulk supply from an alternative source.

Before consent was given in any case the Commissioners required to be satisfied that the need for the new station or additional plant was urgent; that the proposals were technically and financially sound; and that there was no economical alternative source of supply available either at the moment, or in the immediate future. In some cases they found there was no alternative but to consent to the extension of badly placed and uneconomical stations, in order that there might be no shortage of supply pending the formulation and bringing into effect of a general scheme of improvement for the district. In other cases, however, it was found possible, as the result of negotiations and of pressure brought to bear by the Commissioners, for undertakers to obtain a bulk supply on terms at least as favourable as, or even more favourable than, the resultant costs involved in a proposed local extension, and thus to obviate the enlargement of certain small and uneconomical stations.

A number of important applications relating to the establishment of new generating stations were dealt with during the period ended March 31st, 1921.

The Corporation of Belfast was authorised to construct a temporary generating station at Messrs. Harland & Wolff's shipyard, Belfast, pending the completion of the new high power station which was authorised by the Board of Trade in 1918; two 6,000-kW sets ultimately intended for the new power house were installed.

The Corporation of Leicester was authorised to construct a station to contain initially 20,000 kW of generating plant, with the possibility of ultimate extension to meet a demand of 50,000 kW.

The Corporation of Manchester had powers to construct a generating station on a site at Barton, and commenced the erection of the first section of a station to contain two 25,000-hp turbo-alternators, the site permitting of ultimate extension to 150,000 kW. At the instance of the Commissioners, the Corporation agreed to increase the capacity of the first section by installing a third 25,000-kW set, with the object of meeting as speedily as possible the urgent requirements of their authorised undertakers in the district.

The Corporation of Nottingham applied to the Commissioners for consent to construct on a site at Clifton a station to contain 40,000 kW of generating plant with the possibility of ultimate extension to 240,000 kW or more. Concurrently, an application was received from the Derbyshire and Nottinghamshire Electric Power Company for consent to construct on a site at Colwick a station to contain initially 30,000 kW

of plant with the possibility of ultimate extension to 120,000 kW. An Inquiry was held at Nottingham on July 21st and 22nd, 1920, and the Commissioners issued a formal consent in respect of the application of the Corporation and refused the application of the Company.

The Commissioners subsequently issued a consent to the construction by the Corporation of a temporary generating station on the Clifton site to contain 4,000 kW of generating plant to meet the demands for electricity pending the construction of the permanent station.

The Corporation of Salford applied for consent to construct, on a site at Agecroft, a station to contain initially 45,000 kW of generating plant, with the possibility of ultimate extension to 120,000 kW. A decision had not been arrived at by March 31st.

The County of London Electric Supply Co., Ltd., had been authorised to erect a generating station on a site at Barking, and applied to the Commissioners for consent to erect a station to contain initially three 33,000-kW turbo-alternators with the possibility of extension. The Commissioners held a Local Inquiry on October 6th, 1920, and following days. After consideration of the evidence they reserved their decision.

The Portrush Urban District Council was authorised to erect a station of 66 kW.

The West Kent Electric Co., Ltd., and the Yorkshire Electric Power Co. also lodged applications, on which decisions were reserved.

The Commissioners issued consents to the establishment of new generating stations by the following non-statutory undertakings:—

East Anglian Electricity, Ltd. (Felixstowe).—A generating station at Sudbury to contain plant of 264 kW.

E. C. Gates, Ltd. (Norwich).—A generating station at Stalham to contain plant of 4 to 6 kW.

Tullamore Electric Light & Power Co., Ltd.—A generating station at Tullamore to contain plant of 200 kW.

From the foregoing it will be seen that the Commissioners issued consents to five authorised undertakers and to three non-statutory undertakings in respect of new generating stations, representing plant of 150,000 kW with the possibility of ultimate extension to a much larger figure. Further applications were under consideration on March 31st.

The Commissioners dealt with applications from some 120 authorised undertakers and from four tramway and railway authorities for consent to the extension of existing generating stations. They came to the conclusion that only such additions to, or modifications of, generating stations as involved an increase in rated capacity of generating plant constituted extensions requiring their approval. A complete list of consents issued up to March 31st, 1921, is given in an appendix. The sanctioned extensions represent plant of approximately 547,000 kW. Of this total, approximately 415,000 kW was in respect of local authority undertakings and approximately 113,000 kW in respect of company undertakings, the remainder (18,740 kW) being in respect of tramway and railway generating stations.

The Commissioners prescribed or approved the type of current, frequency, and pressure to be used at new private generating stations proposed to be established by 10 owners.

A number of applications relating to the establishment of main transmission lines were made to the Commissioners, and in some cases the necessary negotiations and formalities had not been completed by March 31st, 1921. Formal consents have been issued, however, in the four following cases:—

Corporation of Edinburgh.—6,600-volt main transmission lines from the Westbank Power Station, Portobello, to McDonald Road, Dewar Place, and Cowgate.

Metropolitan Borough Council of Woolwich and Urban District Council of Erith.—33,000-volt main transmission line from the generating station at Globe Lane to the generating station at Erith.

North Metropolitan Electric Power Supply Co.—A main transmission line, to be used initially at a pressure of 10,000 volts, and subsequently, if found necessary, at a pressure of 20,000 volts, between the generating stations of the company at St. Albans and Hertford respectively.

(To be concluded.)

Russian Electrical Industry.—A general review of Russian industry based on material supplied to the Russian Official Economic Journal, *Ekonomicheskaya Zhizn*, referring to the electrical industry in the first quarter of 1921, says that the number of workers engaged in the principal factories in that period had risen from 6,708 to 7,668, or by 14 per cent., whilst other employes had increased in number by 7 per cent.; but the increase in the number of workmen did not result in a corresponding output of goods, which partly negative result was due to the lack of skill on their part which was particularly shown in the quality of the work. Compared with the last quarter of 1920, no improvement is reported. The output in some factories increased; in others it decreased. The principal causes of the continuous unsatisfactory industrial output are again said to be the poor supply of fuel and the food crisis, which for many months now have been a leading feature in the economic situation at Kharkoff and Petrograd.

* A communication embodying the conclusions and decisions of the Commissioners was issued to all interested parties on April 22nd, 1921. (See ELECTRICAL REVIEW, April 29th, p. 571.)

ANNUAL DINNER.

On Thursday last week the annual dinner of the "Beama" was held at the Savoy Hotel; the Right Hon. Lord Amphil, G.C.S.I., G.C.I.E., president, was in the chair, and there was a large attendance of members and guests, numbering some 300. Amongst those present were Lord Carmichael, G.C.S.I., Lord Weston, K.C.S.I., Lord Vaux of Harrowden, Sir James Devonshire, Sir Charles Parsons, Sir H. Frank Heath, Sir C. Ellis, Sir James D. Connolly, Sir John Aspinall, Sir Edgar Walton, Sir William Diamond, Brig.-Gen. Sir H. W. Thornton, K.B.E., Sir W. Noble, Sir J. E. Petavel, Sir Timothy Coghlan, Lt.-Col. Hon. P. Pelletier, Lt.-Col. F. A. Cortez Leigh, Hon. J. McEwan Hunter, Mr. J. C. Gould, M.P., Mr. George Balfour, M.P., Mr. W. O. Smith, Mr. J. S. Highfield, Mr. H. Hirst, Mr. John Taylor, Mr. J. L. B. Atkinson, Mr. H. C. Lewis, Mr. Gerard Swope, Mr. F. C. Wade, Mr. John Howard, Mr. J. B. Whiting, Mr. W. St. D. Jenkins, Mr. J. A. Corcoran, Mr. A. H. Ashbolt, Mr. M. J. Railing, Mr. P. Longbottom, Mr. A. E. Tanner, Mr. E. S. New, Mr. A. F. Berry, Mr. F. H. Nalder, Mr. A. P. Wood, Mr. F. C. Gibbons, Mr. D. N. Dunlop (director and secretary), and many other well-known men.

After the Chairman had proposed "The King," Mr. George Balfour gave "The Industry," regretting the absence of Sir Gordon Hewitt, Attorney-General, who was to have had charge of the toast. Up to the outbreak of war, he said, the electrical industry was backed up by capital, enthusiasm, and sacrifice, and there seemed nothing wanting to make the industry a success; but foreign competition, establishing works and agents throughout the country, designedly so depressed prices that it was impossible to secure the reward of their labours. Those tactics were about to be renewed; but they would face their difficulties with courage, if given a reasonable chance. That young Association could claim fully to represent the electrical industry of this country, and many of the allied trades, touching as it did every branch of industry. Its activities were of the utmost importance not only to the electrical industry, but to the general commerce of the country. As the Prime Minister had just said, the cure of unemployment rested not with the Government but with industry; they could do it, if their pre-war freedom were restored. The main necessity was a readjustment of wages on an economic basis, in order to reduce unemployment. Lord Weir had struck the right note, and he asked them to preach the doctrine of reduction of wages so as to fill the workshops, even if no profits were made.

Responding to the toast, Mr. L. B. Atkinson outlined the events of the past twelve months, resulting in the collapse of industry. They were all calling on the Government to "do something," but it was for the industries to get themselves right, and the Government could only play a small part in the process. The engineering and metal trades were the worst hit; they relied almost entirely on the construction of reproductive works, which depended on the existence of a surplus of production of food and clothing, and they could only be fully employed when that surplus was created. Relief works would not solve the problem, and export credits were useless to the electrical industry, for its products took 20 years to repay their cost. There could be no re-establishment of our industries until the nation was able to make savings. The demoralisation of the German exchange was really due to the liquidation of a bankrupt stock; even the Germans had now become aware that the mark was worthless, and the time was approaching when people in Germany would not accept payment in paper marks. The Germans, however, were working twice as long for a pound of bread as the Belgians or English, and those who did the most work for a pound of bread would secure the world's trade. There must be a readjustment of wages per unit of output; either works would have to close, or workmen would have to realise that the output per unit of wage must increase, and work longer hours until stability returned. Much could be done by discussion with the authorised representatives of labour; he had great faith in industrial councils, which had been very successful in the cable-making industry. It was useless to look to the Government; they must solve their own problem, and face the facts, however disagreeable they were.

The Chairman, proposing "Our Guests," said the objects of the Association were essentially national and patriotic; no one in business could be without a sense of responsibility to the country, or fail to recognise that our national existence depended upon the prosperity of industry. Paying a tribute to the war service of Brig.-Gen. Sir H. W. Thornton, in connection with the management of the Great Eastern Railway, the chairman coupled his name with the toast.

Responding, Sir Henry Thornton made a humorous speech, but said the foundation of all economic wages was that the employer should pay the worker a wage which would enable him to bring up his family in decency and comfort, and more if possible. The railway managers had no quarrel with the present scale of wages, provided that a corresponding production was given; nor did they object to the 8-hour day, if they got eight hours of honest reasonable toil. What they wanted was production. The great railway groups that

THE COST OF LIVING IN CHINA.

In our issue of June 3rd, 1921, we published a letter in which tabulated details regarding the cost of living in Burma were given. The British Chamber of Commerce Journal, Shanghai, had in its issue of July, 1921, published an article on the cost of living in that city, and on seeing the table above-mentioned (which it reproduces, but attributes accidentally to a non-existent *Electrical Engineer*) it was led to publish similar tables for Shanghai, Tientsin, and Hong-Kong in the issue for August, 1921. It points out that, whilst there are free furnished houses in Shanghai and Hong-Kong, they are the exception and not the rule. The first column in the Burma table has not, therefore, been included in the Shanghai or Hong-Kong figures.

THE COST OF LIVING IN SHANGHAI.

Item.	Young bachelor.			Young married couple.		
	Sharing rented mess with two others	Boarding house.	Hotel.	Rented h. use.	Boarding house.	Hotel.
	Mex. \$.	Mex. \$.	Mex. \$.	Mex. \$.	Mex. \$.	Mex. \$.
1. House-rent and taxes ..	46	150	300	138	250	540
2. Food ..	50	—	—	120	—	—
3. Soap, wine, beer, &c. ..	15	15	15	20	20	20
4. Tobacco, &c., papers, &c. ..	8	8	8	8	8	8
5. Lighting ..	4	—	—	10	—	—
6. Guests ..	10	10	15	20	15	20
7. Amusements ..	20	20	20	20	20	20
8. Club bills ..	25	25	25	25	25	25
9. Clothes, shoes, hats, &c. ..	25	25	25	75	75	75
10. Laundry ..	7	5	5	15	9	9
11. Furniture, &c. ..	8	—	—	25	—	—
12. Car and chauffeur ..	—	—	—	100	100	100
13. Carry or motor cycle ..	40	40	40	—	—	—
14. Insurance ..	25	25	25	25	25	25
15. Servants ..	21	5	5	64	6	6
Total, Mex. \$..	304	328	483	655	553	848
Totals in sterling at rate of exchange at time of writing, £1 = Mex. \$7.64	£39 15 10	£42 18 7	£63 4 4	£85 14 7	£72 7 7	£111 0 0
Additional items required in Shanghai not included above:						
1. Telephone ..	2	—	—	5	—	—
2. Fuel, heating and cooking ..	10	5	5	30	10	10
3. Medical attendance, prescriptions, toilet articles &c. ..	5	5	5	16	16	16
4. 6% for contingencies ..	16	17	25	35	29	44
Mex. \$..	38	27	35	86	55	70
Total Shanghai, Mex. \$..	337	355	518	741	608	918
Totals in sterling at rate of exchange at time of writing, £1 = Mex. \$7.64	£44 2 2	£46 9 9	£67 16 0	£97 0 0	£79 11 7	£120 3 0
Totals in sterling at present rate of exchange:—						
Burma: 1 rupee = 1s. 8d.	£ 30 5 52	£ 30 11 11	£ 34 16 72	£ 79 17 72	£ 63 16 04	£ 73 4 104
Tientsin: £1 = Mex. \$7.64	£ 47 7 7	£ 42 16 0	£ 68 8 1	£ 92 17 7	£ 88 19	£ 102 14 9
Hong-Kong: £1 = Mex. \$7.64	£ 37 0 10	£ 40 6 3	£ 60 5 10	£ 78 0 1	£ 67 0 3	£ 105 15 2

Similar figures apply to Tientsin, but roughly speaking they are 50 per cent. higher than in Burma; they are somewhat higher than in Shanghai, except in the case of hotels, which are cheaper. For the sake of comparison, we reproduce the totals in each case.

The Hong-Kong figures are practically a repetition of the Shanghai figures. There are very few motor cars in Hong-Kong, and ownership is the exception rather than the rule. The additional items added to the Shanghai list would apply equally to Hong-Kong.

Further detailed figures for Shanghai are given in the same Journal for September.

Working Hours, Management, and Profit Sharing.—The International Building Trades Conference at its sitting at Brussels on October 21st expressed a desire to see the suspension of the application of the eight hours law in countries where it is in force, and a postponement of its application where it is not, until the complete re-establishment of the international situation. The Conference was also unanimous in considering the participation of labour in the management of business as absolutely incompatible with conditions of enterprise, and it also declared itself definitely opposed to the obligation to give labour a share in profits.—*Router*.

had been formed were closely connected with the electrical industry; the directors had a keen sense of their responsibility to the nation, and knew that unless they rendered a satisfactory account of their stewardship the alternative was nationalisation—a course which never tended to the welfare of the public. The responsible labour leaders of this country were convinced that production must be increased, and that the wages paid must be in proportion to the output. Railway managers were agreed that before industry could prosper, rates and fares must be reduced; the present high charges were but a temporary expedient. He hoped that in the coming months they would be able to join hands with the great captains of industry and the responsible leaders of Trade Unions in an endeavour to restore the country to its pre-eminent position.

An excellent entertainment was provided by the Westminster Abbey Quartette, Miss Olga Haley, and Mr. Sterndale Bennett, and the function was exceptionally successful and enjoyable, the proceedings lasting to a late hour.

LEGAL.

LOBITO, BENGUELLA & CATUMBELLA ELECTRIC LIGHT AND POWER CO., LTD.

AN application was made to Mr. Justice Astbury in the Chancery Division on October 19th by Mr. Charles Wreford Brown to be allowed to rank as a holder of £1,000 mortgage debenture stock, 1916, in the above company, which was formed to supply electric light and power to the towns named, which are in the Portuguese Colony of Angola, and to develop and accumulate electrical power at the falls of the Catumbella river. The matter arose in a debenture holder's action against the company. Counsel for the applicant said the Master of the Court had disallowed the debenture. The writ in the action and notice of motion for a receiver of the company was served on June 26th, 1919, and a receiver was appointed on July 11th. Mr. Brown's debenture was signed and sealed, and bore date of July 7th. It was, however, dispatched to him on July 17th.

Mr. BYRNE, for the Receiver, said the debenture stock was not issued until after the appointment of the receiver and when the company had ceased to carry on business.

His LORDSHIP: Then the receiver must hand it back.

Counsel for Mr. Brown said it was issued before the appointment of the receiver.

Mr. BYRNE said the Master said it would be a fair compromise if this gentleman had his £1,000 back with interest, but not a bonus of 7s. 6d. in the £, which he also claimed under a collateral agreement.

His LORDSHIP thought that was a fair compromise.

All parties agreeing, his Lordship ordered the repayment of £1,000 with interest at 6 per cent., but said the applicant could not have the bonus.

UNEMPLOYMENT PAY.

At the Southport Court, on October 17th, Sydney Brooks (18), electrician's improver, was summoned at the instance of the Ministry of Labour for an alleged breach of the Unemployment Act on July 29th. According to the *Liverpool Post*, Mr. W. H. Watson said defendant signed at the employment exchange as being unemployed from May 26th to July 30th, with the exception of eight days. As a matter of fact, he was employed at night during the whole of the period in connection with the lighting of the Pavilion Theatre, Southport. During most of the time his wages were 25s. a week, and for the remainder 20s. He received 20s. a week unemployment pay up to the beginning of July, and then 15s.

The defence, submitted by Mr. GREENWOOD, was that a person was entitled to unemployment pay if he only did spare-time work apart from his ordinary occupation, and did not earn more than 3s. 4d. a day or £1 a week, and had been previously doing that kind of spare-time work in addition to his ordinary occupation.

The LAW CLERK ruled that the fact of defendant's spare-time work being similar to his ordinary occupation did not matter.

The Bench decided, in view of the importance of the case, to adjourn it until November 2nd.

THE POSITION OF A TELEGRAPH POLE.

At Skipton County Court, on Friday, judgment was given for the Postmaster-General in a case in which the postal department wished to erect a telegraph pole near the Friendly Societies' Hall, Sheep Street, Skipton, and Lord Hothfield, owner of the property, disagreed. The Post Office contended that the place was a public highway, within the meaning of the Telegraph Acts 1863 and 1920. The consent of the Skipton District Council had been obtained, but Lord Hothfield seemed to be aggrieved and demanded the removal of the pole. For Lord Hothfield, it was contended that the pole

interfered with the amenities of the property, casting a shadow into the Friendly Societies' Hall and the café, and interfering with the privileges of the frontage. It tended to prevent the repairing of the property, and was likely to cause annoyance by youngsters climbing the steps to the hall and sliding down the pole. The respondent wished the pole removed, but if the Court allowed it to stand he asked for an acknowledgment of £1 per year. Judgment for the Postmaster-General was given, with costs on Scale C, and the acknowledgment payment was not allowed.

ACTION AGAINST THE BRADFORD CORPORATION.

THE Bradford town clerk has reported to the Electricity Committee upon correspondence with a firm of solicitors acting for a well-known Bradford firm of textile merchants, who have served on the Corporation a writ claiming an injunction, damages and costs, arising out of building operations now being carried out by the Corporation on land adjoining the Bolton Road electricity sub-station. After consultation between the town clerk, the chairman of the Committee (Ald. W. Turner), and the city electrical engineer (Mr. Thomas Roles), the Electricity Committee approved the action of the town clerk, and authorised the Corporation officers and a sub-committee of members of the committee to take all necessary steps to defend the proceedings.

ENFIELD-EDISWAN CABLE WORKS, LTD. v. THE A. & A. ELECTRICAL CO., LTD.

IN the King's Bench Division, on Monday, before Mr. Justice Branson, plaintiffs sued defendants to recover £2,000, balance of account said to be owing for electrical wire sold and delivered for shipment. Alternatively damages for non-acceptance were asked for.

Plaintiffs said that at the end of December, 1919, and the beginning of January, 1920, they agreed to sell defendants 1,000,000 metres, single wire 1.5 sq. mm. insulated cable at £8 per 1,000 metres, less 2½ per cent. cash, against documents, including packing for export and delivery f.o.b., according to specifications in defendants' order of December 31st, 1919. Plaintiffs said that at an interview between representatives of the parties in April, 1920, it was verbally agreed that as to 114 cases containing 910,900 metres, value £7,287, plaintiffs should make delivery to defendants' agents at Poole Wharf. This was done, and the defendants had paid £6,000, part of the purchase price, but had not paid the balance for these goods.

Defendants replied that the goods were not fit for their purpose of a contract with Messrs. Max Weinberger & Co., and they claimed £1,087 damages for loss of profit.

Mr. Barrington Ward, K.C., and Mr. Cartwright Sharp appeared for the plaintiffs, and Mr. Patrick Hastings, K.C., and Mr. Melville for the defendants.

Opening the plaintiffs' case, Mr. BARRINGTON WARD said the larger part of the property had passed, and there he claimed for price; as to the rest he claimed damages. The dispute related to the ordinary electric cable of commerce, and he suggested that if there had not been a fall in the market price this litigation would never have been begun. The balance of price claimed was £1,287. The price of the 910,900 metres delivered was £7,287, and they had received by arrangement with the defendants' bankers £6,000. They had, packed at their works, another 87,000 metres, for which £696 was claimed; there the Court, he submitted, must look to the difference in price between the contract price and the market price at the date of repudiation. There was a balance of £16 for a remaining 2,000 metres. The defence raised the question of the contract. The defendants said the contract was that the plaintiffs should make this cable in accordance with the standard specification of the Verband Deutscher Elektrotechniker. The plaintiffs said that specification was to apply only in respect of thickness; the defendants said that it was to apply in all respects—as to chemical composition as well—and they said the cable was not merchantable. They counterclaimed for the £6,000 and loss of profits on the sub-sale, but loss of profits on a re-sale could not be recovered except on goods sold for the express purpose of fulfilling a particular contract; only the difference was recoverable between the goods as they were and as they should be. With thickness only in question, the defendants tried to place on them an impossible burden by insisting on full accordance with the V.D.E. specification. All through the correspondence the defendants were talking only of thickness. The cable (of which pieces were handed in) was of copper wire surrounded by two layers of vulcanised indiarubber, then tape, and an outer braiding. The defendants in their particulars suggested that the rubber was hard, brittle, and unsuitable, of no elasticity, and poor mechanical quality; that the tape was of poor quality and the braid insufficiently impregnated with black which had not penetrated properly. They said the percentage of rubber was less than it should have been, and its weight was 26.8 per cent., instead of 33.4; that the percentage weight of resin was 13.8 instead of 6; and of other ingredients including sulphur 73.2 instead of 66.7, as required by V.D.E. They put their loss of profit at £1 18s. 4d. per 1,000 m., or £1,087. The early correspondence was empty of complaints, but strikes were mentioned, with

the proper comment "our domestic difficulties have nothing to do with this."

Counsel asked that they were told that strikes at Amsterdam had delayed delivery, and Messrs. Weinberger & Co., their contractors, complaining of quantity, had refused the third delivery. It was suggested that Weinberger & Co. did not find it convenient to take up the lot. Plaintiffs wrote: "You know the cable is equal to the sample we placed before you." Most of the invoices said "to the thickness of the V.D.E."; some "thin copper conductor V.I.R." or vulcanised india rubber. Defendants contracted to sell to Weinberger & Co. cable "to the thickness of the V.D.E." When plaintiffs' invoices said "to V.D.E." it meant to V.D.E. thickness.

Mr. ALBERT VICTOR DOWNTON, technical director to the plaintiffs, said there was a British engineering standard, and the 1910 standard was well known. As to defendants' complaint of the mechanical quality of this cable, he had to say that the Government officials made their bending and elongation tests when they inspected the cable, and this cable passed the tests. All cable became harder, as bread became staler with the lapse of time, especially in a dry storage. All defendants' tabulated complaints were ill-founded, except the statement as to chemical composition. Plaintiffs had supplied £80,000 worth of this cable to the Continent without complaints. The delivery was suitable for general electrical wiring purposes on the Continent. It would not have been possible to supply the cable up to the V.D.E. chemical standard at the price quoted. As it was not according to an English standard, there was no call for it in this country. A sale, if they were able to make a good one, in August, 1920, might have realised £2 10s., the scrap value of the order was under £1. The Germans had been manufacturing for 50s. The Germans officially reduced in their V.D.E. specification for 1920 the rubber percentage to 20. That was when they were out to capture the market.

Mr. DOWNTON told Mr. Patrick Hastings that the defendants were assured, upon the contract, "the cable will be manufactured in strict accordance with the V.D.E." This was safe for house fixings. The difference between the Continental and English requirements was that here a layer of pure rubber, or a pure separator, was required. That was the difference between the Continental and the English practice, but the quality of the Continental kind would be practically equal. His last report from the Continent was that cable was to be bought there for £2. He supposed, by the rate of exchange, the Germans could supply cheaper than we, but the market was down because people were not requiring cable now.

His LORDSHIP said he had been looking at the percentages in the defendants' table of complaints, and he found they totalled 113.8. That seemed to be exacting a good deal.

Evidence was given of the efficiency to-day of the cable supplied for this order, by Mr. GEORGE DANIA, M.I.Mech.E., A.M.I.E.E. He had taken several samples of the cable in question, and found all above V.D.E. thickness. It retained its elasticity to a remarkable degree, the braid was properly impregnated, and the cable was open to none of the complaints the defendants brought against it.

Similar evidence was given by Mr. WILLIAM F. ADAMS, mechanical and electrical expert, who said the wire was distinctly merchantable.

Mr. FREDERICK PLUTTE, of the plaintiffs' firm, said he did not remember that at any interview in May or June, 1920, defendants' Mr. Agazar ever rejected the wire as useless. He said it was not in accord with the V.D.E. specification, but he never said anything against its merchantability. As a matter of fact, it complied in every particular with plaintiffs' undertaking.

Opening defendants' case, on the score of contract, Mr. PATRICK HASTINGS suggested that the parties were never at one. Plaintiffs offered wire insulated with a layer of pure and with vulcanised india rubber. Defendants ordered high-grade vulcanised rubber. "The goods must be in strict accordance with the German V.D.E. they laid down, and no one could say that strict accordance with the British standard specification, for instance, meant accordance with it only in one particular or that V.D.E. did not mean V.D.E."

The first witness for the defence, Mr. MAX WEINBERGER, who spoke by interpreter, stated that when he saw the wire was not in order he sent to the Dutch Government Office and had it tested. He put in the written report, which showed that it was not in accordance with the V.D.E. There was, he discovered, no market for this kind of cable, though had it been in order he could easily have found a market for it.

Cross-examined: What he asked for was wire insulated with high-grade vulcanised india rubber of the thickness of the V.D.E. and of the best quality.

Mr. S. C. MORE, of the India Rubber, Gutta Percha & Telegraph Works Co., Ltd., of Silvertown, stated that for 20 years he was head of the experimental and testing department. The firm employed 5,000 men. High-grade vulcanised india rubber would stretch like a catapult. The rubber in the cable supplied was of low-grade quality, from his point of view.

Electrical evidence was given by Mr. ALFRED MORRIS, B.Sc. (Engineering), London, A.I.E.E., superintendent of the testing department of Faraday House, who said he thought the samples of this cable he examined would let out more electricity than they should.

Mr. MORRIS said the rubber in the samples of this cable he examined in September and December, 1920, was semi-perished and in a state that good quality rubber ought not to be in after 18 months. Its mechanical properties were poor. The proportion of rubber was 26.4 per cent., 16 per cent. of which was resin. He should expect 5 per cent. in high-grade rubber. The rubber would stretch 14 times its length and not five or six times.

Mr. WARD: He should not say the stretching property of cable rubber ought to be as good as that of "electric thread," and to stretch only 14 times was unsatisfactory. He agreed that what he found 16 per cent. of resin in was a mixture, not pure rubber. Deterioration would be greater in a dry store. Practically all the electric light cables tested at Faraday House were of vulcanised rubber, and 5 per cent. would be a usual proportion of resin in such vulcanised rubber.

Mr. WILLIAM HENRY GEORGE SHIPMAN, manager of defendants' firm at the time of the transaction, said Mr. Flakett, for the plaintiffs, wrote to him confirming a telephone assurance that the cable would have two layers vulcanised rubber, and would be manufactured in strict accordance with the V.D.E. specification.

Answering Mr. BARRINGTON WARD, witness said the sub-purchaser's order was for copper insulated with high-grade india rubber to the thickness recommended by the V.D.E.

Mr. BERGE REEBEN AGAZAR, managing director of the defendant company, said they were agents for the sale of electrical goods. He had no experience before of the sale of cable, and no technical knowledge of cables. They telephoned to make it clear that the V.D.E. specification was being followed. Afterwards he told Mr. Plutte candidly that he thought the first reason for their customer's hesitation to accept was financial, and due to fullness of stock; afterwards he said there were verbal complaints of the cable, and said he had encountered criticism when he offered it to other clients.

Cross-examined: He ascertained that Mr. Weinberger sent the cable to the Dutch Government Laboratory, not because of the state of the market, but because his customers had returned his early instalment of the cable to him.

A former director of the defendant company, Mr. ANTONY DE JONG, said Weinberger in Holland complained of the quality of the cable from the time witness showed him the first sample, but witness did not take him seriously. Later Weinberger said the market had become slower, asked that deliveries might be held up till the autumn, and offered joint account on a contra account.

Judgment was given for plaintiffs for £1,287 claimed, with costs, with, in addition, payment for the balance at £2, the price fixed by his lordship for the purpose of calculating damages. A stay of execution was granted.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Creda" Bowl Fire.

THE CREDEA CONDUITS CO., LTD., Whitehouse Street, Aston, Birmingham, have recently commenced the manufacture of a new bowl fire. The bowl of the "Creda" fire (fig. 1) is made from spun copper which is mounted by means of a swivel hinge on a cast-iron pedestal base, the base being enamelled in art colours. A substantial wire guard protects the element from accidental contact, and the element has been



FIG. 1.—THE "CREDA" BOWL FIRE.

designed to be easily replaceable. The top consists of a spiral wire winding mounted on a freelay cylindrical support with grooves in which the element rests. The whole element is mounted on a spring support as a safeguard against damage through accidental knocks. It is quite a simple matter to either change the element, complete with the freelay support, or to fix upon the support a new spiral element. The loading of the element is 600 watts.

The "Baby Spot" Projector.

The BRITISH THOMSON-HOUSTON Co., Ltd., 77, Upper Thames Street, E.C.4, has recently produced a miniature spotlight projector intended to meet the demand for a spot lamp equipment for use with gasfilled concentrated filament lamps. Designed primarily for theatre lighting, the "Baby Spot" (fig. 2) can be used in many other fields of lighting work. For instance, it is eminently suitable for the spot lighting of special articles in store windows, and for the illumination of kinema corridors, clock faces, indicators, small posters, signs, &c. Although its total weight, including brackets, is only 5 lb. 11 oz., it is very strongly constructed.

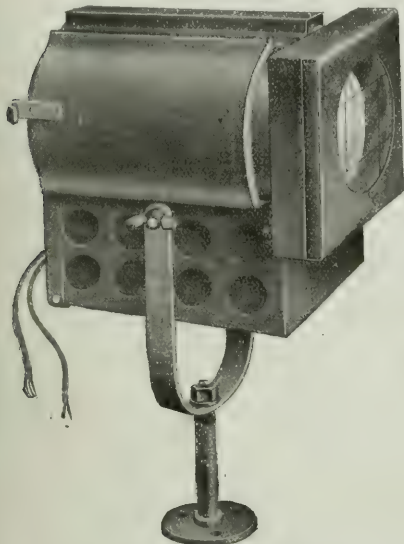


FIG. 2.—THE "BABY SPOT" PROJECTOR.

The body is of sheet steel, enamelled dull black, and the component parts comprise a mirror glass reflector, with copper back, painted with elastic enamel, focusing device, porcelain holder, lens, and universal bracket. The reflector is of such a radius that light reflected therefrom reaches the lens at the same angle as light given direct from the filament. The lens is plano-convex in form, and 4 in. in diameter, and is arranged to give a parallel beam with the lamp in focus and a wide beam when the lamp is moved forward. By loosening a wing nut on the underneath portion of the body, the lamp can be moved forwards or backwards according as a "spotting" or "flooding" effect is desired. This wing nut secures both reflector and lamp in any desired position. The apparatus is very compact, and is thoroughly ventilated. A slide is fitted in front of the lens so that colour mediums may be used when required. This slide attachment is so arranged that it in no way interferes with the beam of light. By a single operation, the colours can be changed as desired in a few moments.

The Kohler Lighting Plant.

Yet another plant for supplying electricity for lighting and power purposes in country houses, farms, &c., has been added to the list of such outfits that are now obtainable in this country—namely, the Kohler & Co., 110-volt plant that comes from the U.S.A. (London representative: Mr. C. H. Cook, 329, High Holborn, W.C.1). This automatic outfit (fig. 3), which we had the pleasure of inspecting recently, has a capacity of 1.5 kW. A special trip to start or stop the engine is not necessary. Whenever any lamp or switch in the line is turned on, the engine responds at once, and conversely when the last lamp is switched off the plant stops automatically. This feature is obtained by a special controller whose sequence of operation is as follows: On switching on a lamp in any part of the line a battery circuit is completed which motors the generator and so starts the engine; when the latter has reached a certain speed the battery is disconnected and then, after a pause to allow the generator to build up its voltage, the line circuit is completed. The only battery used is a small 24-volt starting battery of the automobile type which is provided with a charging coil so that it is always kept charged and ready for use. The engine is rated at 3.5 h.p. at 1,000 r.p.m., and has four cylinders, and is very smooth running and free from vibration. The outfit is plunger pump lubricated and water cooled on the thermo-siphon system, the radiator being provided with a cooling fan. The ignition is by h.p. magneto, so that in

the event of the starting battery or control switch not functioning properly the set can be started up and run under manual control. The engine is governed by mechanical throttling, the speed remaining constant at all loads, but as the demand is varied so is the consumption of petrol decreased or increased as the case may be. The dynamo is a 4-pole compound-wound machine having a commutator 7 in. in diameter and brushes 1 in. wide by 0.25 in. thick. A simple resistance coil maintains a steady voltage at all loads, and the set is very free from flicker; safety fuses and a main switch are also provided. The dimensions of the outfit are as under: Length, 33.5 in.; height, 34.75 in.; width, 14 in., and its weight when crated is 580 lb., that of the starting battery, also crated, being 125 lb.

Witton-Kramer Bench Drills.

Portable electric tools such as drills, grinders, &c., are being used in increasing numbers as their convenience and economy is more and more realised. The Witton Kramer drills, made by the GENERAL ELECTRIC Co., Ltd., are good examples of this class of apparatus.

Fig. 4 shows an electric drill mounted as a sensitive bench drill. The solidly built stand is provided with a rising table and a steel standard to carry the drill. Two types are made, one with an ungearred drill running at 1,050 r.p.m. and capable of drilling holes up to $\frac{1}{4}$ in. in brass and soft metal. The other type has a geared drill running at 510 r.p.m., and will drill holes up to $\frac{1}{2}$ in. in steel.

The type R-3 portable electric drill is also arranged as a bench drilling machine. The stand is of massive design and the sliding head on which the electric drill is carried is fed by means of a lever, a spring return being provided. By removing four screws the drill can be dismounted for use as an ordinary hand drill. This little machine is equipped with a direct current motor consuming 360 watts and running at a

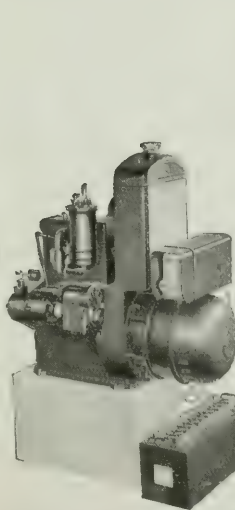


FIG. 3.—THE KOHLER AUTOMATIC LIGHTING OUTFIT.

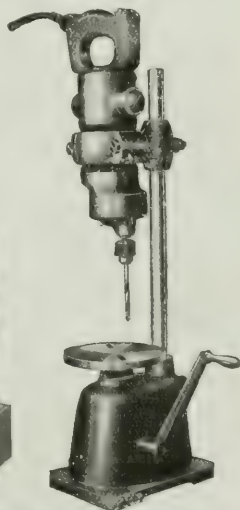


FIG. 4.—A WITTON-KRAMER BENCH DRILL.

speed of 500 r.p.m. Its maximum capacity is 29/32 in. in mild steel and the length of feed is 6 in.

The Witton-Kramer series also includes other sizes of drills, magnetic drill posts, grinding outfits, commutator grinding equipments, buffing machines, &c.

New Accumulators.—The *Aftenposten* reports an important invention by the physicist, M. Gross, of Christiania, who, it states, has produced an accumulator with three cells and weighing 25 kilogrammes, which gives a pressure of 6 volts and more than 200 watt-hours per kilogramme, or six times more than the ordinary lead accumulator. It does not freeze and will sustain short circuits that would be calculated to destroy other accumulators. Prof. Vegard, of the Christiania University, thinks there is reason to hope great things of the invention.—*Reuter's Trade Service* (Christiania).

Sevenska Dagbladet learns that the Allgemene Elektricitäts-Gesellschaft, the Siemens-Schuckert, and other important German concerns are forming a new company at Berlin named Warmespeicher Dr. Ruths, for the purpose of exploiting the new "vapour accumulator" of Dr. Ruths, a Swedish engineer.—*Reuter's Trade Service* (Stockholm).

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEYMOUR JONES O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

- NEW PATENTS APPLIED FOR, 1921.**
- (NOT YET PUBLISHED.)
- Compiled expressly for this column by MESSRS. STEVEN JONES & CO., LTD. & STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C.1.
- 26,387 "Automatic control system." J. H. Bennett. October 10th.
26,391 "Electric apparatus for electric power by underground cables." A. M. Taylor. October 8th. (United States, October 28th, 1920.)
26,402 "Automatic control of electric lamps for motor-vehicles, &c." F. G. L. Johnson. October 8th.
26,403 "Method of producing electric light." D. C. S. Simpson and Spencer & Co., Ltd. October 8th.
26,473 "Electron-discharge devices." British Thomson-Houston Co., Ltd. October 8th. (United States, October 28th, 1920.)
26,739 "Electric irons." Phi-Kappa Syndicate, Ltd., and D. Watson. October 10th.
26,740 "Telephonic apparatus." S. M. Hyman and W. A. Saxby. October 10th.
26,746 "Electric ignition apparatus." E. H. Cardwell. October 10th.
26,751 "Ignition and lighting systems for automobiles, &c." M. Feldine. October 10th. (United States, October 8th, 1920.)
26,765 "Electric switches." H. Hurst. October 10th.
26,768 "Electric connections." G. Oldham and J. Oldham. October 10th.
26,780 "Electrical entertainment devices." C. Dinnebir. October 10th. (United States, October 9th, 1920.)
26,793 "Process for manufacture of electrodes." H. Bardt. October 10th.
26,797 "Insulators." J. F. Scheid and H. Schomburg & Sohle Akt.-Ges. October 10th.
26,801 "Electric storage batteries." H. Bardt. October 10th.
26,802 "Apparatus for influencing electric waves produced by cathode tubes for telephony." Dr. E. F. Huth Ges. and L. Kuhn. October 10th. (Germany, December 2nd, 1920.)
26,807 "Rectification of alternating electric currents." American Radio and Research Corporation. October 10th. (United States, October 8th, 1920.)
26,820 "Reflecting device for electric lamps, &c." S. H. Gurney. October 10th.
26,821 "Relays and apparatus connected therewith, for amplification of sound, &c." R. W. Baynes and Mechanical Supplies, Ltd. October 11th.
26,830 "Bends, elbows, and sets for tubing for electric wires." T. Atkinson. October 11th.
26,835 "Arrangements for indicating position of apparatus or condition of circuits at a distance." Automatic Telephone Manufacturing Co., Ltd., J. K. Beard, Electrical Improvements, Ltd., and A. E. Hudd. October 11th.
26,841 "Electric contact makers." C. J. L. Moore. October 11th.
26,842 "Conductible electric switches." W. L. Barber and Midland Electric Manufacturing Co., Ltd. October 11th.
26,853 "Adjustable time-lags for electric circuit breakers, &c." W. L. Barber and Midland Electric Manufacturing Co., Ltd. October 11th.
26,867 "Circuit transmission devices for ball bearings in electrically-driven rail vehicles." J. Schmid Roost, Ball Bearing Works, Ltd. October 11th. (Switzerland, November 6th, 1920.)
26,892 "Electrical signalling systems." Western Electric Co., Ltd. October 11th. (United States, October 1920.)
26,900 "Electricity measuring instruments." H. Lucas and W. C. Turner. October 11th.
26,901 "Electricity measuring instruments." E. J. B. Danks, O. Lucas, and A. Miller. October 11th.
26,902 "Transmission of pictures by telegraph or telephone." J. T. Anderson. October 11th.
26,905 "Electric precipitating plants." Siemens-Schuckertwerke. October 11th. (Germany, October 28th, 1920.)
26,926 "Electric breaker circuit." Lodge Fume Co., Ltd. (Metallbank und Metallurgische Ges.). October 11th.
26,931 "Thermostatic elements." British Thomson-Houston Co., Ltd. General Electric Co., Ltd. October 11th.
26,932 "Electric relay, &c." British Thomson-Houston Co., Ltd., and A. S. Fitzgerald. October 11th.
26,945 "Automatic circuit breakers." C. Pasteur. October 11th. (France, October 12th, 1920.)
26,963 "Electric transmission of power with underground cables." A. M. Taylor. October 12th.
26,976 "Methods of eliminating currents in lead sheathings of electric cables." A. M. Taylor. October 12th.
26,981 "Means for improving current carrying capacity of existing three-phase alternating current cable systems." A. M. Taylor. October 12th.
26,993 "Electrical driving of machines on the constant current series system." G. Austin, J. C. Macfarlane, and W. A. Macfarlane. October 12th.
27,004 "Dynamo electric machines." E. C. Hatcher and T. Rooke. October 12th.
27,045 "Combined expansion joint and clamping support for electrical busbars." P. H. Coates, S. Darby, C. C. Garrard, and A. H. Railing. October 12th.
27,049 "Electric insulators." E. Hasely et Cie Akt.-Ges. October 12th. (Switzerland, November 6th, 1920.)
27,052 "Canopies for electric light fixtures, &c." G. W. Hoar. October 12th. (United States, October 28th, 1920.)
27,058 "Auxiliary sparking unit for spark plugs." F. E. Wade. October 12th.
27,067 "Electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). October 12th.
27,080 "Wall switch." McGill Manufacturing Co. October 12th.
27,083 "Purifying gas by electricity." Siemens-Schuckertwerke. October 11th. (Germany, October 22nd, 1920.)
27,102 "Electric heating and cooking appliances." R. Wolf and J. Ziemann. October 12th. (Germany, October 27th, 1920.)
27,107 "Telegraphy or telephony." Dr. E. F. Huth Ges., S. Lowe, and B. Rosenbaum. October 12th. (Germany, September 15th, 1915.)
27,108 "Method for generating and strengthening oscillations for wireless telephony." Dr. E. F. Huth Ges. October 12th. (Germany, May 17th, 1919.)
27,110 "Electric switches." British Lighting & Ignition Co., Ltd., E. B. Tuppen, and E. O. Turner. October 12th.
27,111 "Electric connection." Tracy. October 13th.
27,121 "Positive contact breaker for motor cars." W. McKnight and C. A. Underwood. October 13th.
27,131 "Electric motors for gramophones." C. Kratt and T. McClelland. October 13th.
27,139 "Portable electric water heaters." L. C. Speed and West Lancashire Electric Co., Ltd. October 13th.
27,140 "Method of controlling electric water heaters." L. C. Speed and West Lancashire Electric Co., Ltd. October 13th.
27,142 "Device for varying illuminating power of electric lamps." H. C. Roberts and J. C. Roberts. October 13th.
27,148 "Controller for electrical advertising signs, &c." W. Rise and W. Rose. October 13th.
27,159 "Electric irons." A. Russel. October 13th.
27,160 "Apparatus for changing velocity rotation and relative direction of rotation of two rotatable parts." Lancashire Dynamo & Motor Co., Ltd. October 13th.
27,164 "Apparatus for measuring capacity at speed in two or more motors, &c." Eastern Telegraph Co., Ltd., and K. L. Wood. October 13th.
27,180 "Vacuum tubes." K. Rossmann. October 13th.
27,197 "Electric condensers." G. Kemp. October 13th.
27,200 "Method of transmitting signals for telephony transmitting and receiving apparatus." E. A. Graham. October 13th.
27,209 "Process for production of concentrated nitric acid." Norsk Hydro-Elektrisk Kyaelsafabriksselskab. October 13th. (Norway, October 27th, 1920.)
27,222 "Electric diaphragm warning horn." T. Robinson. October 14th.
27,230 "Brush holders for dynamo-electric machines." A. I. Angold, R. Orzech, and A. H. Railing. October 14th.
27,241 "Automatic exchange telephone systems." W. Aitken. October 14th.
27,246 "Electric switches." C. W. Parsons. October 14th.
27,247 "Electric irons." T. D. Finnin. October 14th.
27,254 "Sparkling plugs." P. Challis. October 14th.
27,255 "Electric furnaces, &c." J. J. Lake. October 14th.
27,263 "Wireless apparatus for producing continuous oscillations." C. W. Parsons. October 14th.
27,308 "Holders for incandescent electric lamps." A. H. Hunt. October 14th.
27,309 "Means for producing oscillations." British Thomson-Houston Co., Ltd. (General Electric Co.). October 14th.
27,310 "Radio receiving systems." British Thomson-Houston Co., Ltd. (General Electric Co.). October 14th.
27,311 "Combined coating and winding machines." British Thomson-Houston Co., Ltd. (General Electric Co.). October 14th.
27,312 "Electric output apparatus." C. L. Dubois and J. Reynald. October 14th. (Switzerland, October 14th, 1920.)
- PUBLISHED SPECIFICATIONS.**
- The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.
- 1920.**
- 10,078 "Signalling apparatus for use in mines." J. Ross and A. Ross. April 10th, 1920. (169,473.)
13,461 "Dynamo-electric machinery." H. K. Whitehorn. May 26th, 1920. (169,482.)
16,311 "Sparkless disconnection of conductors traversed by electric currents." Siemens-Schuckertwerke Ges. October 30th, 1915. Addition to (145,072.)
16,312 "Processes and apparatus for the production of Röntgen rays." J. E. Lundblad. April 9th, 1918. (145,084.)
16,918 "Telegraph cables." H. W. Sullivan. June 22nd, 1920. (169,494.)
17,049 "Electric suspension insulators." Siemens-Schuckertwerke Ges. November 29th, 1919. (158,877.)
17,051 "Electric battery lamps." F. J. Turquand. June 23rd, 1920. (167,903.)
17,085 "Electrically-operated speed regulators." Duplex Engine Governor Co., Inc. June 23rd, 1919. (146,136.)
17,233 "Methods and apparatus for use in locating submerged vessels and other submerged and submarine magnetic bodies." R. A. Fessenden. December 12th, 1918. (146,155.)
17,319 "Electric circuit making and breaking device." E. Schattner. January 19th, 1918. (147,177.)
17,467 "Keys for holding down railways, tramways, tramcar rails, and the like in their supporting chairs." L. Green and W. A. Buvers. June 25th, 1920. (169,518.)
17,590 "Magnets." Remy Electric Co. December 17th, 1919. (155,790.)
17,735 "Method of starting continuous current motors." Österreichische Siemens-Schuckertwerke. January 29th, 1916. (145,589.)
18,070 "Electric bell and the like indicators." M. J. Raring, C. W. Saunders, and J. H. Collings. July 2nd, 1920. (169,535.)
18,335 "Electric welding electrodes." British Thomson-Houston Co., Ltd. (General Electric Co.). July 2nd, 1920. (169,538.)
18,584 "Electrical accumulators." Saunders Electrical Co., Ltd., and C. Saunders. July 5th, 1920. (169,541.)
19,009 "Electron discharge device." General Electric Co., Ltd., and M. Thompson. July 6th, 1920. (169,546.)
19,196 "Wireless signalling systems." British Thomson-Houston Co., Ltd. October 29th, 1913. (147,147.)
19,243 "Electric contact thermostats." Vapor Car Heating Co., Inc. January 19th, 1918. (147,177.)
19,329 "Overload electric switches." F. Krupp Akt.-Ges. May 16th, 1919. (147,592.)
19,540 "Electrical systems and apparatus for inducing electric action." W. J. Ricketts. July 8th, 1920. (169,548.)
19,811 "Contact members for vibrating current controlling regulators." V. G. Apple. February 14th, 1918. (147,783.)
19,816 "Armature construction." V. G. Apple. April 27th, 1918. (147,788.)
19,865 "Dynamometer machines." British Thomson-Houston Co., Ltd. October 13th, 1915. (147,818.)
19,993 "Subaque

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

- April 10th, 1920. (169,473).
 14,961. "Dynamo-electric machinery." H. K. Whitehorn. May 26th, 1920. (169,482).
 15,071. "Sparkless disconnection of conductors traversed by electric currents." Siemens-Schuckertwerke Ges. October 26th, 1915. Addition to 145,072. (145,073).
 16,382. "Process and apparatus for the production of Röntgen rays." J. E. Landefeld. April 9th, 1919. (145,084).
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 17,590. "Magnetos." Remy Electric Co. December 17th, 1919. (155,796).
 17,735. "Method of starting continuous current motors." Oesterreichische Siemens-Schuckertwerke. January 29th, 1916. (145,383).
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 18,336. "Electric Co. July 2nd, 1920. (169,538).
 18,584. "Electrical accumulators." Saunders Electrical Co., Ltd., and C. Saunders. July 5th, 1920. (169,541).
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 19,243. "Electric contact thermostats." Vapor Car Heating Co., Inc. January 19th, 1918. (147,177).
 19,299. "Over- and under-current switches." F. Krupp Akt. Ges. May 15th, 1919. (147,592).
 19,549. "Electrical systems and apparatus for inducing electric action." W. F. Ricketts. July 8th, 1920. (169,548).
 19,632. "Control apparatus for controlling current controlling regulators." V. G. Apple. February 14th, 1918. (147,783).
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 21,666. "Secondary electric coils." L. Pillon. July 19th, 1920. (169,564).
 21,912. "Alternating current meter." L. Adamczok. July 22nd, 1919. (149,348).
 21,913. "Electric suspension insulators." Siemens-Schuckertwerke Ges. January 6th, 1920. (Addition to 154,877). (156,767).
 22,295. "Electric switch gear for controlling the supply of electricity to operate machinery and the like." W. de Renzi. July 27th, 1920. (169,575).
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 23,886. "Thermostats." F. J. Heideiman, P. M. Fowl, H. R. Krueger, and C. L. French. August 16th, 1920. (169,593).
 24,013. "Electric service lifts." E. R. Elliston. August 21st, 1920. (169,601).
 24,755. "Automatic electric sub-station systems." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric & Manufacturing Co. August 26th, 1920. (169,609).
 24,761. "Means for regulating alternating currents." Leamington Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). August 26th, 1920. (169,610).
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AN IMPROVING SITUATION.

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There seem to be good reasons for hopefulness with regard to the situation as now developing.

Whether we consider the result of the ballot of the federated engineering trade workers, who voted by a majority of 22,835 agreeing to the withdrawal of the bonus in three stages, thus avoiding a stoppage of the industry and facilitating a return to economic production; or if we pay regard to the united determination in the electrical industry whereunder employers and employed will give a new impetus to electrical progress; or whether we note the attention that is being given to the railway electrification schemes which might make so much legitimate and productive work for British factories and British employes if they were put through now, as they may be, under the Government financial aid measures; or, again, whether we note the substantial operations that may soon emerge from the deliberations of the Electricity Commissioners; whether we think of the growing acknowledgement of the greater safety of British industry if it be left to work out its own salvation and is not "controlled" by the State save in respect of very special points, and the consequent feeling of confidence in the stability of capital; or if we give heed to the result of the vote of censure in Parliament and the stability that may be supposed to exist in that direction—all these things and others like them justify a feeling of optimism, and that alone is so much to the good; it always is if the optimist be not blind to facts and realities.

During September the prices of raw wool and cotton rose, thus enabling manufacturers to liquidate their stocks of goods, and clearing the way for the manufacture of further stocks. Naturally there is still a great deal of timorousness about embarking on a large manufacturing programme at a time when costs of production are falling, but anything which has a tendency to ease up the position is so much to the good.

The inquiries received for iron and steel continue to increase, and these trades are not incommenced by the presence of large stocks. Manufacturing operations can therefore be commenced as soon as any of these inquiries mature into orders. The shutting down of blast furnaces owing to the coal strike causes most of the steel now being turned out to be made from imported pig iron and scrap metal, but furnaces are being restarted almost every day now, and this state of things should soon be remedied.

The receipt of inquiries in increasing numbers is a proof of the truth of our contention that the potential demand for manufactured goods already exists. The iron and steel industries, whose finished products form part of the raw material of the electrical industry, will naturally feel the approach of better times before our industry; but we are informed that the lamp trade shows distinct signs of improvement, so that it seems reasonable to anticipate improved conditions in heavy electrical engineering before long. Many orders for Welsh coal have recently been received.

The hardware and cutlery trades show signs of improvement, particularly in the export field, but naturally these are more subject to competition from Germany, which is becoming increasingly keen. The pottery and leather trades are also looking up, in spite of the fact that here, as elsewhere, buyers are holding off in the hope of a fall in prices. The best way of

bringing about a fall in prices is, of course, the placing of orders, so that costs of production may be brought lower, and overhead charges reduced by increase of output. There is no reason to doubt that for some years to come increasing business will mean lower prices. Manufacturers who have learned anything at all from the course of events during recent months have learned that rising prices kill demand, and until all the factories in the world are gorged and congested with business, it is unlikely that we shall see any considerable rise in the selling price of goods.

The comparison of the sum total of British trade, both import and export, for September, 1921, and September, 1920, shows a decrease of some 40 per cent. in money. The Government, straining at gnats, as is the custom, has abandoned the compilation of statistics as to the weights of exports and imports, although it is obvious that weight is a much surer index of the volume of business than monetary value, especially in these times of rapid fluctuation in the purchasing power of money. Statistics, judiciously used, are of immense value, and for the country not to be in possession of the facts as regards the amount of its import and export trade, is as bad as for a trading concern not to keep any record of its sales or of its costs.

The number of unemployed persons, while still terribly high, has decreased materially since June; and although relief measures, in the form of work or allowances will have to be continued through the winter on an unprecedented scale, the rising volume of trade must have the result of improving the situation.

The utmost use must be made of the most economical methods of manufacture. The prosperity of the nineteenth century was built up upon the work of Watt. The steam-engine then represented the most economical method of using coal. The use of electricity must be extended in all directions. Sir Leo Money hammers away week by week upon the necessity of cheap energy. Coal must come down in price, and electricity must develop. He even advocates a coal subsidy, regarding the expense of thereby encouraging the coal trade as analogous to the expenditure of a farmer upon manure to improve his crops. In general, the effect of a subsidy is to encourage the use of capital and of labour in a trade which normally would be unprofitable, and consequently diverting that capital and that labour from being used in something more profitable. It is true that this view appears to assign limits to the amount of capital and the amount of labour available, and in the long run this is not right. The more work there is to be done, the greater the population that can be supported, and the greater the population, the more work there is to be done. The human family is very far from exhausting the natural resources of the globe, even in the matter of food. Moreover, since modern commerce and manufacture depend on fuel, coal mining is so fundamental an industry that it simply *must* be carried on. It must be done economically, of course, and the most modern methods and machinery must be employed in coal extraction. Capital must be judiciously expended, in order that the greatest results may be derived from the work done. In abnormal times, and in special circumstances, the use of unusual remedies is justified, and may, indeed, become imperative.

The burden of taxation is, as we all know to our sorrow, enormously heavy. It has probably passed the economic limit in nearly every case. The notorious excess profits duty, while founded on the perfectly unexceptionable theory that profits made out of national emergencies must be returned to the nation, was damaging to industry both in its incidence and in its removal. Since profits were limited, it did not pay to develop manufacture to its full extent, yet the very fact that the profits over and above those fixed by the taxing authorities were exhausted, caused some improvements to be made that otherwise would have been postponed indefinitely. Structural improvements in factories, a certain lavishness as regards employment, and in some cases increases of remuneration, were defrayed out of the excess profits tax. When it was removed, and the

whole of the profits became available for distribution, improvements were abandoned, workers were discharged, and remuneration was not infrequently reduced. When the tax existed, new businesses were so hard hit as to make it not worth while to establish them; while old establishments which had never paid any dividend at all, paid excess profits duty and still could not pay their dividend, thus discouraging the investment of much-needed further capital. The history of that tax, ending as it did in a shower of refunds, is one of the most unfortunate that has been recorded in the annals of modern taxation.

Direct and indirect taxation are to-day at figures which would have been deemed fabulous before the war. Men pay a shilling for twopennyworth of tobacco, and every sovereign earned is only fourteen shillings by the time it reaches the pocket, and inflated shillings at that. The craze for parsimony reacts unfavourably on industry, and the extravagance that still prevails in many quarters affords numerous examples of misdirected expenditure.

The revival, of which symptoms seem to be showing themselves, will be slow, but if we believe in it and in our power to bring it about, it will be sure. The future depends on each and every individual, firm, and nation getting right ahead with the job before it, and carrying out that job, whatever it may be, with enthusiasm, efficiency, and true economy.

A New Dynamo.

The method of constructing electric generators and motors has not deviated from standard practice by any appreciable extent for many years; that is to say, no radical alteration in design has been introduced, indeed, it is not to be expected that it will be, so long as conventional ideas are adhered to. If it is desired to produce an innovation one has necessarily to strike out in a new and original direction. To seek it along well-defined paths would be a waste of time, because it would only lead one to the same old limitations.

It was with peculiar interest, therefore, that we recently availed ourselves of an opportunity to inspect an invention which, if it is successfully developed so as to yield the results that are promised, will be of the first importance to the electrical industry. The invention referred to is the outcome of much patient labour by Mr. Brooks Sayers, who has evolved a design which, it is claimed, will reduce the cost of building a dynamo or motor by one-third. The great value of such a reduction in the cost of manufacture will be, no doubt, readily appreciated, but that is not all. It is estimated that, for a given weight and size, a machine can be constructed on the new principle that will be capable of producing an output very nearly double that of a standard machine. Moreover, the motor can be run, if necessary, very much faster than is usual at present, and the dynamo may be driven at the same speed as the turbine if required.

Now similar claims to those expressed above are not exactly novel; they are made periodically with fairly regular frequency, but it is often difficult to appreciate the special feature that would make them possible. In the present instance, however, definite proposals are made to construct the machine in such a manner as to reduce the heating, eddy-current, hysteresis, and other losses, in addition to commutation troubles, to a very considerable extent.

Herein, then, lies the reason for the increased efficiency that is promised, and it only remains to be seen whether a full-sized machine manufactured under commercial conditions will function as satisfactorily as the models have done, and we hasten to add that we know of no reason why it should not.

In conclusion, it should be pointed out that, for various reasons, it would be inadvisable to reveal technical details at the moment, although experimental machines are to be seen in operation in London. Mr.

Sayers deserves hearty congratulation on the successful issue of his labour, so far as it has gone, and we hope that rapid progress will be made in developing the invention.

The New Session of the I.E.E.

YESTERDAY the Institution of Electrical Engineers opened its first session as a body endowed with the dignity of a Royal Charter; we have no doubt that it will prove fruitful of benefit to the industry, not only in respect of the papers discussed at the public meetings, but also—and perhaps in much greater measure—in respect of the operations of the Council and Committees which will be called upon for advice and assistance by the Electricity Commission and other departments of the public service, functions which have continually increased in recent years both in number and in importance. The programme arranged for the first part of the session for the ordinary meetings is of good promise, and we note with interest that to the first of the "Informal Meetings," which will be held on Monday next, a most important subject has been entrusted—namely, "How best to speed up Electrical Progress"—the discussion on which will be opened by the President, Mr. J. S. Highfield.

We must confess to some misgivings lest, in the dignified surroundings of the theatre of the Institution, the distinctive character which has been acquired by the "Informal Meetings" within the hospitable but less awe-inspiring environment in which they were inaugurated may be imperilled. Already we have seen that the Committee in charge of these meetings has relaxed the rule of "No Publication of Speeches" to the extent that it has authorised one of its own members to supply an official summary to the Press—yet it was a cardinal principle in the first instance that no speeches should be reported. Now that the meetings will be held at the Institution, the delightful informality of refreshments served during an interval in the discussion may be abandoned, and eventually the "informal meeting" may become a mere imitation of the formal "Ordinary General Meeting." *Absit omen!* We hope that the Committee will bear in mind the purpose of these meetings, the success which they attained in previous sessions, and the dangers with which they are now beset, and will jealously safeguard their amenities in every respect, so that the speakers who have delighted us in the past may not be driven into silence.

The meeting time of the ordinary meetings has been fixed, as in recent years, at 6 p.m. We believe that this is a popular though by no means unanimous choice, and we trust that it will enable the informal dinners which were started by Mr. Wordingham to be revived.

The Press National Joint Board, held on October 21st, which has been circulated to the District Councils, contains a reference

to the Press which is, we think, very much out of order. The matter dealt with was the proposed agreement between the E.T.U. and the E.P.E.A. The record states that "the chairman observed that notices had appeared in the technical Press regarding this agreement, and the employer members of the Board were very anxious to know the extent of this agreement." The report goes on to say that Mr. Heslop said that the "remarks published in the Press were erroneous, and that the agreement was purely a question of domestic policy." Thereupon the report states that an offer was made by the E.P.E.A. to give copies of the agreement to the employer representatives on the Board and on the District Boards on the understanding that they were to be considered confidential; the explanation was satisfactory to, and the offer accepted with thanks by, the employer members.

The point we consider not in order is that a general statement that the "remarks published in the Press were erroneous" should be circulated by a responsible body such as the National Board without chapter and

verse. The "Press" in this instance, as shown by the chairman's opening remark, was the technical Press of the industry. Without claiming that the technical Press is always accurate in every detail, we do claim that every attempt is made to be accurate on fact and sound in opinion. We are not, of course, concerned with any statement made by an individual; what we object to is that a responsible Board should accept a statement and publish it, without giving any indication that it has satisfied itself that the statement is (or is not) justified.

Railway Electrification. FOLLOWING on the final report of the Advisory Committee on Electric Railway Standards, quite a flood of projects for the electrification of sub-

urban railways and the construction of new tube railways in the Metropolitan area has come upon us. The most recent of these are the proposal of the Underground Electric Railway Company, involving the expenditure of some £6,000,000, and that of the London County Council, contemplating the outlay of £5,000,000, both relating to the construction and improvement of tube and surface railways in London. The L.C.C. scheme, which was indeed no more than a suggestion, was rejected at the meeting on Tuesday last; the other, however, is in an advanced stage, and work could be commenced at once if the capital were obtainable on reasonable terms. In both cases it was proposed to take advantage of the Government offer to guarantee loans for works calculated to promote employment in the United Kingdom.

It is important to note that under existing conditions, it is impracticable to construct new tube railways with any hope that, under ordinary commercial conditions, they will ever produce a satisfactory return on the capital expended. Transport facilities form one of the public services which are indispensable to the life of a great community such as the Metropolis represents; the surface traffic has in many areas reached the saturation point, and future additions to the facilities must necessarily be underground. In order to provide them, the co-operation of the State is essential, whether it be effected through the medium of the Government, or of the County Council, or of a future London Transport Authority, and this fact is clearly indicated by the two proposals to which we have referred.

The Engineering Trades Ballot. BY the time this issue of the ELECTRICAL REVIEW is in the hands of our readers it will be general knowledge

that the members of the 34 trade unions involved in the engineering and shipbuilding industries have balloted in favour of accepting the proposal of the employers to withdraw the 12½ per cent. bonus given by Mr. Churchill when he was Minister of Munitions. It is true that less than one-third of the workers affected took the trouble to express their views on the subject, but it is nevertheless satisfactory to note that a clear majority of those who did so has been obtained for the course of action suggested.

Some fairly substantial improvement in production costs should be the result, especially when the reduction in wages is reflected in the cost of materials. This is necessarily and naturally a slower process in a falling than in a rising market, but by the New Year it should be quite evident. The step is definitely in the right direction, and we hope it may be followed by a real effort to increase production. The lessons of adversity having apparently been brought home to Labour sufficiently to cause agreement to the wage reduction, it is, perhaps, not unreasonable to hope that the responsible leaders of the workers, together with the rank and file, will realise speedily that it is possible to cheapen production still further by the abolition of restrictions, by a return, as suggested by Mr. Llewelyn Atkinson, to the longer working week, and by putting their shoulders to the wheel to the utmost of their ability. Having regard also to the signs already visible of increasing briskness in trade, the future seems rather more hopeful

NEW DEVELOPMENTS IN ELECTRIC COOKING.

ELECTRIC COOKING ON THE GREAT NORTHERN RAILWAY. IN A new five-car train (fig. 1), which the Great Northern Railway Co. has recently put into service between London and the West Riding, a distinct advance has been made in the history of British railways. Among a whole host of improvements, the elimination of gas is the most satisfactory feature of the new train, as in far too many accidents the rupture of the gas tanks has led to the most horrible circumstances.

While individual pieces of apparatus such as electric kettles, urns, food warmers, &c., are frequently used in

maximum of 3.5 kW. Above this is fitted a steaming oven for the steaming of potatoes, puddings, &c., measuring 18 in. by 18 in. by 20 in., this being loaded to 3 kW. Above the steaming oven is fitted a grill with a raising and lowering grid having a grilling surface of 18 in. by 12 in., and loaded to a maximum of 3 kW, this being surmounted by a water boiler in which is fitted an immersion heater of 500 watts capacity.

By the side of the equipment is mounted a table containing four 'open-type' boiling plates and two 10-gallon boiling pans. The whole of the equipment, with

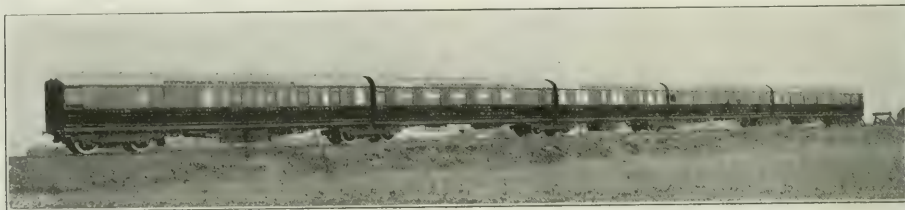


FIG. 1. NEW G.N.R. TRAIN WITH ARTICULATED COACHES.

railway carriages, this is the first dining-car train on which the cooking is entirely done by electricity, and naturally the details of the application have required special consideration, for which credit is due to the enterprise of the chief mechanical engineer of the G.N.R., Mr. H. N. Gresley, under whose personal supervision the work has been carried out. The whole of the

exception of the small immersion heater and water boiler, is arranged for heat regulation, the appliances being specially constructed and thoroughly well heat-insulated to obviate excessive loss due to radiation. The switchboard controlling the apparatus, mounted at the back, is fitted with busbars and built upon well-conceived and sound principles. The whole of the con-



FIG. 2. THE ALL-ELECTRIC KITCHEN.

apparatus has been supplied by Messrs. J. Stone & Co., Ltd., of Deptford, whose well-known system of electric lighting is also fitted on the train.

The electrical cooking apparatus installed in this train was designed and manufactured by the Jackson Electric Stove Co., Ltd. The main equipment of the kitchen (fig. 2) consists of a combination suite composed of an oven for roasting and baking, measuring 24 in. high, 20 in. wide, and 20 in. deep, and loaded to a

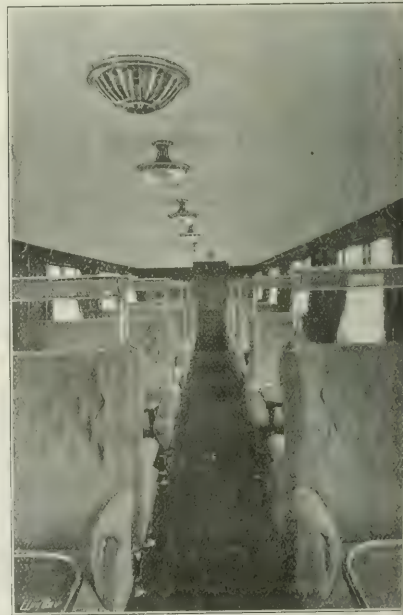


FIG. 3. FIRST-CLASS DINING SALOON.

nections can be inspected by merely removing the front cover of the board. The heating elements of the cooking apparatus are easily accessible, and have solid rod connections throughout, mounted on porcelain insulators. No loose wires, loose leads or beads of any description are employed, the apparatus being built to stand hard wear; the replacement of an element is an extremely simple matter.

A 4 ft. by 2 ft. by 2 ft. 9 in. hot enpboard with plain

top, the cupboard being double cased and lagged and loaded to a maximum of 2.5 kW., a water urn, two six-pint kettles, and a fish fryer complete the equipment.

The apparatus is specially designed to operate on a varying voltage of 150-220 V., special elements, of course, being needed for this wide variation.

A 40-gallon tank for warm water is fitted in the roof of the corridor alongside of the kitchen, and heating elements are clamped to the underside of it: from the warm water in this tank the boiler on top of the oven range and the hot water urn are supplied, and this enables boiling water to be obtained very quickly.

Inasmuch as the length of run of this train is comparatively short, and the luncheon is required to be served shortly after the commencement of the journey, and in order to minimise the capacity and weight of the battery and generating equipment to be carried, connecting plugs and sockets are provided on the train, so that when in the terminal stations the supply of electrical energy for preliminary operations may be drawn from the station supply.

A main throw-over switch enables the load to be changed over to the d.c. supply from the battery and dynamos before leaving the terminus. Subsidiary boards are provided for each main group or important element of the apparatus, carrying separate switches for the control and regulation of the heat of individual elements. Pilot lamps are set over the switches. Electrical energy for operating the cooking apparatus while the train is under way is provided by two of Messrs. Stone's "Lilliput" dynamos, carried on the underframe of the kitchen car, supplemented by a battery of accumulators to enable cooking operations to be continued during intermediate stops. The dynamos are each of 6 kW capacity with self-contained automatic pole changers, and they are belt driven from the axles of the trucks.

Automatic switchgear is provided for the control of the machines, to connect them to the battery and the cooking equipment as soon as the machine is running at the pre-determined speed and to disconnect them on falling below this speed. A battery overcharge-preventing switch automatically diverts a portion of the current from the batteries as soon as the fully charged condition is reached; the current so diverted is utilised by passing it through a supplementary heater applied to the warm water tank. "Motoring" switches with resistances are provided, one for each dynamo, conveniently placed so that the examiner can readily "motor" the machine to test it in the regular way to see that it is in working order. The motoring switch has a spring on the lever so that it cannot be left in the "on" position; immediately the lever is released the circuit is opened. As a safeguard against an excessive load being imposed on the dynamos and battery while in service, an overload circuit breaker is fitted, and before this will hold in (on the lever being replaced), the load has to be reduced by turning off or reducing to lower heat one or other of the cooking elements. An ammeter and 3-way switch enable the output of either dynamo or the total load due to the apparatus in use to be read at any moment; an ampere-hour meter is fitted, which indicates the state of charge of the battery. The accumulators are small, measuring 3 in. by 6½ in. by 14½ in., and are of the light-weight, high-capacity type, 9-plate size, in ebonite boxes with lids sealed down. They have screwed vent plugs for access to the acid for testing density, refilling, &c. The battery comprises 80 cells, arranged in two boxes on the underframe. The weight of the complete battery is 1,880 lb. The wiring is carried in enamelled screwed conduits, which are earthed, as also are the frames or casings of the various cooking apparatus. The plug connections for the supply from the station mains are interlocked with a valve on the train pipe, a lever controlling this valve being so placed that while the plug is connected the valve is open and a vacuum cannot be created in the train pipe. Additional sockets are arranged for conveniently charging the battery at terminal stations.

The advantages of cooking by electricity in a railway

train will be apparent to everyone. But special mention should be made of the better conditions, the cooler and purer atmosphere, in which the *chef* is able to do his work. Meat which has been cooked electrically is better cooked, more palatable, and more nutritious than meat cooked by gas. The objectionable smell of gas is, of course, eliminated.

The fans in the dining cars (fig. 3), instead of being fixed in the usual position on the end partitions of the dining cars, are electric extractor fans fitted in the roof of the carriage. In addition to these, the usual torpedo ventilators are provided.

Semi-indirect electric lighting is provided in the dining cars, being fitted in the centre of the roof. The first-class saloon is provided with alabaster bowls 12 in. in diameter, and in the third-class saloon are fitted obscured glass bowls. In addition to these, table lamps are provided in the first-class saloon. Each of the bowls is provided with four 25-c.p. gasfilled lamps, the total candle-power provided in the first-class dining saloon being 750 and in the third-class 600. The light is so diffused by means of the plain white roof and the indirect fittings, that there is an entire absence of glare and no objectionable shadows. The lights throughout the unit can be controlled either from the guards' vans or by the dining car conductor.

Sufficient has been said in the above notes to prove that a great step forward has been accomplished by the Great Northern Railway Co., and we hope that in a few years' time this type of train will be a commonplace, failing the electrification of our main lines.

THE B. & K. ELECTRIC RESTAURANT.

The electric restaurant which was opened by the Brompton & Kensington Accessories Co., Ltd., at Earl's Court, in 1913, is in many respects unique. In our last issue we explained its origin—the necessity of developing a domestic load other than lighting, to make good the deficiency of load resulting from the increase in the efficiency of glow lamps, the Accessories Co. being a subsidiary concern formed by the Brompton & Kensington Electricity Supply Co., Ltd., for this purpose. It is claimed that the "B. & K." restaurant was the first of its kind in London, the second in the United Kingdom, and that as now constituted it is without an equal in the world. In addition to meals served on the premises, it has developed a thriving business in the sale of cakes, pastry, and other cooked dishes, and the company manufactures and sells electric cooking and heating appliances of all kinds. It will readily be understood that these several functions are mutually helpful; in fact, the restaurant was established in order to enable the owners to perfect their electric cookers by acquiring experience at first hand, instead of depending upon the complaints of users to reveal defects, and consequently there is justice in their claim that their appliances are well-ried apparatus, which can be relied upon to give good service for long periods. Moreover, the restaurant fulfils the important function of education: its kitchens and other departments are always open to inspection, and are kept up to date in every respect. As a result of this far sighted policy, the Supply Co. has 500 domestic electric cookers on its mains, as well as restaurant equipments and bakehouse installations, and looks forward to a rapid increase in the number.

Fully to appreciate the amenities of this establishment, in respect of its culinary equipment as well as of its provision for the comfort of its customers, a visit to the premises is essential: it will be found that all that we say of its merits falls short of the reality. We can here only indicate the nature of the arrangements and of the apparatus installed, with the aid of a few illustrations.

The Servicing.—The servory is the centre of distribution for the whole restaurant (fig. 2). Its equipment has a total loading of 15.3 kW. and comprises the following items: A three-dish carving table, a hot-cupboard (on rollers) to accommodate 800 plates, a heated serving shelf, aluminium soup tureens in a water bath, and bains

maries for vegetables and coffee. Water at 150 deg. F. is supplied from the hot-water system to the bains-maries and water baths, and is raised to simmering temperature by immersion heaters.

In the servery also there is a grill and toaster, with a hot-cup board, fixed at a convenient height; two three-heat switches are provided, so that when the grill is being used intermittently, the switch may be turned to "low" (one-quarter heat), keeping the fire bars hot

possible hiding place for dirt or vermin. There are no flies or beetles in the "B. & K." kitchens.

The equipment of the main kitchen comprises the following items: A central double boiling table fitted with twelve 2,000-watt "universal" boiling plates, and accessible on all four sides; two roasting ovens, each of 12 cu. ft. capacity; one four-compartment oven of a capacity of 28 cu. ft., capable of dealing with 2 cwt. of meat at once; and fish fryers, grills, mincing machines,



FIG. 1.—THE "B. & K." RESTAURANT: MAIN KITCHEN.

enough to attain their full working temperature within a few seconds when the switch is turned to "high." Aluminium plate-warmers are fitted in the servery, and in each room of the restaurant, with the result that food is served at table at the highest temperature (140 deg. F.), permitting of consumption with comfort.

The Main Kitchen.—The special features of all the kitchens are that they are clean, bright, and well ventilated; there are no fumes, the lay-out being well balanced and convenient, with the apparatus well above

a Hobart pastry mixer, two small hot-cupboards with vegetable bains-maries, and two aluminium plate-warmers. The boiling utensils are of cast aluminium with machined bottoms, and corners externally square and internally rounded, to ensure efficiency and cleanliness.

The large oven can be used as a 1, 2, 3, or 4-compartment oven of varying sizes at will. As each compartment is separately controlled, a very wide range of totally different classes of cooking can be carried on



FIG. 2.—THE SERVERY.

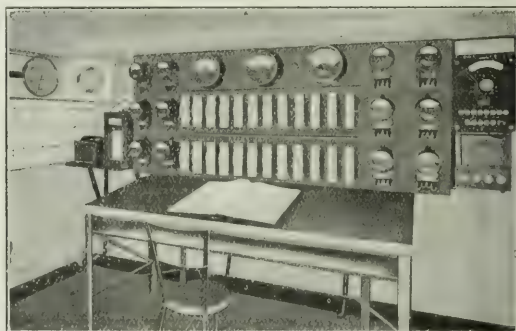


FIG. 3.—THE CONTROL ROOM.

the floor level; no stooping or bending is called for; all the controlling devices are placed at a lower level than that required for cooking; all tables and cupboards are mounted on rollers; no wires or cables are visible anywhere, and the fuses are conveniently placed but unobtrusive; there is an indicating lamp to every switch; the lighting is effective and diffused from a hidden source; there is a plentiful supply of hot and cold water; all floor corners are rounded, and there is no

simultaneously, the temperatures ranging from as low as 120 deg. F. in the bottom oven, for proving or drying meringues, through the varying higher temperatures required for casseroles and roasting, up to the temperature of between 450 and 500 deg. F. in the top oven required for French pastry.

The Vegetable Kitchen.—The boiling and steaming of vegetables, together with all other steaming operations, are kept entirely separate from the main kitchen for

the sake of convenience and cleanliness. A waste lift carries all refuse from the vegetable kitchen direct to the bins in the area below. For this reason these model kitchens have been free from flies during the exceptionally hot summer we have just experienced.

The equipment consists of a steaming oven fitted with five galvanised wire baskets, each capable of accommodating 25 lb. of potatoes, fish, suet puddings, &c., the heating elements being of the immersion type; a five-tier steamer for similar operations; a 30-gallon boiling pan; and a cooker for roasting potatoes and the preparation of specialised vegetable dishes.

Adjoining this kitchen is the scullery for washing, cleaning, and storing all cooking utensils.

The Pastry Kitchen.—This is equipped with one two-tier pastry oven, which supplies the whole of the confectionery department with French and English pastries. The proved excellence of the "B. & K." pastry is due in a large measure to the certainty of results obtained from this oven, the elimination of all variables and guess-work, which is the pre-dominant feature of all electric cooking, being, perhaps, more important in this



FIG. 4.—PART OF THE RESTAURANT.

branch of the culinary art than in any other. All the tables are placed on rollers, as well as two galvanised-iron flour bins. The pastry kitchen is in direct telephonic communication with the confectionery counter, just as the main kitchen is in contact with the restaurant manager's office, thus facilitating the smooth running of the whole establishment.

The Control Room.—This room, which is situated immediately beneath the kitchen, is the nerve centre of the whole establishment. It contains a very complete equipment for recording the consumption and measuring the temperature at which every cooking operation is carried out in the kitchens.

To attain this end, a separate watt-hour meter is connected in circuit with each oven, boiling table, fish fryer, &c., in the various kitchens. Thus it is possible not only to obtain the overall consumption of the whole kitchen for any period of time, but also to check the consumption on any single piece of apparatus. A recording ammeter is installed, which can be connected in series with any piece of apparatus on test, so that a graphic record of the variation of the loading may be obtained. The temperatures are very efficiently checked by means of a multiple electrical distance thermometer. A platinum resistance thermometer is fitted not only in each oven, fish fryer, hot-cupboard, &c., but also inside and outside the main kitchen, in order to get a comparison of the actual working temperature in the kitchen with that of the atmosphere outside. These thermometers are connected to a galvanometer in the control room, so that an immediate and accurate reading of the temperature prevailing during any cooking operation may be obtained at any moment.

The equipment in the control room is completed with an electric clock synchronised with every clock in the building, and a Cardew open dial voltmeter.

A tour round the whole establishment shows that the utmost use is made of electricity throughout the multifarious operations connected with the preparation, cooking, and serving of meals, down to the electric cash registers, signs, and plate washers. With regard to the last named, a very efficient and up-to-date electrically-operated teak plate-washing sink is installed in the basement for cleansing all the plates, dishes, &c., from the restaurant. One attendant can deal with as many as 1,000 plates per hour, which are soaked, washed, sterilised, and dried with the minimum of labour.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

THE sixth annual report of the Committee of the Privy Council for Scientific and Industrial Research has been published (Cmd. 1,491; price 1s. net). In presenting the report, the Lord President of the Council (the Rt. Hon. A. J. Balfour) says that the necessity for restricting public expenditure led to a curtailment of resources which has caused the committee great anxiety. A total sum of £40,889 was expended on the Fuel Research Station during 1920-21. A long series of experiments on the effects of steaming various coals in vertical gas retorts has been completed and a report issued. The results show broadly that substantial gains can be made in the gas evolved, and also in the by-products, tar and sulphate of ammonia. A report has now been issued dealing with the experiments on low-temperature carbonisation and the carbonisation of air-dried peat at various temperatures. The expenditure of the National Physical Laboratory is settling down to a permanent level now that the war activities of the Laboratory have been completed. The number of approved industrial research associations is now 26, and grants under this head amounted during the year to £74,557. The income provided by the interest on the unexpended balance of the Million Fund amounted to £51,889. After applying £13,567 to meet industrial research and other charges, the balance was appropriated in aid of the Vote of the Department. During the year approximately £40,850 was given in grants to 245 students and research workers and assistants. Sir John F. C. Snell was added to the Advisory Council.

The three main Co-ordinating Research Boards commenced work almost a year ago, and their preliminary investigations appear to show that there is remarkably little overlapping in the researches conducted by the different services. In many instances where the same problem is being attacked at different establishments, it is treated from very different points of view. Should any commercial development be of importance to only one fighting service, that service is in the best position to supply such information as the Government possesses; but this is exceptional and usually all three services are interested in varying degrees. A recent conference between representatives of the fighting services and the British Electrical and Allied Industries Research Association, called to discuss the possibilities of research aiming at improvements in accumulators, brought this out very clearly. It appeared that, although the immediate requirements of the services differed, each wanted much the same information; on the other hand, each had some information to give. There are a number of researches which were undertaken during the war, for war purposes, which can be extended to meet civilian requirements. Among these may be classed the inspection of materials by means of X-rays.

In briefly describing the work of the various associations, the report repeats the warning against the short-sighted policy of confining research organisations to the search for results of immediate commercial value. It is recorded, however, that associations are concentrating more and more on the fundamental principles underlying the methods and processes of their trades. Among the activities of the British Photographic Research Association was included a study of the contrast and exposure in X-ray photographs through metals. As a result of representations made by the Medical Research Council, a conference was held between representatives of the British Scientific Instrument Research Association and leading radiologists, with the object of obtaining information as to the lines along which improvement in the manufacture of X-ray apparatus should be sought, in order to meet the requirements of the medical profession. A sub-committee was appointed to co-operate with the Electrotherapeutic Section of the Royal Society of Medicine to draw up a complete specification for an X-ray outfit complying with modern requirements. The Scientific Instrument Research Association has found it expedient to arrange for close co-ordination with the British Electrical and Allied Industries Research Association in electrical researches of common interest to the two bodies.

In the National Physical Laboratory a number of researches are in progress as a "free service" for civilian Government Departments. Among these may be mentioned: Illumination, for the Factory Lighting Committee of the Home Office; an investigation for the Office of Works relative to the lighting of public buildings; and tests of ships' navigation lights for the Board of Trade. Research is being instituted with a view to the production of high-class insulating materials in this

country, in order to avoid dependence on foreign sources of supply. It was ascertained that the Government Laboratory had had considerable experience of some of the problems involved in the production of artificial materials of this kind, and investigations are being continued there. Arrangements have also been made with the British Electrical and Allied Industries Research Association to extend its work on insulating materials in conjunction with the N.P.L. The latter is also carrying out researches into such matters as searchlight carbons, alloys for compass correctors, non-magnetic steels, &c.

The progress made by the various sub-committees of the Radio Research Board has been satisfactory, although it has necessarily been handicapped by the present lack of experienced investigators to undertake the type of research required by the Board. The Board has arranged for an extensive investigation into the origin and fundamental nature of "atmospherics," with a view to providing data which it is hoped will lead to the development of reliable apparatus for their elimination. The Aldershot wireless station of the Meteorological Office has been taken over for this purpose. The Directional Sub-committee has enlisted the co-operation of seven colleges and four Government technical establishments in a scheme for making simultaneous observations in various parts of the country. These observations are made with identically similar instruments, and the observed errors in bearing are carefully collated. Grants have been made for the carrying out of important research work in connection with thermionic valves, &c.

The work on Dielectric Separation, commenced by Mr. S. H. Hatfield under the Tin and Tungsten Research Board, has been completed, and it is considered that it is possible that a process has been evolved which may prove useful in the separation of minerals from their ores, or from one another, and may be capable of wide application. The Lubrication Research Committee has carried out further researches into the fundamental theory of the action of lubricants in sliding friction and the influence of small quantities of fatty acids upon the lubricating properties of mineral oils. A committee on Gauging Rivers and Tidal Currents has been formed, and as a preliminary a bibliography of the subject has been prepared with a view to ascertaining what further work is required.

The British Electrical and Allied Industries Research Association has taken over the whole of the work of the Electrical Research Committee. This includes researches upon fibrous and composite insulating materials, porcelain, mica, coil-insulating, buried cables and overhead wires, electrical control apparatus of various descriptions, and on dielectric losses, and the drawing up of standard specifications for the purchase of electrical materials.

Included in the appendices to the Report are a list of works by persons in receipt of grants; notes on research organisation in the overseas dominions and foreign countries; and a list of departmental publications.

LEGAL.

CHARLES SIMON & CO. v. THE BRADFORD CORPORATION.

This case, which was mentioned to Mr. Justice Peterson in the Chancery Division on Friday last, is a motion by the plaintiffs, Bradford woollen merchants, to restrain the Corporation from obstructing ancient lights by building extensions at the Bolton Road electricity sub-station. The land opposite Simon's has been vacant hitherto, and the Corporation proposes to put up a building 70 ft. high. For the Corporation, Mr. Cunliffe, K.C., suggested that this was a case for early trial, and in the meantime he undertook that building should not proceed above 45 ft. high, the street being only 45 ft. wide.

The motion therefore stood over with a view to an early trial of the action.

FRAUDULENT CONSUMPTION OF ELECTRICITY.

THE *Birmingham Post* reports that the maximum penalty of £21 was imposed by the Worcester magistrates on Saturday, on Thomas Jones, hairdresser, Sansone Street, Worcester, who was summoned for fraudulently consuming a quantity of electricity of the value of £2. Defendant pleaded guilty. For the prosecution it was stated that before defendant occupied his shop, a supply of electricity was provided by the Corporation, but, on the change of occupier, the supply was given up, and the Corporation took steps so that the energy should not be used. Recently an electric light was noticed in the front of the shop, and, as there was no meter, an inquiry was instituted. The seals which had been put in when the supply was cut off had been tampered with, and, by means of a thin wire, an improper connection had been made with the Corporation lines.

The Chairman (Mr. J. Maygling) said the case was of a serious character. The magistrates had considered sending the defendant to prison, but in view of his long residence and his previous character, they imposed the maximum fine, or one month.

THE SOUTH-EAST LANCASHIRE ELECTRICITY DISTRICT.

REORGANISATION OF ELECTRICITY SUPPLY.

We have received a copy of the scheme for the reorganisation of the supply of electricity in the above named area that has been submitted to the Electricity Commissioners by the local authorities and companies that are supporting the scheme, together with the statistics therein referred to. The matter is set out in great detail, and we regret that we are unable to do more than briefly outline the proposals. Copies of the scheme are, however, to be obtained from Mr. A. H. Banks at the Town Hall, Manchester.

Arising out of the Electricity Commissioners' delimitation of the area*, the South-East Lancashire Electricity Committee was formed of representatives of every authorised undertaking in the district, and that body appointed a sub-committee consisting of 22 members, with Ald. W. T. Dagnall as chairman, which, after considering matters of general policy and the nature of the administrative body to be set up under the scheme, appointed an engineering sub-committee (Messrs. S. L. Pearce, chairman, R. Elackmore, R. Lomax, J. A. Robertson, C. D. Taite, S. J. Watson, and W. J. H. Wood) to prepare the technical details of the scheme. Some 43 authorised undertakers and local authorities have adopted the scheme, while the Electricity Committees of four others have passed resolutions in favour thereof that are awaiting confirmation by their councils. The scheme is divided into six sections. Parts 1 to 3 comprise a general statement of the electrical development in the district as it was on March 31st, 1920, together with the estimated development that will have taken place by 1925-26. Full statistics relating to the 26 generating stations existing within the area are given; of these six are company-owned, the remainder being municipal undertakings. Details are also given of the existing interconnection lines, of those in course of construction, and of existing e.h.p. lines that are suitable for use as interconnectors. They are of both the underground and overhead types, and operate at pressures of 33,000, 11,000, 10,000, and 6,600 volts. The total coal consumption for the area in 1919-1920 was 1,530,306,838 lb., which produced 486,991,001 kWh, or an average of 3.14 lb. per kWh.

The total maximum demand in the area for 1919-20 is given as 185,077 kW, and the plant capacity as 295,263 kW. It is proposed to construct eight new capital stations (on two of which the work of erection has already commenced), which will have a total plant capacity of 755,000 kW, the estimated maximum demand in 1925-26 being 432,230 kW, and in 1930-31 643,730 kW.

If the various stations were developed individually without regard to a scheme in order to accommodate the anticipated demands in the respective areas in 1925-26, the estimated coal consumption would reach a total of 2,257,899,280 lb., producing 1,067,886,400 kWh, or an average of 2.114 lb. per kWh. In 1930-31 the figures would be 3,290,001,000 lb., 1,618,961,200 kWh, and 2.0321 lb. per kWh respectively. Under the same conditions the capital expenditure would amount in 1925-26 to £8,078,000 on 330,450 kW of plant (£24.44 per kW), plus £100,000 on transmission lines and switchgear. Similarly by 1930-31 the capital expenditure would be £6,487,500 on 308,950 kW (£20.99 per kW), plus £300,000 for transmission lines and switchgear.

In addition to the new capital stations mentioned above, 17 existing stations would be utilised as part of the scheme, and eight stations would be extended by an aggregate of 78,500 kW, so that by developing on the lines laid down the capacity of the stations forming part of the scheme would total 622,175 kW in 1925-26, the maximum demand for the district at that time being 69.4 per cent. of the plant installed. In order to distribute the supplies as contemplated, it will be necessary prior to 1925-26 to construct 21 underground main transmission lines to operate at 33,000 volts, and the estimated capital outlay which will be involved in the scheme up to 1925-26 will be as follows:—Generating plant, £5,875,500 on 247,450 kW (average £23.74 per kW); transformers, &c., £220,650 on 153,000 kVA; cable, 69.2 miles (route miles 51.42), £504,730; switchgear £201,000, or a total of £6,801,880. The total coal consumption would be 2,213,476,480 lb., producing 1,077,279,628 kWh, or an average of 2.05 lb. per kWh, so that the saving that would result from the operation of the scheme as against individual development would be: Coal, 19,831 tons per annum at 35s. per ton, £34,704, and capital, £1,376,120 at 10 per cent. interest, £137,612—a total of £172,316 per annum in addition to substantial reductions in labour costs for the operation and maintenance of plant.

Part 4 deals with the second period of expansion. By further developing on the lines of the scheme it is estimated, that by 1930-31 the plant capacity will have reached a total of 894,075 kW and the maximum demand 643,730 kW, or 71.9 per cent. of the plant installed, but after 1931 a ninth new station will be required.

In order to distribute the supplies as intended during the second period of development, it would be necessary to construct during that period 14 main underground transmission lines to operate at 33,000 volts, and the capital outlay between 1927 and 1931 would be as follows:—Generating plant,

* *ELEC. REV.*, June 25th, 1920; p. 815.

£5,637,500 on 265,450 kW (£21.23 per kW); transformers, £114,750 on 90,000 kVA (15s. per kVA); cables, 55.2 (route miles 35.7), £418,200; and switchgear, &c., £114,200—a total of £6,284,650. The coal consumption at the end of the second period would amount to 3,209,722,789 lb., producing 1,637,555,260 kWh, or an average of 1.96 lb. per kWh, which shows a saving, by the operation of the scheme against individual development, of 35,838 tons of coal at 35s. per ton, equalling £62,716, and of £498,400 on capital outlay at 10 per cent. interest, equalling £49,840—a total of £112,556 per annum. The combined saving of both first and second periods would therefore be £250,168 per annum.

Part 5 contains general information showing that the supply would be 3-phase, 50-cycle, a.c. The main transmission pressure would be 33,000 volts, and the local secondary pressures 11,000 and 6,600 volts; at a later stage it might be desirable to adopt a main pressure of 66,000 volts. The stations to be shut down number eight, while four stations would continue to operate for the present, giving non-standard supplies.

Part 6 deals with the constitution of the proposed Advisory Board to consist of 48 members, 41 of whom will be elected by the authorised undertakers in the district; an Engineering Advisory Committee would also be formed to assist the Board.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Durability of Lead-covered Wiring.

Mr. O. Skidmore is not quite correct in stating that compo piping for gas has been used for years *without question*. Many gas undertakings have discontinued its use, and I am informed by an engineer to a large gas undertaking that iron barrel for gas piping in houses is to-day's standard practice. In any case, compo piping of the sizes generally used for gas to-day is considerably thicker than the lead compo coverings used for house wiring.

Plain lead-covered cable as used by the G.P.O. and for 11,000-volt supply is drawn into earthenware ducts, and thus is protected from certain salts which corrode lead.

Lead-composition-covered wiring is largely used by the G.P.O. for internal wiring, but a G.P.O. electrician informs me that faults due to corrosion and electrolysis are very frequent. He instanced a fault he located recently, where the lead covering of a wire which passed through a damp brick wall was found converted into a spongy white paste.

Were it not for this inherent weakness, why should the I.E.E. rules be so stringent with regard to the use of lead composition wiring? Amongst nearly a page of other rules relating to this system are the following:—

68x (c). "They must not come into contact with damp brickwork or plaster." This rule should debar the use of compo-lead-covered systems in a new house where walls are anything but dry, and although a house may be perfectly dry when the wires are installed, some part of it may subsequently become damp.

Again, 68x (b). "Lead-covered wires must be protected by wood or metal casing where buried in plaster, cement, or brickwork." And 68x. "The resistance of the metal sheathing between any two points shall not exceed 2 ohms."

What proportion of installations are so protected, or ever tested for sheath resistance, or have their sheaths efficiently made continuous and thoroughly earthed? I venture to say a very small proportion.

In conclusion, I would recommend to "W. T. J." a good tough-rubber-protected system, which, though more expensive than lead-covered, has not the above objection or rules to be observed.

B. W. Gothard,
Chief Engineer.

Electricity Works,
Farnborough, Hants.
October 25th, 1921.

Your correspondent "W. T. J." need have no hesitation in adopting this system—it is absolutely reliable, and as durable as the best system in use. We think the following will convince him that this is so:—

The twin lead-covered system was introduced by this firm 27 years ago, and has been used for work of every description. Many important installations, which may now be classed as aged, have never cost a copper for repairs beyond the usual upkeep of switches, lamp-holders, &c. We should be very glad to furnish your correspondent with a list of many hundreds of contracts which we have carried out on this system, including private residences (town and country), factories, cold stores, breweries, steam ships, and, in fact, every place where electric wiring may be subject to hardship. There are, of course, special points to be noted in the carrying out of work on this system. First, damage to the lead covering by clumsy handling in fixing must be avoided. Secondly, the lead covering must be brought well through the walls where

it may come into contact with wet plaster, otherwise damage will be done by "creeping" of moisture. Insulation defects at the start will nearly always be found within a few inches of the end of the cable. Thirdly, mechanical damage must be provided against, and switch drops on the surface are best protected with a neat wood moulding, stained or painted as required. In positions under floors, &c., where there is special risk of damage, steel channelling is specially made, and where passing through brick walls short pieces of tubes should be used to prevent abrasion of the lead when pulling through. Fourthly, it is absolutely necessary that the lead covering should not be a mixture, such as "compo," which in damp positions will not last any time at all owing to local action or electrolysis. Lastly, it is of the utmost importance that the lead covering should be continuously and efficiently earthed.

There are many makes of suitable junction boxes, &c., for use with this system, and we should be very glad to demonstrate the utility and reliability of the system to your correspondent, or anyone who will refer to us.

Tyler & Freeman.

London.
October 25th, 1921.

The practical electrician referred to by "W. T. J." is not the only one who has condemned lead-covered wiring. I have had power-station engineers do the same thing, saying that the use of this system should be prohibited.

My experience is that lead-covered wiring, when properly installed and carefully used by the wiremen, is equal to any system in steel conduit, excluding C.T.S., equally free from faults.

If "W. T. J." will get his electrician to install lead-covered wiring, using Callender's Kaleco system, or, in fact, any of the later forms by any of the cable makers, he will have no cause to complain; but he must have a really good man to handle his materials.

M.E.C.A.

London Branch.
October 26th, 1921.

Why is it that when an individual objects to anything, somebody like "Othello" (who does not sign his name) comes along and talks about "personal prejudice"? Is not the fact of Othello so loving lead-covered systems, also personal prejudice in favour of these, or perhaps I should say, one of these systems?

Personally, I hate lead-covered systems, and I am glad to relate that we are not troubled with many here. From one house here lead-covered wiring (installed during the war) was removed a short time ago. It is only fair to state that the installation was replaced by the brave owner with another lead-covered installation which I think is giving satisfaction. I, however, am personally prejudiced against lead-covered wiring, and I might even go so far as to state that I am a fanatical enemy of small lead-covered wires under the floors of houses, warehouses, or any other building.

If it is necessary to use an earthed metal-covered system, which to be safe must be for ever trying to break down the insulation of the installation (and this to me does not seem common sense), then I say use a metal which is not liable to melt when the strained and weary insulation does at length peter out! By the above I do not refer to a metal conduit system, wherein no wire can possibly live for long in our climate, unless it is a 2,500-megohm grade Association aristocrat!

I like good quality cab tire, because it helps the insulated wires inside to keep their end up. In dry places I am also fond of our old friend wood casing, for the same reason.

I am aware that lead-covered systems are perfectly safe when installed, bonded, and earthed, as the advocates and makers of these systems intend them to be; but I have in my time seen such criminal jobs installed with this wire that I would hesitate to sleep over a lead-covered installation unless the patentee had actually carried out the job himself or the main switch was off!

Now, a cab tire system can be put in with safety by the jerry wireman's smallest boy, if you see that he uses the right kind of cab tire and watch what he does with the ends. Is this test, after all, not the proof of any wiring system?

A. J. Abraham, M.I.E.E.

Electricity and Tramways Department,
Aberdeen.
October 31st, 1921.

With reference to the correspondence in the current issue of your paper, I would like to say that I have always recommended an insulated lead-covered system of wiring where possible in preference to, say, the concentric system with metal-sheathed uninsulated return.

The advantages of the lead-covered system are obviously:—

1. Risk of insulation failure halved.
2. No risk of electrolytic action.
3. Cheap to install.

Lead is generally regarded as incorrodible, but I have seen cases where, in damp places in contact with wood, the sheath-

ing has been attacked by organic acids. These cases are very rare.

Concentric systems, in my opinion, with *uninsulated* return merely ask for trouble, especially in damp places.

W. H. F. Murdoch.

London
October 29th, 1921.

Battery Carbons.

With reference to the letter appearing in your issue of the 25th inst. under the above heading and criticising the report of an interview with me which appeared in the *Evening Standard* recently, I should like to say that I was not quite correctly reported in one particular, viz., I did not say that the pocket-battery industry in this country depended upon imported carbon rods. What I actually stated was that a well-known firm of British pocket-battery makers was, in fact, being kept waiting for a consignment of 600,000 carbon rods which the Board of Trade alleged to be liable to the Key Industries Duty. (This ruling has now been reversed.)

I think if reference is made to the letter which the Fancy Goods Vigilance Committee of the London Chamber of Commerce sent to members of the House of Commons, it will be found that the statement made therein was in practically the same terms. I appreciate the generous allowance which your correspondent is good enough to make for Press inaccuracy. I should not presume to enter into argument on the technical question as to the relative quality of the imported and the home-made carbons. Why the manufacturers to whom I have referred buy their carbons from abroad is, of course, a matter for their judgment. But I think your correspondent will agree that it is not desirable, in any one's interest, that official interpretations of an Act affecting the business community shall be allowed to pass unchallenged if they appear to be unreasonable. This seems a sword with two edges; and I do not think that either manufacturer or importer is anxious either to see Customs delays increased, or the power of bureaucracy magnified.

Frank W. Challis.

Secretary.

Electrical Importers' and Traders' Association.

London.
October 29th, 1921.

A Suction-gas Problem.

Your correspondent under this heading on page 530 does not say whether the complaints occur just after the plant is shut down or during the time the fire is being blown up previous to starting.

We have a plant that has been running since 1915 and, at first, we had complaints (we are right in the centre of a town). Then we made arrangements to ignite the waste gas at stopping time, when the waste is gas rich in CO; this burns till the waste gases get so poor as to be incombustible.

We also got some complaints at the time of blowing up when the suction plant was put in, but as this merely took the place of a pressure plant that had been running for 18 years, we told the complainants that it was purely imagination, that there was no difference in this respect to what had been in existence for the last 18 years. Only one man complained, and as he left the town shortly after there was no further trouble.

With regard to the water from the scrubber, the quality of the coal used makes a considerable difference; a coal rich in sulphur will make a smelly effluent, the smell being due to sulphuretted hydrogen. Cheap coals suffer in this respect. We pass it into the town sewer and have no complaint, our drains being fitted with a ventilating pipe and fresh air inlet. We find the fresh air inlet valve wants looking to periodically on account of the gases, or fumes, from the water acting on the metal hinges of the mica valves.

D. G. T.

October 29th, 1921.

Patriotism and Unemployment.

I have been much surprised during recent months at the regular way in which vacant appointments are given to men already in positions. Surely, during the present bad times at least, the proper and patriotic duty is to fill the vacancies with men who are out of employment! One would think that people who are supposed to be educated, such as electricity committee members and managing engineers of electricity supply undertakings would see to this, but I can name several appointments from engineer and manager downwards which have this year been given to men already in positions over the heads of good men who were unemployed and applied for the posts at lower salaries than are being paid; this does not help the latter, or the ratepayers to get cheap electricity, and the Government ought to intervene in the matter.

Again, is not the present mania for giving all the work to single young men being overdone? It seems hopeless for an engineer over 30 years of age to apply for a job at all; if he is married, he stands no chance whatever. I have heard of cases where first-class engineers, married, have applied for shift jobs in small stations at £5 to £6 per week and have

been turned down in favour of a single young man with very little experience. Has the country gone raving mad, or where are we drifting to?

It would also appear that the electricity supply industry is getting into the hands of a ring. Who are these people called the Associated Municipal Electrical Engineers who advertised in the *Review* last week advising as to the salary for the post of chief engineer and manager at Long Eaton? The Long Eaton Council has been frank enough to state the salary offered, and those who do not agree need not apply for the post; it is to be hoped the Long Eaton Council will give the country a lead by selecting the most suitable unemployed engineer and never mind the A.M.E.E. or anybody else.

Wake Up England!

October 31st, 1921.

Single-phase Traction on Railways.

As the question of railway electrification is rather prominent at the moment, before any definite movement is made, it seems a favourable moment to review the merits of single-phase traction.

As is well-known, this method embodies most of the good points of d.c. and a.c. power units and transmission without their disadvantage; especially is this so on fairly long-distance schemes.

As compared with a.c.-d.c. traction, a fully single-phase system would prove a great saving to the railway companies, both in capital outlay and in running costs, since there is no need for rotary transforming stations, with their attendant personnel and running charges at definite intervals along the route. Fewer sub-stations could be used with single-phase transformers needing only occasional skilled inspection and attention.

I am aware of certain inherent difficulties in the way, but believe it possible that they may shortly be overcome, and the way be smoothed for single-phase traction to come into its own. The day seems not far distant when railway electrification will be the rule rather than the exception.

Opinions on this subject would, I think, do the industry as a whole a great deal of good.

W. T. Rushton.

Leyton.

October 29th, 1921.

The I.E.E. Rules

Is it necessary to add a d.p. switch and fuses to an ordinary flat-iron at 230 V in circuit with lights and a two-way distribution board?

Is it necessary to install a 5-amp. d.p. switch and fuses (by I.E.E. rules) expressly for a ½-h.p. motor, with a starter and double automatic features at 230 V?

If the master d.p. switch and starter are on the same board, within appreciable distance of the motor, and on the same rateable value as the whole installation, can we not add some pendant 60-W lamps to the circuit to the extent of 5 amps?

Pilot.

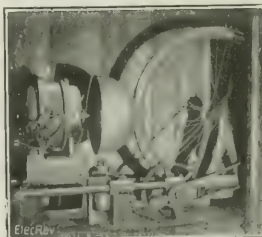
October 28th, 1921.

A.C. Organ Blowers.

In view of the interest taken in the above correspondence, I send herewith two photographs (obviously taken by naked eye or light) showing a blowing device for adaptation to hand-blown apparatus, which I believe is commercially marketed, though I do not know by whom.

The motor is of ½-h.p. of the single-phase squirrel-cage induction type, supplied at 200 volts, 100 cycles, and running at 1,900 r.p.m.

The hemisphere on the shaft engages with the tire on the cycle wheel, which drives through cycle-chain reduction gear a slowly rotating crank, connected to the blowing handle.



The carrier on which the motor is mounted is pivoted just below the hemisphere in a line with its centre, and the outer end is borne by a roller running on a quadrant.

By means of a wire attached to the main reservoir in the organ, the whole motor is swivelled round as the reservoir deflates, and so causes a wider part of the hemisphere to make contact with the tire, thus raising the gear, as shown in the second photograph. The return is effected by the spring seen in the foreground. Means are provided for slackening the wire for starting up, &c.

The apparatus is enclosed in a double-walled case, packed with sawdust, which makes it practically silent. Sufficient ventilation occurs to prevent overheating.

If run light very much, the fire suffers considerably from the twisting action of the hemisphere, and emits a squeaking noise.

One would think that a driver which came to a point on the shaft and curved out to a shape approaching that of a disk (the pivot being placed at one side of the shaft) would overcome this difficulty and also give the maximum rate of rise of gear at full load when the reservoir is lowest, just when it is most needed.

F. J. A.

Derby.

October 24th, 1921.

[This device, known as the "Rotasphere," was described in our issue of December 17th, 1909, p. 976. The hemisphere was of aluminium. The makers were the Kinetic Co., Ltd., Lincoln.—EDS. ELEC. REV.]

I have read with interest the letters on this subject, and as it is not a job that the average electrical engineer meets, it may be of interest to tell how I got over an interesting but tricky installation that I found whilst canvassing for work about two years ago.

A gentleman wanted an organ-blowing and automatic pumping plant. He had had two estimates, both of which specified for two motors, one motor on the blower and one motor on the pump, but he wanted only one motor to operate both if possible. Supply pressure 100 volts, 50 periods, single-phase; organ, 3-manual in drawing room; position for blower, motor, and pump in cellar under scullery, about 25 ft. from the organ, with 7 angles; the pump to be automatic and the blower to be controlled from the organ.

The following is what I specified and installed: Century motor, Rotary Co. pump, running at 350 to 400 r.p.m., Roots blower running at same speed, one air chest, one double-pole float switch, and double-pole change-over switch.

The pump and blower were mounted pulley to pulley (pulleys same size) and the motor pulley (wide) in line with the centre of the other pulleys for an endless belt drive. The motor when pumping was controlled by the float switch, which gave an automatic supply of water. The motor when blowing was controlled by the change-over switch fixed at the side of the organ, which cut out the float switch. The belt was changed from one pulley to the other by striking gear connected by rods and cranks to a lever at the side of the organ. The wind was controlled by the air chest, which had two valves, an electric valve operated by contacts on the organ bellows and a safety valve operated by the bellows of the air chest in case the electric valve failed. The safety valve in the organ bellows was also left in operation, but by releasing the wind at the air chest in the cellar with the electrically-operated valve, it stopped the hissing of escaping air at the organ. We installed a metal wind trunk first, but the metal pipe carried all the noise of the blower and motor to the organ; we replaced it with a wood trunk and put a felt box over the blower, after which you could not hear the motor or blower at the organ.

There is also on the market a patent blowing apparatus for connecting direct to the lever of the organ bellows, consisting of a motor on a turntable with a turned wood hemisphere on the spindle and a cycle wheel. This apparatus is suitable for alternating or direct current.

George T. Church.

Chertsey.

October 24th, 1921.

Wear of Rotary-Converter Slip-rings.

A correspondent over the *nom de plume* of "Koocaf" asked, through the hospitable "Correspondence" columns of the May 20th REVIEW, for advice about rotary-converter slip-rings. The writer, and also Mr. B. T. Smith, offered a hint or two, and would be very glad to hear further from "Koocaf," and hope that this will catch his eye, and that he will be able to express himself as satisfied.

W. G. Stuart.

Trethomas.

October 25th, 1921.

Thunderstorm Phenomena.

With reference to the above subject, whilst in South Africa some years ago the writer had similar experiences as follows:—

1. A corrugated-iron building was efficiently earthed in four places, and had a telephone fitted therein. The instrument was protected by a lightning discharger fixed immediately above it. Some excitement was caused one evening during a thunderstorm just as dinner was being served. A servant was passing the telephone, which was fixed in a passage, when a flash and loud report occurred. The servant dropped the tureen he was carrying and ran. The writer, on making an examination, discovered that the earth wire from the discharger was taken through a small window near by and laid along the roof of the passage and connected to a water tap about 60 feet distant.

He is of the opinion that the lightning discharge flashed over between the discharger and the building in preference to following the path provided via the earth wire. Holding this opinion, the discharger earth wire was removed from the water tap and connected to the building, the length of earth wire being now reduced to not more than 3 or 4 feet. No further trouble was experienced.

2. The occupant of a corrugated-iron bungalow wired throughout in wood casing complained of the large number of breakages of metallic-filament lamps therein.

The breakages were at first attributed to an inferior type of lamp supplied. After paying very heavily for lamp renewals, it was reported by the occupant that he had observed that the broken lamps were invariably discovered on switching on at dusk, and after there had been a thunderstorm during the day.

After this discovery he had given instructions that on the approach of a thunderstorm during the day, lamps were to be removed from their holders, and by so doing he was saved some expense in lamp renewals.

The supply in this instance was underground, d.c., 3-wire system, 240 volts outer to neutral.

The writer not being satisfied, made an inspection, and discovered that the bungalow, built on brick piles, had not been earthed. The building was earthed, and this is believed to have cured the trouble.

As for an explanation, one can only suggest that in this instance a charge was induced in the internal wiring of the building; one side being connected to the neutral, a path was thereby provided for neutralising these induced charges via the lamps and flashing over switch breaks.

To avoid a repetition of the trouble at Alverstoke, Hants., the writer suggests that:—

1. The telephone earth wire appears to have inductance, possibly due to the numerous angles through which it passes. A shorter or more direct route should be chosen.

2. Assuming that the earth wire of the telephone discharger has inductance, the lightning discharge flashed over between the lightning discharger and the electric light distribution box and thence to the neutral of the 3-wire supply, on account of the neutral offering a path connected with earth and of less inductance.

M. E.

Sheerness.

October 25th, 1921.

Grinding v. Turning Commutators.

My attention has been drawn to the above correspondence, and I think it would be as well to draw the two gentlemen's attention to the fact that the simplest way of truing up a commutator is to use a hand-grinding block for ridges, flats, or high micas. This block can be obtained at a mere fraction of the cost of any of the other methods, and the block is so constructed that it will not glaze with the copper, as a carborundum block will do; the only thing necessary is to have a block suitable for the diameter of the commutator, and to apply it as soon as there is any sign of ridges, flats, or high micas.

Don't leave it till you have a commutator like a ploughed field.

Andrew A. Hurry.

For the Commutator Grinding Block Co.

Greenock.

October 31st, 1921.

[Other letters are unavoidably held over.—EDS. ELEC. REV.]

Wireless Control of Fog Signals.—A wireless development of interest to seafarers has resulted from the demand for a means of controlling fog signals off the coast and at the mouths of estuaries. This afforded a somewhat unusual problem, since to be of use the receiving apparatus must be capable of functioning without any adjustment or attention for long periods. Also it must operate without fail when required, and must not be liable to accidental operation by wireless signals other than those to which it is designed to respond. The practical solution has been provided by a combination of an improved form of the otherwise obsolete coherer acting in conjunction with a tuned mechanically oscillating relay. A wireless transmitter, suitably situated on shore, is caused to send out a series of "dots" by means of a controlling pendulum to which the receiver relay is tuned. The dot signals are received upon a small aerial on the fog gun or beacon, and each dot acting on the coherer causes a local current to apply an impulse to the tuned relay and, at the same time, to operate a tapper which provides the necessary decohering action. The relay is thus caused to swing through an arc which increases with each impulse until the relay contacts meet and the gas valve or other mechanism is operated. Apparatus of this description is to be found in the Clyde, where the fog guns at Fort Matilda and Rosneath Patch are operated from Gourcock Pier. It is understood that the system is entirely satisfactory and has demonstrated its immunity from interference under exceptionally adverse conditions.—*The Times Trade Supplement.*

BUSINESS NOTES.

Bankruptcy Proceedings.—FREDERICK CHARLES NICHOLS, trading in partnership with Margaret Parks, as the Scarborough Motor & Accessories Supply Co., 19, South Street, Scarborough, Yorkshire, electrical and motor engineer.—The public examination of this debtor was held on October 25th at Scarborough. The statement of affairs showed liabilities of £72 against assets £26. The examination was closed.

GEORGE WILLIAMS ENDALL, trading as Endall & Co., Canal Motor Works, Canal Bridge, Church Street, St. Helens, Lancashire, electrical, mechanical and automobile engineer.—The first meeting of the creditors of the above was held recently at the offices of the official receiver, 11, Dale Street, Liverpool. The receiving order was made on debtor's own petition. According to the statement of affairs the unsecured liabilities amounted to £1,393, against net assets £338. The assets comprised stock in trade, machinery, and good book debts. Debtor attributed his failure to bad trade and illness. It appeared that after having been in the employ of an engineering firm in Manchester for two years, he went to St. Helens in February, 1915, and commenced business as an electrical, mechanical, and automobile engineer with about £15 capital. For the first two years he was successful, but subsequently he was ill, and on his return to the business he was obliged to obtain financial assistance from a friend, who lent him £200. As security he signed an agreement which purported to give a charge over his plant, tools, and stock in trade. The £200 with interest was still owing at the date of the receiving order, and the creditor had proved as being unsecured for the amount. In April, 1918, debtor removed to his present address, where he traded until January, 1920, when he took a partner, who provided £500 capital. Debtor stated that at this time his own capital consisted of stock and business effects valued at £2,000. The partnership lasted until May, 1920, when the partner retired. In order to repay the balance of capital to the outgoing partner the debtor obtained a loan of £540, for which he gave a promissory note for £600, payable in 12 months. He stated that he had since repaid about £170. Debtor became aware of his position in July, 1920, but continued in the hope that the business would improve. At the time of the receiving order two creditors had obtained judgment against him for £480, and three were suing him. The creditors decided to appoint Mr. F. T. P. Deyes, C.A., of 51, North John Street, Liverpool, as trustee of the estate. The following are creditors:—

	£		£
J. A. Gamble	650	H. Stowell	220
Howard & Appleton	13	Watkinson	25
E. Craven	15	Boardsall & Co., Ltd.	12
Hall & Hall	16		

J. JONES and J. R. JONES (Jones & Son), electrical engineers, 7, Chapel Street, Penzance.—First and final dividend of 9s. in the £, payable November 8th at the trustee's (Mr. W. C. Pezzack) office, Public Buildings, Penzance.

J. JONES (separate estate), electrical engineer, carrying on business in co-partnership with J. R. Jones (J. Jones & Son) at 7, Chapel Street, Penzance.—First and final dividend of 2s. in the £ payable November 8th at the trustee's (Mr. W. C. Pezzack) office, Public Buildings, Penzance.

E. S. ELAM and J. WALTON (Elam, Walton & Co.), electricians, Kingston-upon-Hull.—Trustee (Mr. G. H. Acheson, O.R., York City Bank Chambers, Hull) released October 17th.

F. J. MARTLAND (F. Martland & Co.), electrical engineer, Albion Yard, Millgate, Wigan.—Receiving order made October 25th on debtor's own petition.

J. V. BELL, electrical engineer, 21, North Bar Within, Beverley, Yorks.—First and final dividend of 6s. in the £, payable at Victoria Chambers, Bowalley Lane, Hull.

F. A. S. WORMMULL (Lewisham Electric Wiring Co.), electrical engineer, 273, High Street, Lewisham, S.E.—Receiving order made October 26th on debtor's own petition. First meeting, November 8th, at 29, Russell Square, W.C. Public examination, November 15th, at the Court House, Greenwich, S.E.

F. J. MARTLAND (F. Martland & Co.), electrical engineer, Albion Yard, Millgate, Wigan.—First meeting, November 8th at the Official Receiver's Offices, Liverpool. Public examination, November 15th, at the Court House, Wigan.

Reduction of Capital.—COMPANIA DE ELECTRICIDAD DE LA PROVINCIA DE BUENOS AIRES, LTD.—A petition for confirming the proposed reduction of the capital of the company from £825,000 to £562,500 is to be heard by the High Court on November 15th.

Company Liquidations.—PHONOPHONE CONSTRUCTION CO., LTD.—Winding up voluntarily. Liquidator: Mr. T. Jones, Broad Street House, New Broad Street, E.C. Meeting of creditors was called for November 3rd.

TELEPHONE MANUFACTURING CO., LTD.—Meeting November 24th, at 2 and 3, Norfolk Street, W.C. 2, to hear an account of the winding up from the liquidator, Mr. C. W. Rooke.

GILFORD ELECTRICITY SUPPLY CO., LTD.—Winding up voluntarily. Liquidator: Mr. B. D. Holroyd, 6, Great Winchester Street, E.C.2.

MERSEY ELECTRICAL ENGINEERING CO., LTD.—Meeting of members called for November 30th at 24, North John Street, Liverpool, to hear an account of the winding up from the liquidator, Mr. T. L. Hamner.

NEW PROCESS ELECTRICAL LAMP CO., LTD.—Winding up voluntarily. Liquidator: Mr. W. S. Deyes, 10, Cock Street, Liverpool. Meeting of creditors, November 11th.

Dissolutions of Partnership.—PENGILLY & BURGESS, electrical engineers, 6, Ormonde Buildings, Station Road, Epsom.—Messrs. H. W. Pengilly and G. F. Burgess have dissolved partnership.

ELECTRIC BLOCK CO., electric block makers, Gaol Lane, Halifax.—Mr. S. Fowler, Mr. A. Hoyle, and Mr. F. E. Crowther have dissolved partnership. Mr. Crowther will attend to debts.

BRAYNE & THOMAS, electrical engineers, 106, Walm Lane, Cricklewood.—Mr. G. E. Thomas and D. H. Brayne have dissolved partnership. Mr. Brayne will attend to debts and continue the business.

Trade Announcements.—The registered office of the ENGLISH ELECTRIC & SIEMENS SUPPLIES, LTD., has been transferred to the company's city premises, 38 and 39, Upper Thames Street, E.C. 4. All communications should be sent there.

MR. E. PICKBROW (The G. & P. Electrical Co., electrical factors and importers), 29, Heathcote Street, Nottingham, wishes to receive catalogues and price lists.

The lease of their premises having expired, MESSRS. ALBERT C. HANDS & SONS have removed their offices and showrooms to 57, Shoe Lane, Charterhouse Street, London, E.C. 1. Telephone No.: Holborn 215.

MESSRS. WARREN BROS. (J. W. F. Warren and S. N. Warren, founders of Warren, Beattie & Co., Ltd.) have started in business as electrical engineers and manufacturers' agents at Prudential Chambers, Middlesbrough. The principal manufacturers whom they will represent will be the Ateliers de Constructions Electriques de Charleroi. They will also carry large stocks of wires, cables, and motors.

THE GORWALL TRADING CO., of 40, Shaftesbury Avenue, London, W. 1, are the sole agents in the British Empire of Messrs. Kieserling & Albrecht, for all kinds of metal-working machinery.

MESSRS. MEDWAY'S SAFETY LIFT CO., LTD., of London, have just opened a new branch office at 131, Oxford Road, All Saints, Manchester (telephone No.: Central 1764), with a special staff of skilled engineers.

Catalogues and Lists.—THE "COVENTRY" CHAIN CO., LTD., Spon End Works, Coventry.—An illustrated pamphlet describing "The Coventry" chain coupling.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—A well-illustrated and priced booklet dealing with "Plexsim" fires, including a "projector" bowl fire. Also a showcard dealing with the latter.

MESSRS. HUGGS BROS., Sand Pits, Birmingham.—"Monthly Magazine" for November, containing the usual features and including particulars of solid and stranded copper conductors—B.E.S.A. specification.

THE BROMPTON & KENSINGTON ACCESSORIES CO., LTD., 254-260, Earl's Court Road, S.W.—An illustrated catalogue of electrical cooking and heating apparatus, including ovens, urns, hot plates, fish fryers, &c. Also a booklet of testimonials from clients.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, E.C. 2.—List W.O. 1, an illustrated pamphlet giving particulars and prices of 500-V switch fuses for currents up to 500 A. and of porcelain handles fitted with quick-break links.

ELECTRIC FIRES, LTD., King Street, Norwich.—A well-produced catalogue giving illustrations, details, and prices of various types of fires, heaters, boiling rings, grillers, &c.

THE BRITISH ALUMINIUM CO., LTD., 109, Queen Victoria Street, E.C. 4.—A post card for the use of inquirers for information regarding the various uses of aluminium.

MESSRS. RICH & BUNDY, 13, New Road, Ponders End, N.—An illustrated list of "Hot-Spot" heating and cooking appliances, including grills, immersion heaters, fires, &c. Fully priced.

THE COWPER-COLES MANUFACTURING CO., Sunbury-on-Thames.—A booklet and a pamphlet dealing with the preservation from corrosion of iron and steel by means of the "Sherardizing" process.

THE COWPER-COLES GALVANIZING CO., Sunbury-on-Thames.—A pamphlet describing the Cowper-Coles electro-galvanizing process.

THE ZENITH MANUFACTURING CO., Villiers Road, Willesden Green, N.W. 2.—A priced leaflet giving particulars of "Zenite" vitreous enamelled resistance units.

ENGINEERING & LIGHTING EQUIPMENT CO., LTD., Sphere Works, St. Albans.—An illustrated and priced list of ship, dock, mill, and colliery lighting fittings.

MESSRS. WARD & GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester.—An illustrated and priced pamphlet describing the "Vigil" watchman's lamp for projecting a long or wide beam.

MESSRS. CHARLES CHURCHILL & CO., LTD., 9-15, Leonard Street, Finsbury, E.C. 2.—An illustrated and priced catalogue of Norton grinding wheels of numerous types, diamond tools for truing grinding wheels, oilstones, and grinding machines.

BARIMAR, LTD., 10, Poland Street, Oxford Street, W.1.—A vest pocket booklet giving examples of the efficiency of the firm's welding system, with letters from clients.

SWITCHGEAR & COWANS, LTD., Elmsford Road, Old Trafford, Manchester.—Catalogue Section 3, illustrating numerous examples of mining type switchgear, with full descriptions and dimensions.

THE AORA CO., Loughborough, Leicestershire.—A priced and illustrated pamphlet of fires and warming plates, including the "Halo" bowl fire.

MR. S. UTTING, Grosvenor Mansions, 82, Victoria Street, S.W.1.—An illustrated publication dealing with "Thermix" air heaters and a pamphlet describing tests on one of these heaters applied to a small Belleville boiler.

The Engineers' Ballot Result.—The *Times* gives the detailed figures of the ballot vote of the engineering and shipbuilding trade unions which resulted in a majority of 22,000 in favour of the employers' proposal to withdraw the Ministry of Munitions bonus in three stages, starting November 1st.

"The figures show that the unskilled and semi-skilled workers represented by the National Federation of General Workers and the unions included in the Federation of Engineering and Shipbuilding Trades voted in favour of the reduction, while the Amalgamated Engineering Union was opposed to them. In the Federation of Engineering and Shipbuilding Trades the only large union giving an adverse vote was that of the boilermakers. The votes cast by the three main bodies were:—

	For.	Against.
General Workers' Federation ...	58,299	26,857
Amalgamated Engineering Union ...	48,976	66,682
Engineers and Shipbuilders ...	49,595	47,312

The total represents about 20 per cent. of those entitled to vote."

For Sale.—Leigh (Lancs.) Corporation Electricity Department has for sale a reversible booster set, consisting of a 30-h.p., 440-V, d.c. motor, direct coupled to two boosters.

Wolverhampton Corporation Electricity Department has for disposal a quantity of Venner street lighting time switches.

Leek Urban District Council has for disposal two Andrews 100-h.p. horizontal gas engines direct coupled to two 20-kw d.c. dynamos. (For full particulars see our advertisement pages to-day.)

Inquiries.—Impulse or Solenoid Operated Switch.—A correspondent seeks information as to the makers of an "impulse" or solenoid operated switch suitable for switching on motors up to 10 h.p. on a 200/400-volt, 50-cycle a.c. supply. The switch is to be controlled by push buttons some distance away. A contactor type switch is not desired owing to noise, the motors being used for organ blowing.

Electrically Heated Shaving Pot.—We are asked for the manufacturers of a porcelain electrically heated shaving pot of the immersion type, the heating element being fixed on the underside of the lid.

Ceiling Fan.—Makers of the "Export" ceiling fan are asked for.

Forthcoming Exhibitions.—The following exhibitions are being organised:—

LONDON.—November 17th to 25th, Public Works, Roads and Transport Exhibition; February 27th to March 10th, 1922, British Industries Fair; March 1st to 25th, 1922, Ideal Home Exhibition.

BIRMINGHAM.—February 27th to March 10th, 1922, British Industries Fair.

CARDIFF.—May to October, 1922, Welsh National Exhibition.

BELGIUM (Brussels).—April 3rd to 19th, 1922, Commercial Fair.

FRANCE (Lyons).—March 1st to 15th, 1922, Spring Fair.

HOLLAND (Amsterdam).—November 25th to December 26th, International Electrical Exhibition. (*Utrecht*).—February 21st to March 3rd, 1922, International Fair.

SPAIN (Barcelona).—March 15th to 25th, 1922, Samples Fair.

UNITED STATES (New York).—January 15th to 25th, 1922, General Merchandise Fair.

Rebate in Spanish Customs Duties on Machinery.—The Spanish Embassy announces that as a result of information put before the Ministry of Finance, a Royal Order, dated October 22nd, 1921, published in the *Gaceta de Madrid* of the following day, has been issued by the Spanish Government, by which the following concessions are granted:—

1. In view of the provisional character of the existing Customs duties and as an exception machinery, accessories, mechanical implements, and working tools contracted for previous to May 17th last will be considered exempt from the increased duties established by the Royal Order of May 17th last, provided the manufacturers can prove that such goods are destined to be applied or installed for their own industry. To these goods will be applied the tariff of 1911, with the subsequent modifications, including those established by the Royal Order of November 26th, 1920, up to the present date.

2. This privilege will be applied as much to goods which are shown to have been imported since May 17th as to those which may be awaiting importation.

—*Reuter's Trade Service.*

Dockyard Discharges.—In consequence of the scarcity of work in the boilermaking and electrical engineering branches at Sheerness Dockyard, it has been necessary to issue notices for the discharge of a number of boilermakers and electrical fitters.—*Morning Post.*

Book Notices.—"Lloyds' Register of Shipping. Report of the Society's Operations during the year 1920-21." London: Lloyds' Register of Shipping.—This report contains details of shipping classified during the year, &c.

"The Geology and Mineral Resources of the Serb-Croat-Slovene State," by D. A. Wray, B.Sc., F.G.S. (107 pp. with maps and diagrams.) London: H.M. Stationery Office (F.E. 383). Price 3s. 6d. net.—This is the report of the geologist attached to the British Economic Mission to Serbia. The coal and iron ore resources are exhaustively dealt with, and notes on the state of the workings are included.

"Absolute Measurements in Electricity and Magnetism," by A. Gray. Second edition, pp. xix+831; 260 figs. London: Macmillan & Co., Ltd. Price 42s. net.

"Elektrische Fördermaschinen," by Prof. W. Philipp. Leipzig: S. Hirzel.

"Radiations from Slow-Radium," by John B. Kramer, with a note on their therapeutic value, by John Hall-Edwards. Pp. 105; 53 figs. London: Baillière, Tindall & Cox. Price 12s. 6d. net.

"The English Electric Journal," Vol. I, No. 7, July-October, 1921. London: The English Electric Co., Ltd. Price 1s. net.—This number contains "Reflections on Unemployment," "Mechanical Advantages of Electric Locomotives compared with Steam," by Sir Vincent Raven, K.B.E., a description of a motor installation in a large textile factory, by J. S. Randles, A.M.I.E.E., and other interesting articles.

"Questions and Solutions in Magnetism and Electricity," by W. J. White. Pp. 108. London: S. Rentell & Co., Ltd. Price 2s. 6d. net.

We have received the first number of "Electrical Wonders of the World," by F. A. Talbot, a new serial publication published by Cassell & Co., Ltd., to be completed in 24 fortnightly parts at 1s. each net.

The Swiss Oerlikon Engineering Works.—The accounts of the Maschinenfabrik Oerlikon, for 1920-21, show net profits of 1,801,000 fr., as compared with 2,386,000 fr. in the previous year. The investment account has risen from 513,000 fr. in 1919-20 to 1,555,000 fr. last year, the increase being in connection with the company's participation in an English company which took over the Swiss company's sales bureau in London.

Advance in German Prices.—The Berlin *Osram Co.*, on October 21st, issued a notice intimating that the war-time surcharge of 250 per cent. on the list prices would be increased to 300 per cent. as from October 20th, in consequence of the constant rises in wages and raw materials. Orders on the books at that date will be executed in accordance with contract conditions at the surcharge of 200 per cent. until November 30th, but those not carried out by then will be subject to the additional 50 per cent.

The Foreign Trade Department for electrical manufactures announces that in accordance with the change in circumstances, electric heating and cooking appliances can now only be sold in foreign currency to countries having a high exchange, and export permits will only be granted to firms who comply with this condition. The export prices for galvanic batteries and elements, as well as for other electrical articles, have been substantially increased.

Consolidation of Interests in Saxony.—It is proposed to consolidate various companies in Saxony, in which the State of Saxony holds a dominating interest through its shareholding in the Elektra Co., of Dresden. The Zwickau Electricity and Tramway Co., the Vogtland Electricity Works Co., of Bergen, and the Erzgebirg-Vogtland Tramway and Electricity Co., of Annaberg, which are subsidiaries of the Elektra Co., are to be amalgamated by the Zwickau Co. absorbing the two other concerns and assuming the title of the West Saxony Power Works. The transaction will involve a large increase in the share capital of the absorbing company, and part of the augmentation will be taken over by the Elektra Co. and the State of Saxony. In addition, an increase in the share capital of the Electricity Works Operating Co., of Riesa, is to be made, a portion of which will also be subscribed by the Elektra Co., which in turn is raising its capital from 10 to 25 millions of marks for the purpose of completing the transactions in question.

Wanton Lamp Breaking.—Two boys were ordered to pay 5s. each at Bridgend for breaking electric lamps by throwing stones at them. Mr. A. Adams, secretary of the Ogmere Valley Electric Light Co., stated that a great deal of similar damage had been done recently, the company having to replace 50 lamps within three months.

Unemployed Engineering Workers in Switzerland.—Unemployed on September 30th numbered 136,067, of whom 33,000 were in the watchmaking trade and 29,000 in engineering.—*The Times.*

Kohler Lighting Set.—CORRECTION.—With reference to the description of the above-named automatic electric lighting set in our last issue, some confusion may arise out of our reference to Mr. C. H. Cook as the firm's London representative. We understand that Mr. Cook is the service engineer and that Mr. Washington B. Clarke is the firm's London manager.

Board of Trade Committees.—We extract the following particulars and addresses (revised up to date) from the *Board of Trade Journal*.

Committee	Secretary	Headquarters
Advisory Committee for the Coasting and Agency Duties and the Department for the Administration of Customs and Revenue Properties.	A. H. Hannas	Cornwall House, Stamford Street, S.E. 1.
British Industries Fair (Exhibitors' Advisory Committee).	J. A. Stirling	2, Queen Anne's Gate Buildings, S.W. 1.
British Industries Fair Joint Consultative Committee, London and Birmingham.	J. A. Stirling	2, Queen Anne's Gate Buildings, S.W. 1.
Electrical Communication with Light Houses Committee.	R. H. Haylett	Merc. Mar. Dept., Lake Buildings, St. James' Park, S.W. 1.
Metalliciferous Mining Industry, Advisory Committee to the	F. C. Starling	46, Victoria Street
Mining Lamps Committee	E. G. Fudge	46, Victoria Street
Mining Pumps Research Board	E. G. Fudge	49, Victoria Street
Overseas Trade Credits Advisory Committee.	A. C. Crutenden	73, Basinghall Street, E.C. 2.
Water Power Resources Committee	T. Turner	Gt. George Street

"Pyram" Lighting Fittings.—The Pyram Manufacturing Co. is showing a selection of "Pyram" lighting fittings in rooms at 63, Queen Victoria Street, E.C. 4. "Pyram" is a material similar to papier mache but lighter and stronger. The fittings consist principally of shade rings in old metal and wood finished, carried out in imitation of Grinling Gibbons carvings. Indirect lighting bowls are also on view, as well as electrolers and wall brackets. The reproductions are very true to the originals, and, of course, far cheaper. The ceiling fittings should find an application to lighting, in place of heavy suspended fittings, which often constitute a source of danger.

The Austrian Electrical Industry.—The *Economic Review*, quoting a recent statement by Dr. Heinrich Schneider, says that the dismemberment of the Austro-Hungarian Empire has had but small effect upon the makers of electric lamps, wires, switches, and installation apparatus. The Austrian firms retain a close connection with the Succession States, and their activity cannot be dispensed with; nor, in view of the exchange situation, can they be underbidden. The Austrian industry is therefore not compelled, as is even the German, to produce ever accumulating stocks, nor has any falling off tendency as yet been observed. This is partly due to the home requirements.

A further advantage recorded for the electrical industry is the repeal of the Electrical Economic Law which was so irksome to it. Henceforth, the Electricity Law will function in correspondence with the claims of the industry, and without placing upon it any undue burdens.

Trade with Canada.—Mr. Ben H. Morgan, chairman of the British Empire Producers' Organisation, who has recently returned from a visit to Canada, affirms that there is an immense field for the sale of British goods in Canada at the present moment. Last year Canadian imports from the United States amounted to \$600,000,000, the bulk of which Canadian buyers would have been glad to obtain from British sources. The chief reason that they were not so obtained is that British goods are not available in Canada as and when they are required and in small parcels. The Canadian buyer is able to regard the United States as a warehouse for his supplies from which he can obtain them in small quantities or large by means of a mail order or a telephone call with delivery in a few days at most. To combat this situation, manufacturers must carry stocks in Canada and, where necessary, obtain the assistance of the Government to finance them.

Electrical Wages in Australia.—Including an increase of 9 per cent. granted in September, the new wage rates in the Melbourne metropolitan district and Geelong are as follows:—

Electrical mechanics, linemen or wiremen, £5 8s. a week; battery erectors, £5 12s. 6d.; electrical erectors, £5 12s. 6d.; cable jointers, £5 16s. 6d.; cable jointers' assistants, £4 12s. 6d.; "all others," £4 9s. 6d. Apprentices and im-provers: 1st year, 11s. a week; 2nd year, 16s. 6d.; 3rd year, 30s. 6d.; 4th year, 41s.; 5th year, 54s. 6d.

Steam Accumulator Patents. It is reported, as was mentioned in our last issue, that as a result of negotiations carried on for some months past between the Swedish A.B. Vapor Accumulator and German interests, a company has been formed in Germany to work the storage patents of the former under the title of the Warmespeicher Doktor Ruths' G.m.b.H. The Swedish company holds 20 per cent. of the capital in the new company, the other parties interested being the A.E.G. representing the Rathenau group, the Deutsch-Luxemburg Mining and Ironworks Co., and the Siemens-Schuckert works for the Stinnes group, and the Augsburg-Nürnberg Maschinenbau Co., and the Gutehoffnungshütte for the Haniel group. The direct working of the patents is being organised by the four firms in question specially for the erection of Ruths' storage installations.

The Nation's Food Exhibition.—This exhibition, which is to be held at Olympia in September, 1922, is to in-

clude the display of apparatus used in the preparation of food, and it would appear that an opportunity is presented for manufacturers of electrical cooking appliances to further acquaint the public, and especially caterers, with their productions. The exhibition is being organised by the International Trade Exhibitions, Ltd., in conjunction with the Trades' Markets and Exhibitions, Ltd., and all communications should be addressed to Broad Street House, E.C. 2.

A Local Exhibition.—A local exhibition of electrical apparatus, principally domestic, at Epsom, comes to an end to-morrow after a ten days' run. This has been organised by the electrical engineer to the Urban District Council, and the whole of the work in connection with it has been carried out by members of the staff and their wives. A large number of well-known electrical firms are participating, and the result is a comprehensive display of domestic appliances, motors, cycle and motor-car lighting equipment, organ-blowing apparatus, lighting fittings, switchgear, &c. The electrical staff has made a number of heating and cooking tests, and so visitors are enabled to gain some idea of the performance of the appliances shown.

Engineering Discharges in Norway.—Mechanical workshops in Norway are reducing activity and discharging workmen. The situation is especially bad at Drøenheim.—*Reuter's Trade Service*, Stockholm, October 25th.

Profitable Employment.—An article containing some reflections on unemployment appears in the current number of the *English Electric Journal*. The writer dwells upon the importance of productive work being given the preference over doles and relief schemes as a means of providing employment, and proceeds:—

"It is not always realised what the loss to the nation through ordinary relief work is. Take a man earning £4 a week in an engineering shop and transferred through lack of employment to relief work at the same wage. His normal employer has a clear loss, in unabsorbed establishment charges, of £5 a week, on the moderate basis of establishment charges of 125 per cent. on labour. On relief work a good tradesman is inefficient and uninterested, and of the £4 a week which he is paid probably not more than £1 on the average has any permanent value. There is therefore a loss to the nation of £3 a week through this one man being turned adrift from his normal employment. An electric power station, on the other hand, or the electrification of a railway, absorbs an enormous amount of direct labour per £ expended, and it is an important addition to the wealth and the wealth-producing capacity of the country. An examination of an actual railway electrification scheme, which would cost £6,000,000 and could not fail to produce a very high return on the money spent, shows that when every allowance is made for certain imported materials, such as copper, £4,800,000 out of the total capital cost of six millions would be spent on direct labour in this country. Nearly all the great railway companies have schemes for electrification worked out or in contemplation, but it is unreasonable to expect that the large sums of money required can be raised unless the status of this new money in relation to the present capital of the railways is safeguarded. If the Government would trust the great industries of the country by facilitating the financing of such schemes, a large number of men could be found employment at their own trades, instead of being left to the slow demoralisation of the dole or useless relief work."

The £60,000 Claim against the Sydney City Council.—The Sydney City Council had before it in September, a report of the Electric Lighting Committee regarding the claim of the English Electric Co., Ltd., already referred to in these notes. The Committee reported with regard to the claim by the English Electric Co. of Australia, Ltd., for alleged non-fulfilment of the Council's undertaking to place with the company an order for a turbo alternator set, and in respect of which a writ has been issued against the Council claiming £60,000 damages, recommending that authority be given, with a view to a settlement, for the English Electric Co. of Australia, Ltd., to be asked (without prejudice) to submit a quotation for the supply of one 12,000-kW at .85 power factor, turbo alternator set complete, with exciter, condenser, air and circulating water pumps, wet air filter or air cooler, and everything necessary and usually supplied, the whole of the plant to be delivered, erected, and ready for commercial use by March 1st, 1924, provided that the City Council has the foundations ready to receive the plant.

French Bauxite.—Since October 23rd, 1920, an export duty of 20 per cent. of the value has been levied on any tonnage of bauxite sent out of France. As a consequence the production and the deliveries from the Bouches-du-Rhône have been reduced. The Union des Bauxites, which is said to be an English company, and the Société des Terres Refractaires de Provins, in which are Swiss interests, have this year lodged action protests against the maintenance of the duty. A French newspaper states that the question is whether the necessity for protecting the aluminium industry implies the duty of prohibiting or practically forbidding the export of silicious bauxites. Another report, however, now states that the duty has been abolished.

New Uses of Rubber.—The Rubber Growers' Association has issued a booklet giving the full results of its prize competition for ideas and suggestions for new and extended uses of rubber. The competition opened in July, 1920, and closed on December 31st, 1920, about 10,000 suggestions being sent in. The prizes were (1) £1,000; (2) three prizes of £500 each; (3) ten prizes of £100 each; (4) £1,500 divisible among the remaining competitors who submitted suggestions of value. The expert adjudicators have awarded the prizes to:—suggestions for the use of sponge rubber for upholstery purposes (80 competitors suggested this, and the £1,000 prize is divided between them); suggestions for incorporating rubber in liquid form with paint for preservation of wood and metals against the action of the sea (five successful competitors); suggestions for the use of rubber in paint for general decorative and preservative purposes (nine successful competitors); suggestions for the use of rubber for the valances and mudguards of motor vehicles (eight successful competitors); and so on.

While the competition has not produced any suggestions which would appear to afford an opportunity for the realisation of the aims of the Association, i.e., the exploitation of a new use which would be responsible for an immediate and marked increase in consumption, at the same time, it is felt that amongst these suggestions there must be some which, when submitted to expert technical investigation, may prove to contain substance for feasible development. The Association has decided therefore to submit all suggestions received to a panel of qualified technical men of established repute in the industry who will carefully consider the ideas. These suggestions will duly be brought before the rubber manufacturers in a series of pamphlets.

Hadfields' Australian Company.—In September there was registered in Australia a company under the title Hadfields (Australia), Ltd., with a capital of £500,000 in £1 shares, to acquire as a going concern the business, assets, and undertaking of the company registered under the name of the Australian Electric Steel, Ltd., to carry into effect an agreement with Hadfields, Ltd., Sheffield; and to carry on the business in Australia of ironmasters, steel makers, colliery proprietors, &c.

New Steamship Service to Australia.—Steamship communication with Australia is receiving an active fillip by the inauguration of a new service of five big fast vessels specially built for the Commonwealth Government Line. Omitting Mediterranean ports, they will accomplish the voyage in at least three or four days less than other lines to Australia, including mail service lines. Improved regular speedy communication between England, Ceylon and Australia will be welcomed, both by traders and by the travelling public. The *Moreton Bay*, the pioneer of the new line, is timed to leave London on December 7th, and the other ships of the "Bay" class will follow her at four-weekly intervals. They will proceed direct from London to Port Said, thence to Colombo and Australia, calling in turn at Fremantle, Adelaide, Melbourne, Sydney and Brisbane, the terminal port.

Electrical Displays in Large Stores.—A visit to several of London's large departmental stores shows that these establishments realise that, if they wish to completely fill the rôle of "Universal providers," they must not neglect domestic electrical apparatus. Electrical showrooms are therefore destined to take a large place in these huge shopping centres.

Messrs. Harrod's probably have the best of these electrical displays, having devoted a good deal of floor space to the exhibition of every item in the present wide range of domestic appliances. On the first floor, in the Linen Department, some of the larger machines are demonstrated for the benefit of visitors. Here may be seen a Western Electric dishwasher, which when closed in at the top may be used as a spare table. To enable its operations to be examined, a glass top has been fitted, and prospective buyers may see for themselves how the machine works. The action of this appliance is to force water at high speed over dishes, placed in two wire racks, by means of a revolving blade. Other Western Electric productions shown are a washing machine, an ironer, a vacuum cleaner, and sewing machines. A large display of "Universal" and "Hotpoint" kettles, irons, grills, coffee percolators, &c., is also present. Six "Magical" fires are placed in an alcove at the back of the display. On a floor above there is another large selection of electrical apparatus. Suspended from the ceiling and arranged on tables are all kinds of lighting fittings, plain and artistic, including bowls, silk shades, table lamps, floor standards, &c. "Thor" and "Elen" washers are shown in operation, and among a large collection of other things are Benham electro-vapour heaters, "Magnet" fires, "Eureka" vacuum cleaners, &c. Some cooking apparatus is shown, but not very prominently. To aid the customer who cannot afford to spend forty or fifty pounds at once, Messrs. Harrod's have instituted a hire-purchase system by which the larger machines can be more conveniently acquired. This is an absolute necessity, and is to be commended.

The General Electric Co., Ltd., has invaded Messrs. Wm. Whiteley & Co.'s large stores and arranged a comprehensive display of appliances for the firm. Nearly all of the well-known "Magnet" productions are represented. One small

2,200-watt oven shown has a hotplate let into the top with two 700-watt elements. The main cooking element is in the bottom. Other exhibits are bowl fires, ornamental fires, grills, irons, blowers, cigar lighters, &c. A new piece of electrical furniture is exhibited for the first time. This is an oak cabinet having an aluminium-covered platform which can be let down on four guides into the cabinet. Upon this table are arranged a three-heat grill and two plugs for putting a toaster and a kettle or other appliances into circuit. The cabinet is on wheels, permitting it to be easily moved from room to room. A "Time Saver" washing machine is running. This is a "dolly" type machine, with a wooden container and simple gears, which, it is explained, can be run from a lampholder. (This, by the way, should not be encouraged!). Lighting fittings are also shown as well as examples of neon lamps and "Atrax" projectors.

Messrs. Selfridge's show is cramped into a rather small space, and the appliances are therefore not seen to the best advantage. Nevertheless, the display is fairly comprehensive so far as the smaller appliances are concerned. "Qead" and "Cosmos" fires, "Hoover" vacuum cleaners, toasters, grills, saucepans, &c., occupy most of the space. A special line of lighting fittings is shown. This consists of painted vases with lampholders fixed in the top. Numerous other lighting fittings are suspended from the ceiling, and torches, pocket lamps, and small batteries are shown in profusion.

We hope that the exhibition at Harrod's will be made a permanency, and that the other large stores will come into line with it.

New Belgian Companies.—There has been formed at Brussels (13 Rue Brederode) the Société Nationale Radio-Electrique for commercial, industrial or financial operations connected with telegraphy and telephony. Capital, 500,000 fr.

At Sarrebruck has been embodied the Elektro-Werke Sarrebruck, with a capital of 2,250,000 marks.

New Italian Companies.—The Società anonima Fiumana per Radio Comunicazioni has been formed at Fiume for the construction of wireless stations. Signor Guglielmo Marconi is the president.

At Milan has been established the Società anonima Siemens with a capital of 2,500,000 lire. Of the six directors, half are Germans.

The Consorzio per l'Elettrotrazione has been constituted at Turin, the greater part of the capital being put up by the F.I.A.T.

New French Companies.—Under the style of Boiteux et Bucquoi has been formed at Paris (326 Rue des Pyrénées) a company to work the goodwill of a business for the manufacture and sale of all kinds of electrical appliances and apparatus. The capital is 170,000 fr.

The Scierie Hydro-Electrique du Val Vernier is a newly formed saw-milling company, which proposes to utilise a waterfall on the Upper Marne for the generation of electricity for the purposes of its business, which also includes the drying of timber by a special method. Its capital is 2,000,000 fr., and its offices are at 12 Rue Castex, Paris.

Berthon et Touzot, Société d'Installations et Constructions Electriques et Mécaniques is a company recently formed at Boulogne-sur-Seine (Rue d'Aguesseau 40), with a capital of 100,000 fr.

Under the title of the Secteur Electrique de la Vallée d'Anga, a company has been formed at Orbec (Calvados) with a capital of 750,000 fr. for the generation and distribution of electricity.

‘LIGHTING AND POWER NOTES.

Adwick-le-Street (Yorkshire).—ELECTRICITY SUPPLY.—The Urban District Council has decided to take steps to secure a supply of electricity for public and private lighting, and application has been made for the necessary Order. An electrical engineer is to be engaged to prepare a scheme. It is probable that the electricity will be supplied from one of the neighbouring collieries.

Bedford.—EXTENSIONS OPENED.—On October 29th a new Parsons turbine coupled to a single-phase alternator was put into commission.

Belfast.—LOAN.—Application has been made to the Electricity Commissioners for sanction to the borrowing of £550,000 for the establishment of a sub-station in Ballymacarrett district and extensions of existing feeders, and £52,000 for service mains, meters, &c.

Bradford-on-Avon.—ELECTRICITY SUPPLY.—Owing to the Ministry of Transport having decided to revoke the electric lighting order granted in 1914 to Mr. J. H. Edwards, the Urban Council has appointed a committee to consider the question of a supply of electricity for the town.

Brighton and Hove.—ELECTRICITY IN BULK.—The laying of new cables and the installation of new plant to enable the Hove electricity undertaking to obtain electricity in bulk from Brighton Corporation's station at Southwick have been completed.

LOAN SANCTIONED.—The Electricity Commissioners have given sanction to the borrowing of £1,224, for 20 years, for switchgear, &c., in connection with the supply of electricity to Hove.

Chester.—**SUPPLY IN BULK.**—A conference has taken place between the representatives of the Chester Corporation, the Hoole Urban District Council, and the Chester and Tarvin Rural Councils regarding the supply of electricity in bulk to the urban and rural districts. The Town Clerk of Chester has been in communication with the Electricity Commissioners with regard to the formation of a joint committee for the district, and the Commissioners have expressed the view that a scheme of the kind suggested appears to be cumbersome and complex. They suggest that it would be more expeditious for the Chester Corporation to obtain a special order to extend its supply area. After discussion, it was agreed that the representatives of each authority should obtain the views of their Councils, and in the meantime the Chester Corporation should take the preliminary steps towards obtaining a special order.

Colwyn Bay.—**LOAN.**—The Council is borrowing £42,500 for electricity extensions.

Centinital.—**BELGIUM.**—It has been decided to establish a new station at Ghent, at an estimated cost of about 13,000,000 francs.

The installation of electric lighting in the commune of Exaerde, Eastern Flanders, is under consideration.

The Provincial Council of Luxembourg has devoted a session to the consideration of the question of the electrification of the province, with the result that an advance of 1,400,000 fr. at 4 per cent. has been sanctioned for the installation of two distributing networks for light and power in the Arthus-Arlon-Virton and the Bouillon-Bertrix-Palisseul-Neufchâteau districts respectively. Use will be made of energy supplied from blast-furnaces at Holanzy to meet immediate demands. The partial use of the plants left by the Germans is proposed. The general electrification of the province will be undertaken shortly.

CZECHO-SLOVAKIA.—With the financial co-operation of the Czecho-Slovak Government, the Western Slovak Electrification Co. has been founded with a capital of 8 million kronen, which is to be increased to 16 millions in the course of the next three years. The first object of the new company is the electrification of the Bratislava (Pressburg) district.—*Reuter's Trade Service* (Prague).

The *Journée Industrielle* learns from Prague that the Ministry of Public Works is about to establish at the Hedwig pits in the coal district of Most (Bruew) large electric works which will furnish power to Prague and Central Bohemia. The cost is estimated at 150 million crowns.—*Reuter's Trade Service* (Paris).

UPPER SILESIA.—The decision of the Council of the League of Nations, regarding the division of Upper Silesia as between Germany and Poland, stipulates that where the whole of a water, electrical, or other system is not included in one of the divisions, this system shall be maintained as before except in the case of a special agreement between the two parties.

NORWAY.—As in Switzerland, the abnormally dry year has caused a serious shortage of water, and many hydro-electric works have been compelled to suspend operations.

SICILY.—A message from Rome says that the Technical Commission for Unemployment has approved the urgent execution of works in connection with the exploitation of the River Simeto, in Sicily, for the production of electric power. The Consiglio Superiore delle Acque has authorised a concession for this purpose, and it has also authorised a provisional commencement of the works as soon as the agreement is signed without waiting for the settlement of details. The scheme provides for the formation of an artificial lake at Valle di Aderno capable of storing a hundred million cb.m. of water. The total expenditure, exclusive of work in connection with bringing land into cultivation, is estimated at 60 million lire. The power to be utilised is calculated at 14,000 h.p., while 35,000 hectares of land will be irrigated and cultivated.—*Reuter's Trade Service* (Milan).

Deal.—**LIGHTING ORDER ABANDONED.**—The Deal & Walmer Gas and Electricity Co. has informed the Town Council that owing to the altered financial condition since the powers were obtained, and the high prices now ruling for machinery, &c., it has decided not to carry out its powers under the Electric Lighting Order.

Electricity District.—**MID-LANCASHIRE.**—The Electricity Commissioners give notice that they have for the fourth time extended the time within which objections or representations may be made or schemes submitted in connection with the above-named area, from October 31st, 1921, to March 31st, 1922.

Fermoy.—**ELECTRICITY SCHEME.**—A deputation from the Co-operative Society explained the proposals for an electricity scheme to the Council recently. The total expenditure was given as £9,000, and the Council was asked to use its influence to obtain subscribers to the scheme. It was stated that the charge would depend upon the consumption of electricity. For an output of 40,000 kWh, 1s. per kWh would be charged, whereas if 200,000 kWh could be sold, the price would be about 4d. A special meeting of the Council is to be held to consider the proposals.

Greenock.—**ELECTRICITY SCHEME.**—An experiment on the utilisation of waste steam for the generation of electricity has

been agreed upon by Greenock Corporation. The generating plant, which will be of 1,500 kW capacity, is to be set up in the Glebe Sugar Refinery, and will remain the property of the Corporation. The steam is to be supplied by the Refinery, which will secure all power and lighting requirements free of charge. The surplus, estimated at about 900 kW, will be given to the Corporation. The experiment is expected to reduce costs both at the Refinery and at the Corporation Electricity Department.

Hemsworth.—**ELECTRICITY SUPPLY.**—The Urban Council has decided to ask the Yorkshire Electric Power Co., Ltd., for terms upon which it would supply electricity to the district.

Hurst.—**ELECTRICITY SUPPLY.**—The Council proposes to apply for a Special Order for the supply of electricity in the district, and afterwards to transfer it to the Ashton-under-Lyne Town Council, provided the latter body agrees to pay all costs.

Holworthy.—**SEMI-PUBLIC LIGHTING.**—A novel lighting scheme has been instituted by the Holworthy (Devon) Urban Council. The tender of the local gas suppliers for public lighting being considered too high, the Council has asked householders who possess outside electric lamps to switch them on at night during the winter months, and the expense will be re-imbursed to them at the end of the season.

Luddendenfoot (Yorkshire).—**ELECTRICITY SUPPLY.**—The public electric lighting in Luddendenfoot, supplied by the Yorkshire Electric Power Co., under agreement with the local District Council, has commenced. Arrangements for electric lighting in the Boulderclough district have also been completed, and other outer districts of the Council's area will be lighted as fast as the cable-laying, &c., is completed. The whole scheme is on the time-switch system.

Littleborough.—**LOAN SANCTIONED.**—The Electricity Commissioners have sanctioned the borrowing of £8,500 for electricity purposes in respect of the £9,000 applied for, pending receipt of particulars as to the approximate cost of the work.

London.—**POPULAR.**—The Electricity Committee seeks approval for a proposal to expedite the laying of electricity mains in streets in the borough not at present supplied, in order to provide employment under the Government scheme for the unemployed. It reports that the Council authorised this extension in July, 1920, by a gradual process spread over a period of ten years. The proposal would involve a cost of £70,053, of which £33,715 would be paid for labour. The committee also proposes to submit a scheme for the conversion to electric lighting of public gas lamps at an estimated cost of £5,000, as a non-revenue producing scheme, ranking for grants of 65 per cent. of the interest and instalments for one-half the loan period.—*Daily Telegraph*.

The revenue shows a reduction of £24,000 on the previous, which is attributed to the loss on coal.

BETHNAL GREEN.—On October 31st a new transformer substation was declared open by the Mayor (Councillor J. J. Vaughan). The building, originally a chapel, is situated at the Oval, Hackney Road, and houses, at present, two transformers, one of 250 kVA and the other of 500 kVA capacity; the station is ultimately to deal with 3,000 kVA, although there will still be ample space. Energy is brought in bulk from Stepney at a pressure of 6,000 V, and is stepped down to 415 V. It is distributed at this voltage for power; lighting is taken off one phase and a balancing wire giving 240 V. The switchgear consists of two high-pressure panels and inter-connecting panel with switches of the cubicle type. The distributing board is in seven sections. The switchgear was supplied by the Metropolitan-Vickers Electrical Co., Ltd. The transformers were manufactured by the Hackbridge Electrical Construction Co., Ltd., and the cables by the British Insulated and Helsby Cables, Ltd. The station is equipped with a 10-ton crane mounted on the roof girders. At the ceremony the chairman of the Electricity Committee (Councillor J. J. Cunningham) outlined the history of the Bethnal Green undertaking, and paid a tribute to Mr. H. H. Couzens, M.I.E.E., and members of the staff for their good work. The Mayor also gave recognition to their services, and said he hoped that soon meters would be abolished and electricity would be as plentiful as water.

BATTERSEA.—At the request of the E.T.U. and other trade unions the Electricity Committee recommends the carrying out of a number of works to relieve unemployment. These include extension and replacement of mains, and the wiring of buildings.

HAMMERSMITH.—The electrical engineer reports that the contractors supplying the first 10,000-kW turbo-alternator under the extension scheme will be in a position to deliver it in the early part of November.

FULHAM.—In response to the request of the N.J.I.C. for the cable making industry, mentioned in our "Notes" columns last week, the Electricity Committee recommends that application be made for sanction to the carrying out of cable extensions at a cost of £11,124; also that the Unemployment Grants Committee be asked to contribute to the cost.

The Electricity Committee has approved the laying of a duplicate linking-up main between the Fulham and Hammersmith undertakings. The cost is estimated at £7,500, and it has been agreed to pay a third of this, Battersea being associated with the linking-up scheme. The switchgear for the Fulham station will cost £1,000.

(Continued on page 605.)

ELECTRICITY SUPPLY AT SHEFFIELD.

The Blackburn Meadows Generating Station.

THE phenomenal growth in the demand for electricity in the City of Sheffield and the surrounding districts during the war period is familiar to our readers. The enormous increase in the capacity of the Corporation's electricity supply undertaking will be better realised when compared with its previous progress: The under-



FIG. 1.—EXTERIOR OF BLACKBURN MEADOWS STATION, SHEFFIELD, SHOWING COAL-HANDLING PLANT.

taking commenced to supply electricity in the city in May, 1892, with the result that in March, 1914, after 22 years' working, the total plant capacity had reached the figure of 23,225 kW. The upward curve representing the growth of the number of kWh generated at the

rangements had been made to augment the capacity of the undertaking to no less than 68,225 kW. During the four years 1914 to 1918 the maximum demand on the system grew from 12,519 to 58,909 kVA, the station load factor remaining practically constant at 40 per cent. during that period, and by 1920 the demand applied for had reached the figure of 164,500 kW, the plant installed had a capacity of nearly 69,000 kW, and the maximum load on the system had reached the total of nearly 61,000 kW.

At the outbreak of the war the Neepsend generating station site had been developed to the extent of approximately one-third of its ultimate capacity, but by April, 1916, the last of the contracts covering the extensions for the full development of the site, both as regards plant and buildings, had been placed, and nearly three years ago we described the undertaking as it then was.* But the city electricity supply undertaking under the able leadership of its general manager and engineer, Mr. S. E. Fedden, M.I.E.E., M.Inst.C.E., M.I.Mech.E., was far from being content to rest on

its laurels, and even then a new station, to be of no less than 100,000 kW capacity, was in contemplation. However, for future intentions we must await the result of the local inquiry which the Electricity Commissioners are to commence at Sheffield on the 29th inst., when the

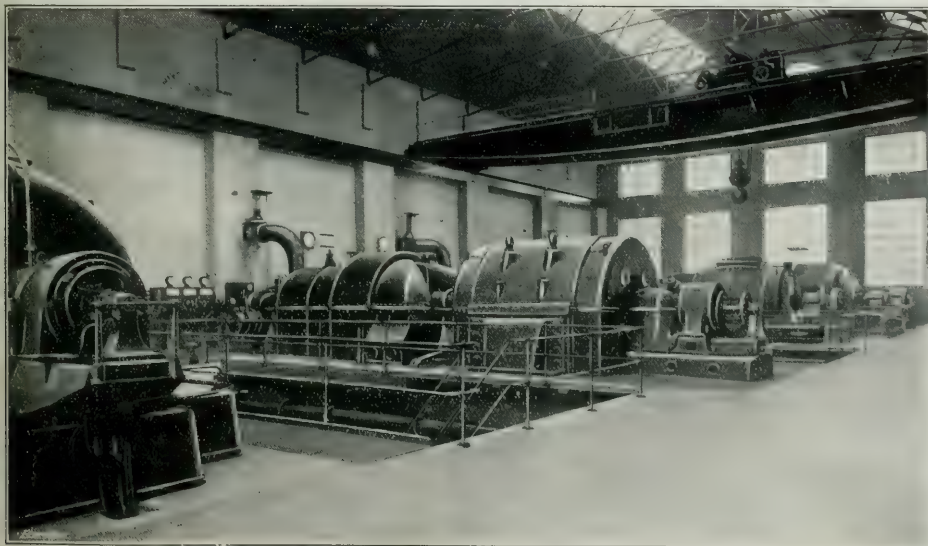


FIG. 2.—TURBINE ROOM.

Neepsend station became nearly a vertical line, and steps were taken to add to the plant installed in order to meet the general need for electric lighting and power in Sheffield. Then on top of the natural increase in the load was superimposed the imperative call for power in connection with the manufacture of munitions of war, and within a period of less than three years ar-

Corporation will outline its scheme for the reorganisation of the supply of electricity in the North-East Midlands Electricity District and for the formation of a Joint Electricity Authority for the area.

To return to the period under consideration, the

* ELECTRICAL REVIEW, January 3rd and 10th, 1919.

demand for electricity continued, and it soon became apparent that the additional plant would be insufficient to meet the ever-growing need for more power. Accordingly in the summer of 1916 the Electricity Supply Committee authorised a search for a suitable site for a new generating station to be made, and an area of approximately 27 acres adjoining the City of Sheffield for disposal works was finally decided upon in Octo-

rating plant which had been manufactured to the order of the Government for the Henbury Explosive Factory, and although the plant is not of the size and type that the Corporation would have ordered in normal circumstances, yet the Corporation considered itself fortunate in being able to acquire equipment that was in the final stages of completion and, moreover, at a price considerably below that at the time obtaining in the open market.

The splendidly situated site is level and surrounded on three sides by main-line railways, whilst the sidings of the Sewage Disposal Department were already in existence along one side. It abuts on the east side upon the river Don and the South Yorkshire Navigation Canal, which join at this point, and it will, therefore, be understood that the location of the site affords ample facilities for obtaining all the fuel and materials required—either by rail or canal—whilst the proximity of an abundant supply of water for condensing purposes is of importance.

Messrs. John Greenwood, of Mansfield, contracted for the building and civil engineering work, which was commenced in November, 1917, the actual erection of the buildings being started in January, 1918. The boiler house stands on the west side of the site, and takes the form for a double bay with reinforced concrete overhead coal bunkers along the centre. One of the special

features of the design of the boiler house is its spacious basement on the ground level which gives ample room for the men to work under healthy conditions, and may be utilised as a store for heavy materials. At each side of the top main concrete beam carrying the bunkers, which are capable of holding 1,200 tons of coal, a special system of ventilation has been introduced with the object of keeping cool the central portion of the boiler house

ber, 1916. The site is at the extreme eastern boundary of the city, and is situated close to many of the large local steel works. At this stage, however, an obstruction was met with in the form of a refusal of the Ministry of Munitions to permit the work to proceed, and the original proposals were, therefore, cancelled. This action of the Ministry resulted in a delay of 12 months, and consequently a start on the erection of the war emergency generating station was not made until November, 1917. The Blackburn Meadows station, as it is known, of which fig. 10 is a plan, is now almost complete: turbo-generating and boiler plant with a total capacity of 35,000 kVA has been installed, and the station was to be opened by H.R.H. the Duke of York this morning. Actually, however, a portion of the plant has been on load for the past 12 months; a large proportion of the energy generated is delivered to Sir R. Hadfield's adjacent works for power purposes and for consumption in electric furnaces. The station is interconnected with that at Neepsend, so that no night shift is worked at Blackburn Meadows at present. Incidentally, no smoke issues from the stacks while the boilers are on load. It should do so it is a sure sign that the furnaces have been loaded.

When the contracts were finally placed it was found that in addition to the delay in putting the work in hand other serious disadvantages had resulted from the action of the Ministry of Munitions—the situation was aggravated by the increased shortage of labour and by the substantial advances in rates of wages and cost of materials that had taken place between 1917 and the date of completion. In place of the original proposals the Electricity Committee bought the boilers and gene-

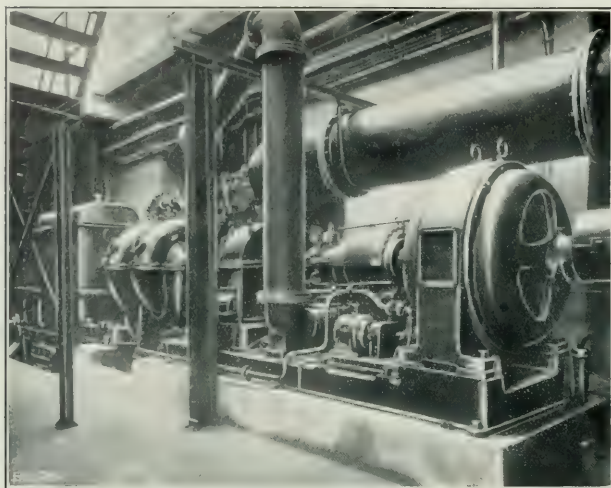


FIG. 3.—CONDENSER AND AUXILIARY GEAR.

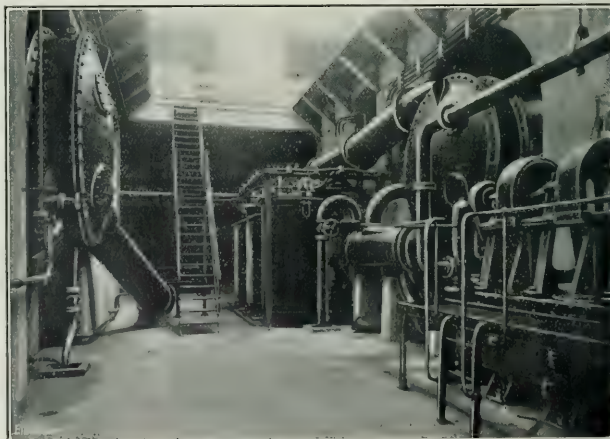


FIG. 1. CONDENSERS AND TRANSFORMERS.

in which the stokers work. The whole of the natural lighting of the boiler house is obtained from the roof.

There are approximately 12,000 tons of reinforced concrete in the main buildings; the use of this material was rendered necessary by the great shortage of steel that was experienced when the work was commenced, and the building of structures of this character being necessarily a slower process than the erection of standard

steelwork, combined with the shortage of labour, considerably delayed the completion of the building.

At the moment all the fuel used is transported by means of the railways, and the sidings originally laid down by the Sewage Disposal Department are employed



FIG. 5.—MAIN SWITCHBOARD.

to deliver it—at present. Two sets of rails are laid at right angles to the existing sidings and 12-ft. turntables are located at the junction of each set of rails with the sidings; electrically-driven Clarke, Chapman capstans are also provided by means of which the loaded wagons are hauled on the sidings. As will be seen from fig. 10, two coal tipplers are installed, one for each pair of rails, and each is capable of dealing with a fully loaded 10-ton wagon. They are of the usual circular revolving type, and each is fitted with a 2-h.p. motor for driving the screw clamping gear which retains the wagon in position while the tippler revolves. The revolving gear is driven by an 8-h.p. motor, and the coal is emptied into a pit from which it is raised by means of two bucket elevators—one for each tippler—to the overhead conveyor. Each elevator is capable of raising 40 tons of coal per hour, and is driven by a 15-h.p. motor. Upon reaching the head gear at the top of the elevator the coal is deposited on a conveyor that runs over the tops of the bunkers and extends the whole length of the boiler house. The conveyor is of the push-plate pattern, is capable of transporting 60 tons of coal per hour, and is driven through speed-

reducing gear by a 15-h.p. motor. Surface rollers in the base plate of the conveyor are provided with sliding doors so as to allow of the coal being deposited into the bunkers at any particular point required. From the overhead bunkers the coal is delivered by means of steel chutes, which are fitted with mixing vanes, into the stoker hoppers, thus automatically feeding the fuel to the boiler furnaces. The contractors for all the coal-handling plant, together with the railway sidings, were Messrs. R. White & Sons, of Widnes.

An interior view of the boiler house is presented by fig. 7; the firing floor is 12 ft. above the basement, and is supported by 180 reinforced concrete stanchions. The number of boilers installed is 14, but only six of them are in use at present; each is capable of evaporating 30,000 lb. of steam per hour from feed water at a temperature of 212 deg. F. to a pressure of 190 lb. per sq. in. Eleven of the boilers are of the 5-drum Stirling type, each of which contains 620 tubes with an outside diameter of 3.25 in., and has a heating surface of 8,282 sq. ft. and a grate area of 196 sq. ft. The boiler mountings and fittings were supplied by Messrs. Clarke, Chapman & Co., of Gateshead, and a superheater is fitted to each boiler comprising 96 tubes, of an outside diameter of 1.5 in., having a heating surface of 1,120 sq. ft., and capable of imparting a superheat of 200 deg. F. to all the steam generated. The three remaining boilers are of the Woodeson pattern, and each has 8,800 sq. ft. of heating surface, 196 sq. ft. of grate area, and contains 894 tubes, 2.5 in. outside diameter. They are also provided with Clarke-Chapman superheaters similar to those mentioned above. The total weight of each boiler when filled with water is 91 tons. The whole of the boiler mountings are of the Hopkinson type; a regulator is fitted to each boiler so as to ensure a constant feed of water into it and to maintain the water at practically the same standard level in the drums during the whole period that the boiler is in service.

A separate Green economiser is installed in the discharge flue of each boiler; it consists of 320 tubes 11 ft. 6 in. in length, and is fitted with the usual scrapers and reversing gear driven by 3-h.p. motors. The quantity of water supplied to each boiler is regis-

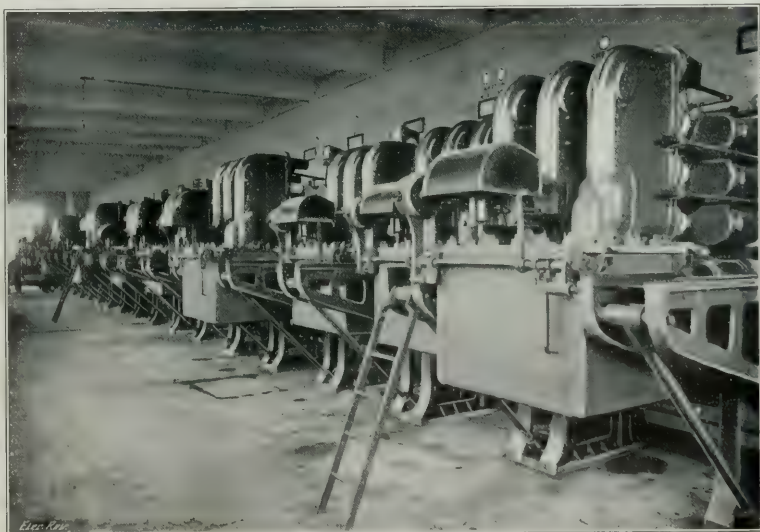


FIG. 6.—MAIN SWITCHROOM.

tered by a Venturi meter, and by this means the actual evaporation of each boiler can be separately ascertained.

The boiler feed pump house is situated on the firing floor level of the boiler house; it is divided into two sections, the first of which contains three six-stage cen-

trifugal pumps supplied by the British Electric Plant Co., of Alloa (fig. 11). Each pump will deliver 20,000 gallons of water per hour against a head of 555 ft., and is direct driven at a speed of 1,440 r.p.m. by a 100-h.p. motor. The second section contains three steam-driven direct-acting Weir cylinder pumps, each capable of pumping 17,000 gallons of water per hour against the boiler pressure of 190 lb. per sq. in. The



FIG. 7.—BOILER ROOM.

water supply is derived from a main tank that forms the roof of the pump house; it is passed through two Lea recorders and thence direct to the pump suction. By-pass pipes are also provided so that water can be drawn direct from the main tank in the event of its becoming necessary to take the recorders out of service. All the pumps discharge direct to the boiler feed mains. A special 5-cell centrifugal pump that is driven by a 30-h.p. motor is included in the pump house to provide the water that is required for boiler tube cleaning purposes, &c.; alternatively, this pump can be used as a



FIG. 8.—INDUCED-DRAGHT PUMP.

special fire pump in case of emergency. Between the pumps and the economisers 8-in. diameter steel mains with separate branches are provided in duplicate. A 9-in. town water service main enters the boiler house basement, and two meters are fitted at its junction with the town main, and two others at the point where the main enters the building. From the latter point a 6-in. ring main carries the water to the storage tank above

the pump house. From this main branches run over the coal bunkers and are provided with connections for fire hose and also for the domestic supplies of the various mess rooms. A ring main is also provided for the purpose of cleansing the boiler tubes, &c. The main water tank is divided into two sections, either of which can be cleaned out without interfering with the working of the plant; moreover, into it is returned all the water

that is drained from the boilers, turbines, and steam pipes, &c., thus helping to heat up the feed water. All the condensed steam from the turbines after being registered by Lea recorders is also pumped back into the main water tank. The pipework in the station was supplied by Messrs. Foster Bros. of Wednesbury, and is supported by slings or on rollers so that the pipes are free to expand in any direction. The solid-drawn 12-in. steel steam mains are arranged to balance the steam between each set of plant, so that under ordinary working conditions the flow of steam in the mains will be negligible.

The turbine room, of which fig. 2 is an interior view, is located on the east side of the boiler house, and is spanned by an overhead electric travelling crane made by Messrs. Herbert Morris, Ltd., of Loughborough. It is suitable for dealing with loads of up to 30 tons, but is

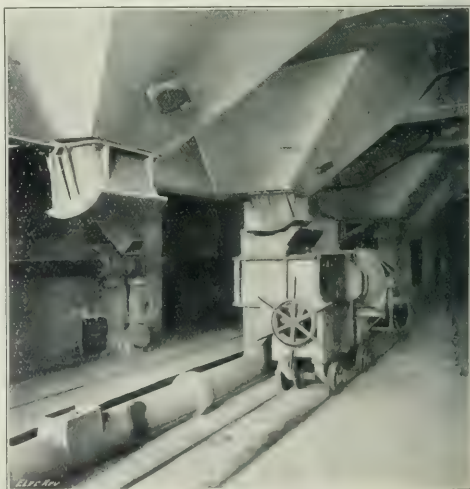


FIG. 9.—ASH CRUSHER

capable of lifting a dead weight load of 45 tons; it is provided with a 27-h.p. hoisting motor, an 18-h.p. main travel motor, and a 7-h.p. traversing motor. The crane spans 67 ft., travels about 140 ft., and is fitted with a safety device to prevent over-winding; it is controlled from a cab that is slung beneath the main crane girders.

(To be concluded.)

LIGHTING AND POWER NOTES.

(Continued from page 604.)

Lancaster.—PLANT PURCHASE RECOMMENDED.—The Electricity Committee recommends that the plant of the Caton Engineering Co. be bought from the Disposal and Liquidation Board for £6,000. It is estimated that it will cost £2,000 to remove it to the power station, where the plant is inadequate to meet the present needs of the town.

Maidstone.—YEAR'S WORKING.—The accounts of the Corporation's Electricity Department show a loss for the year ended March 31st last of £526.

Manchester.—LOAN SANCTIONED.—The Electricity Commissioners have sanctioned the borrowing of £50,000 for mains extensions.

Markinch (Fife).—WATER POWER SCHEME.—The Balgonie Colliery Co. is to utilise the water of the river Leven to generate electricity by water turbines.

Nayan.—ELECTRICITY SUPPLY.—The Urban Council has finally decided to take a public electric lighting supply at 1s. per unit from Messrs. Spicer, local merchants.

Newport.—CABLE IN RIVER BED.—The laying of a submarine cable linking the western side of the river Usk with the power station on the eastern side, thereby obviating a long length of cable through the streets of the town, has been completed. The new cables, which are laid in a trench eight feet below the river bed, are part of a scheme of extension on which a capital outlay of £200,000 is contemplated, one of the chief objects being to supply energy to the large new ironworks of Messrs. Whitehead, of Tredegar, which is now under process of completion. A long term contract has been entered into with Messrs. Whitehead, under which the firm will pay the Corporation a minimum of £8,000 and a maximum of £20,000 per annum.

New Zealand.—AUCKLAND.—An agreement has been arrived at between the City Council and the outside local bodies with regard to the formation of a single electric power board for the Auckland metropolitan area. The Council's electricity undertaking will be taken over by the Board at a price to be fixed later. The capital expenditure on the electricity works to June 30th last amounts to £506,749.—*Reuter's Trade Service* (Melbourne).

Ripon.—ELECTRICITY SUPPLY.—The Town Council has decided to ascertain from the War Disposal Board the purchase price of the electricity plant at the North Camp, and what facilities could be afforded to the Corporation in connection with it.

South Africa.—PROPOSED ORANGE RIVER DEVELOPMENT.—The *S.A. Mining & Engineering Journal* states that in his last annual report, the Inspector of Machinery for the Kimberley district speaks of the possibility of harnessing the power of the Orange River to assist in the development of the iron fields near Potmasburg. These iron fields are devoid of coal for their economical working, and the Augrabie and King George Falls are about 160 miles away. The falls mentioned are 400 ft. in height, and it is estimated that a power of from 8 to 10 thousand h.p. is available. The Inspector considers that a part of the power might be utilised in the electrification of the De Aar-Windhoek railway and any later branches.

Mossel Bay (CAPE PROVINCE).—A contract has been entered into between the South African Milling Co. at Beaufort and the Municipality for the supply to the company of all its power requirements from the Municipal Power Station. The contract provides for a minimum consumption of 100,000 units per annum.

JOHANNESBURG.—Owing to the inability of the Town Council to maintain adequate supplies of electricity to cope with the growth of the town and its industries, a demand has arisen that the town should obtain supplementary supplies from the Victoria Falls Power Co. The Labour Party in the Town Council is, however, opposing this demand, as it is considered that it would lose a powerful weapon in the event of an industrial dispute, were the power station to be closed down.

The dispute has been advanced a further stage by a recommendation by the Tramway and Lighting Committee to the Town Council that the Town Clerk be instructed to obtain full particulars of the terms on which the V.F.P. would give auxiliary supply during the period required for the improvement of the municipal supply. This represents a considerable advance, as the tendency on the Labour side of the Council has been apparently to fight against every suggestion of taking current from the V.F.P.—*Cape Argus*.

Spokenborough.—YEAR'S WORKING.—At the District Council meeting last week it was reported that the electricity undertaking had made a profit of £2,285 during the past financial year.

Swindon.—REDUCED CHARGES.—The Town Council has reduced the price of electricity for lighting from 8d. to 7d. per unit, for power from 4d. to 3½d., and for heating and cooking from 2d. to 1½d.

LOAN SANCTIONED.—The Corporation has received sanction to borrow £42,500 for electricity purposes.

Welshpool.—ELECTRICITY SUPPLY.—The Town Council has appointed a committee to investigate the possibilities of a municipal electricity undertaking.

TRAMWAY AND RAILWAY NOTES.

Blackburn.—TRAMWAY EXTENSIONS.—The town clerk has been instructed to take steps to include in the Bill being promoted in Parliament powers to extend the tramway system from Cherry Tree to Feniscowles, Billinge End to the borough boundary, and from Wilpshire to Langho.

Brighton.—LOAN SANCTIONED.—The Electricity Commissioners have given sanction to the borrowing of £20,000, for 15 years, for the reconstruction of certain sections of the tramways.

Continental.—BELGIUM.—Brussels tramwaymen have threatened to strike unless the company takes back six painters whom it has discharged because it had no more work for them to do.—*The Times*.

NORWAY.—The Commercial Secretary to H.M. Legation at Christiania states that the Norwegian Storting has granted a concession to A/S Akersbanerne for the construction of an electric railway from the centre of Christiania to Ostensjø, a distance of about 8 km. The work on this line will probably be commenced simultaneously with the construction of the Majorsteun-Sogsvandet Railway, a concession for which was granted recently.—*The Board of Trade Journal*.

Darlington.—RENEWAL OF TRACK ADJOURNED.—The Electricity and Light Railways Committee has adjourned consideration of the question of relaying the tramway track in view of the capital outlay which would be involved.

Edinburgh.—NEW TRUCKS.—The Tramway Department recommends the ordering of 51 single trucks suitable for the new electric car system. The trucks are to cost £250 each, and with equipment the sum involved is £70,000.

India.—CALCUTTA STRIKE.—Owing to a strike of the employees, the Calcutta tramway services are suspended.

Lancashire Railway Electrification.—The plans for the electrification of the Manchester-Oldham, Lytham-Blackpool, and Blackpool-Fleetwood Railways are now complete, and will be carried into effect at the first favourable opportunity.

London.—PROPOSED "UNDERGROUND" EXTENSIONS.—Further details regarding the ambitious scheme of the London "Underground" Companies were made public last week by Lord Ashfield. The extensions would entail an expenditure of £6,000,000, apportioned approximately as follows:—Reconstruction of the City & South London Railway, with an extension to link up that railway with the London Electric Railway at Camden Town, £4,100,000; extension of the Hampstead line from Golder's Green to Edgware, with intermediate stations at Woodstock, Hendon, Colindale, and Burnt Ash, £1,300,000; connecting loop between the Central London Railway and the London & South-Western Railway at Shepherd's Bush, enabling the former line to be projected to Kew and Richmond, £700,000.

It is estimated that employment would be given to 20,000 men for at least two years, and the Government is asked to guarantee securities and interest to lower the rate at which money will be obtained in the City. No actual financial assistance is required from the State.

HAMMERSMITH.—The Law and Parliamentary Committee recommends that representations should be made to the Ministry of Transport that the fares on the London United Tramways should be reduced.—*The Times*.

PROPOSED L.C.C. "TUBE."—At the meeting of the London County Council on November 1st, Mr. A. Emil Davies moved: "That in view of the Government scheme for guaranteeing capital to enable works of public utility to be put in hand that will lead to extensive employment, the Council make application to Parliament for the necessary executive powers with a view to applying under such scheme for the sum of five million pounds in order to carry out the construction of tube railways within the country, and especially such as will link up South London with other portions of the Metropolis."

Mr. Davies urged the necessity of greater transport facilities in South London, which was badly served in this respect. After some discussion the motion was defeated by 61 votes to 37.

Manchester.—LOAN SANCTIONED.—The Tramways Committee has received sanction to borrow £56,000 for the reconstruction of the tramway in Ashton Road, &c.

TRAMWAY EXTENSIONS.—The Corporation has commenced laying a double track of tramway lines between Denton and Hyde, a distance of two miles. When the work is completed there will be a through service between Manchester and Hyde.

New Zealand.—AUCKLAND.—The City Council and outside local bodies have come to an agreement, whereby a single electric power board has been formed to take over, among other interests, the tramway service. The tramway assets to June 30th last total £247,041.

Scarborough.—TRAMWAYS PURCHASE DECISION.—The Town Council, after careful consideration, has decided that the proposal to take over the undertaking of the Electric Tramways Co. cannot be entertained.

S. E. & C. Railway.—**PROMOTED ELECTRIFICATION.**—According to *Modern Transport*, the management of the South-Eastern and Chatham Railway has drawn up a comprehensive scheme for the electrification of the company's suburban lines, to be taken in hand as soon as conditions permit. The plans embrace the whole of the lines within a radius of 30 miles of Charing Cross, and for the purpose of electrifying in the first place lines having the heaviest traffic, the lines have been put into two groups. Section A has a route mileage of 94 and a single line mileage of 210, and includes the inner suburban lines. Section B covers 140 route miles, representing 438 miles of single track, and consists principally of extensions of the lines in Section A. The equipment of the running lines will be of the direct-current conductor-rail type. The rolling stock for suburban services will be of the motor car type with "multiple-unit" control, which, to ensure the greatest flexibility of service, will be permanently coupled up in units of three coaches, a unit consisting of two motor coaches each equipped with two 200-h.p. motors and one trailer coach. This arrangement will enable the committee to provide trains of three, six, or nine coaches, accommodating 256, 512, and 768 passengers respectively, in accordance with traffic demands.

Stoke-on-Trent.—**TRAMWAY PURCHASE.**—At a recent meeting of the Council a letter was read from the Potteries Electric Traction Co. asking the Council to defer its right to purchase the tramways until the year 1932. This the Council refused to do.

TELEGRAPH AND TELEPHONE NOTES.

Finland.—**WIRELESS TELEPHONY.**—The directors of Södra Finlands Interurbana Telefon A.B., of Helsingfors, have made application to the Finnish Ministry for Communications for the grant of a concession for the establishment of a system of radio-telegraphy between Finland and Sweden for general public use. According to the company's statement, it is proposed to form a separate company, in which the Finnish State would have the opportunity of being represented, for the execution of the scheme. A radio station would be erected in the vicinity of Helsingfors and would also be provided with apparatus for effecting a connection with the station of the Interurban Telephone Co. in Helsingfors, and the latter station would serve as the intermediary for all the telephone messages. The concession is asked for a period of 15 years with the exclusive right of establishing and maintaining telephone communication with Sweden, although it is suggested that the State, if deemed desirable, should be empowered to take over the undertaking at an earlier time or at the end of ten years. Should the State refuse to prolong the concession, the State would be placed under the obligation to purchase the company's property. If a concession can be obtained by the Interurban Telephone Co. in Finland and by the competent company (Radio) in Sweden, it is said that these countries will be the only ones which will possess, after England and Holland, a system of wireless telephony. The question has not yet been investigated by the telegraph authorities in Sweden, although it is said that cable connection is preferable to wireless telephony.

Italy.—**SUBMARINE CABLE DEVELOPMENTS.**—Signor Giufrida, Italian Minister of Posts and Telegraphs, speaking at the final meeting on October 21st of an electrical congress held at Catania, mentioned that a committee was engaged on the investigation of a scheme for the transmission of energy across the Straits of Messina to Sicily. As to his own particular department the Minister is reported to have stated that new telegraph cables would be laid between the Continent and Sicily, between Ravenna and Trieste and Genoa and Nice, and new lines of direct communication with the principal European centres were being examined. In addition, an agreement had recently been signed for the establishment of a direct submarine cable to Spain and to South America, and it was hoped to have another direct cable to the United States. Among the developments proposed in the telephone service, the Minister stated that the five networks in Turin, Genoa, Milan, Rome, and Naples were to be transformed to the automatic system, while Pupin coils would be used in connection with telephony from one end of Italy to the other.

Storm.—Bad storms raged last week in the south of Italy and both telephonic and telegraphic communication was severed, says *The Times*.

Turkestan. **TELEGRAMS IN CENTRAL ASIAN TONGUES.** The Postal Department of Turkestan has prepared a telegraphic Morse alphabet for telegrams in the Kirgiz and Uzbek languages. The results on trial were quite satisfactory. Telegrams in the local languages are already being exchanged between Old and New Tashkent.

Uruguay.—**NEW TRANSATLANTIC CABLE.**—The work of uniting Uruguay with Italy by cable will shortly be begun. This line will connect Rome, Spain, and Brazil with Monte Video, says the *Financial News*.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Australia.—**MELBOURNE.**—City Council. February 20th. One 2,000-kW rotary converter with transformer, also 6,600-V, 50-cycle, 3-phase switchgear.—*Reuter's Trade Service* (Melbourne).

NEWCASTLE (N.S.W.).—December 22nd. City Council. One 25-kW motor-generator set. Electrical engineer and manager, Watt Street, Newcastle (N.S.W.).

SYDNEY.—April 24th, 1922. City Council. One 10,000-kW turbo-alternator and two 2,000-kW rotary converters.—*Reuter's Trade Service* (Melbourne).

Argentina.—**BUENOS AIRES.**—January 19th, 1922. Board of Sanitary Works. Plant and accessories for a new generating station, comprising three four-cycle Diesel engines of 375 h.p., and three 3-phase alternators each of 250 kW, 2,200 V, 50 cycle.*

Aylesbury.—November 11th. Town Council. Electric motors and pumps. (October 21st.)

Dublin.—November 16th. G.N.R. Co. of Ireland. Three months' supply of stores including electrical fittings, lamps, cable, wire, &c. (See this issue.)

London.—**L.C.C.**—November 28th. Water-tube boilers, superheaters and economisers, &c. (October 21st.) Metropolitan Asylums Board. November 23rd. Installation of electric lighting cables throughout the training ship *Exmouth*, off Grays, Essex. (See this issue.)

Portsmouth.—November 18th. Corporation. Four centrifugal pumps, direct coupled to 3-phase, a.c. motors, sludge pump and motor, and various small motors, switchboard cables, lighting, and other apparatus. (October 21st.)

Sheffield.—November 26th. Health Committee. Plant and machinery for refuse disposal works, including cranes, switchboard, pumps, &c., steam-driven electrical plant and condensers, motors, and starters, &c. (October 28th.)

South Africa.—**DURBAN.**—Municipal Council. 250 s.p., or 125 d.p. ironclad fuses, 25 amperes, 200 volts; 500 combined double-pole enclosed switches and fuses, 35 amperes, 200 volts, suitable for house service use; 144 single-pole switch fuses, unmounted, 100 amperes, 200 volts; 50 single-pole switch fuses of the "Brush" or other similar type, 50 amperes, 2,750 volts, suitable for sub-station use. One 3-phase transformer, 25 kVA capacity, 50 cycles.*

JOHANNESBURG.—November 24th. 15,000 traction lamps, 110 V, 20 watt, metallic filament; 24 750-A s.p. knife switches; 36 400-A ditto; 36 200 amp. ditto. (Contract 828.) Delivery of the lamps to be made as and when required, commencing early in March, 1922.*

Warrington.—November 15th. Electricity and Tramways Committee. Motors and transformers. (October 21st.)

Whitehaven.—December 1st. Electricity Supply Department. Two water-tube boilers with superheaters, economisers, pipework, &c. (See this issue.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CLOSED.

Australia.—**MELBOURNE.**—Morwell electric supply and briquetting.

The Australian Electricity Commissioners have accepted the offer of Zeitz and Co. of Halle, Germany to supply a briquetting plant at a cost of £110,000. The Commissioners state that no knowledge of the successful briquetting of brown coal without the use of a binder exists outside of Germany, and that no other country is able to provide certain specialised machinery of guaranteed efficiency for such a purpose. The plant to be installed will be capable of producing 96,000 tons per annum at an estimated cost of £350,000. The plant will later be expanded to a commercial factory producing 300,000 tons per annum, which is estimated to cost £2,400,000. In addition to the briquetting plant to be supplied by Zeitz & Co., £264,000 will be expended in buildings, boilers, conveyors, electrical plant, and other appliances, a large portion of which will be obtained in England.

Cost-handling plant for Newport "B" station, £17,850.—Fraser & Chalmers Ltd., London.

SYDNEY.—Electric Supply Committee. Recommended:—
A. m.c. Magnetron-Vickers Co. Ltd., for type "N".
Meters, &c. Noyes Bros. (Sydney) Ltd., for Ferranti type "C" meters.
Each four to supply 6,000 5-amp., 2,000 10-amp., 600 20-amp., 50 50-amp., spare parts, &c., total £17,720.
D.c. meters. Noyes Bros. (Sydney) Ltd., Ferranti type meters, £8,307.—
Tenders.

Bury.—Town Council. Accepted. In connection with extensions at Chamber Hall power station, the Town Council has sealed contracts with the following firms:—

Switchboard floors.—Macleay & Co.
Extension gallery.—J. Webb & Sons, Ltd.
Switchboard.—Ferguson, Pailin & Co.
Electric capacitor.—Clarke, Chapman & Co.
Coal weighing machines.—W. & F. Avery, Ltd.
Structural steelwork.—Holden & Porter.

G.P.O.—Messrs. Johnson & Phillips, Ltd., have just received from the Post Office Engineering Department a contract to manufacture, supply and lay a trunk telephone cable between Glasgow and Edinburgh. The order comprises 46 miles of 204-pair cable.

Newcastle-on-Tyne.—Corporation Electricity and Transport Committee. Recommended:—

1,500 tons rails for the permanent way.—Bolckow, Vaughan & Co., Stockton-on-Tees, £12 10s. per ton. This is stated to be slightly in advance of the lowest foreign tender.

New Zealand.—WELLINGTON.—Accepted:—

6,000 66,000-V Canadian insulators, in connection with the Lake Culteridge hydro-electric power scheme, £11,501. Lawrence & Hanson. *Tenders.*

Romford.—Board of Guardians. Accepted:—

A 25-line telephone for the medical officer's residence.—Private Telephone and Electric Co., Ltd.

South Shields.—Corporation. Accepted for the Electricity Department:—

E.h.t. feeders and pilot cables £1,417.—British Insulated & Helsby Cables, Ltd.

E.h.t. sub-feeders, at £577 12s., and underground distributing mains, house service switch control mains and services for public street lamps, for the sum of £1,412.—British Insulated & Helsby Cables, Ltd.

E.h.t. switchgear, £1,387.—Reynolds & Co.
Three car bodies, at £800 per car, including teak frames, for the Tramway Department.—English Electric Co.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, November 4th, at Caxton Hall, S.W. At 8 p.m. Lecture on "The Timber Trees of Commerce," by Mr. T. H. Ivey.

Friday, November 11th. Question and general discussion evening.

Society of Engineers (Incorp.).—Monday, November 7th, at Burlington House, Piccadilly, W. At 5.30 p.m. Paper on "Extraction Turbines," by Mr. C. H. Naylor.

Institution of Electrical Engineers.—Informal meeting. Monday, November 7th, at the Institution, Victoria Embankment. At 7 p.m. Discussion on "How Best to Speed Up Electrical Progress," to be opened by the President of the Institution (Mr. J. S. Highfield).

(Liverpool Sub-Centre).—Monday, November 7th, at the University, Liverpool. At 7 p.m. Chairman's (Mr. G. H. Nisbett) address.

(Western Centre).—Monday, November 7th, at the South Wales Institute of Engineers, Cardiff. Chairman's (Mr. A. C. MacWhirter) address.

(Scottish Centre).—Tuesday, November 8th, at 207, Bath Street, Glasgow. At 7.30 p.m. Chairman's (Mr. E. T. Goslin) address.

(Wireless Section).—Wednesday, November 9th, at the Institution. At 6 p.m. Chairman's (Dr. G. W. O. Howe) address.

(London Students' Section).—Friday, November 11th, at the Institution, Victoria Embankment, W.C. At 7 p.m. Opening address, "The Future of Railway Electrification," by Sir Philip Dawson, M.P.

(Scottish Centre, Students' Section).—Friday, November 11th, at the Royal Technical College, Glasgow. At 7.30 p.m. Address by the chairman (Mr. A. Lindsay).

(Irish Centre, Dublin).—Friday, November 11th, at the Royal College of Science, Dublin. At 8 p.m. Discussion on the Report of the Fuel Research Board on the winning, preparation, and use of peat in Ireland, and on the Report of the Sub-committee on the Water-power Resources of Ireland.

(North-Midland Centre).—Tuesday, November 15th, at the Hotel Metropole, Leeds. At 7 p.m. Chairman's (Mr. W. E. Burnand) address and smoking concert.

(North-Western Centre).—Tuesday, November 15th, at the Engineers' Club, Manchester. At 7 p.m. Chairman's (Mr. W. Walker) address.

Institute of Marine Engineers.—Tuesday, November 8th, at the Institute. At 6.30 p.m. Paper on "Liquid Fuel and its Application for Steam Generation," by Mr. J. H. Anderson.

Electro-Harmonic Society.—Friday, November 11th, at the Grand Hall, Cannon Street Hotel. At 8 p.m. Ladies' night.

Exhibition of Housecraft.—(Under the direction of Miss Gwynne Howell.) At 17, Harrington Gardens, Gloucester Road, S.W. From November 8th to November 11th, 11 a.m. to 5 p.m.

Motor Exhibition.—November 4th to 12th, at the White City and Olympia, London.

Northampton Engineering College Engineering Society.—Wednesday, November 9th, at the Northampton Institute, Cliftonwell, E.C. At 5.30 p.m. Paper on "Mishaps," by Mr. H. C. Brown.

Nottingham Society of Engineers.—Wednesday, November 9th, at the Wilbekin Hotel. At 8 p.m. Paper on "The Training of Apprentices," by Prof. H. Schofield.

Royal Society of Arts.—Wednesday, November 9th, at John Street, Adelphi. At 8 p.m. Paper on "The Work of the Industrial Fatigue Research Board and its Applications to Industry," by Mr. D. R. Wilson.

Chelmsford Engineering Society.—Thursday, November 10th, at the East Anglian Institute of Agriculture. At 7 p.m. Students' meeting.

Edinburgh Electrical Society.—Friday, November 11th, at the Philosophical Institute. At 8 p.m. Paper on "Some Particulars Regarding C.T.S. Cables," by Mr. D. Landale Few.

Association of Engineers-in-Charge.—Saturday, November 12th, at the Holborn Restaurant. Ladies' night. Dinner and dance.

Birmingham and District Electric Club.—Saturday, November 12th, at the Grand Hotel. At 7 p.m. Paper on "The Gyroscopic Compass," by Mr. H. F. Stevenson.

Salford Technical and Engineering Association.—Saturday, November 12th, at the Royal Technical College. At 7 p.m. Members' short papers in competition for Gold Medals, awarded by Mr. W. O. Larnum.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

For many years past we have been replying through the post to inquiries sent to us by our readers.

The queries, which have numbered many thousands, have covered almost every conceivable matter which can be connected even remotely with any one of the innumerable fields into which electricity has spread.

Perhaps the most common request is for the name of the manufacturer of a particular piece of apparatus, especially apparatus which is known under a trade name, such as (to give well-known examples) Osram, Simplex, Mazda, &c. In this field alone we may claim to have been the means of putting literally thousands of potential purchasers into touch with the makers of the goods which they require.

Many of our readers are already aware of this service to the electrical industry which we have considered it a privilege to be able to render in the past, but we wish the large number of new readers to know that the same service is equally at their disposal provided the following simple rules are observed:—

1. Address your inquiries to the ELECTRICAL REVIEW, Ltd., Service Department, and enclose a stamped addressed envelope.

2. Do not ask for information until you have satisfied yourself that it is not already contained in our advertisement pages.

3. If we are the means of putting you in touch with the firm or firms that you require, do us the favour of mentioning the ELECTRICAL REVIEW.

No charge is made for the service.

NOTES.

Freemasonry.—On Friday last, the annual installation meeting of the Kelvin Lodge, No. 3736, was held at Mark Mason's Hall, when Mr. H. Porter-Cox, the W.M., installed Mr. E. E. Sharp as his successor in the chair. In this instance particular interest attached to the ceremony, inasmuch as Mr. Sharp is already reigning Master of the Electric Lodge, so that he is now actually reigning over the two Masonic Lodges which are most intimately associated with the electrical profession.

Among those who were present at the banquet which followed the ceremony were: Messrs. Percy Still, P.G.D.; Charles F. Quicke, P.G., Supt. of Wks.; F. A. B. Lord, P.A.G., St. B.; John W. Elliott, P. Prov. J.O.D. (Herts.); G. T. Fairbrother, P.M., 2455; W. B. Ross, P.M., 2767; and C. H. Wordingham, Past President Inst.E.E., as well as many other gentlemen intimately associated with the electrical industry.

Fatality.—An inquest was held at Hammersmith recently upon Henry Melhuish, an L.C.C. tramcar driver, who died as the result of a collision between his car and a motor lorry. It was stated that before his death deceased stated that a mist suddenly came before his eyes, and he lost consciousness, and was therefore unable to apply the brakes. A doctor stated that death was due to syncope from heart disease accelerated by the shock received in the collision. A verdict of "Accidental death" was returned.

Appointments Vacant.—Plumber-jointer, for the Southend Corporation Electricity Department; sub-station attendant for the Newport Corporation Electricity and Tramways Department; general assistant (£547), for the Chesterfield Corporation Electricity and Tramway Department. (See our advertisement pages to-day.)

French Transport Conference.—Mr. G. J. Shave, operating manager and chief engineer of the London General Omnibus Co., and Mr. A. V. Mason, deputy general manager and engineer of the London and Suburban Tramway Group, attended a Convention of the Unions des Voies Ferrées d'Intérêt Local and des Transports Publics Automobiles de France, held in Paris recently. Papers were read on permanent-way construction, supply of electrical energy, electrolysis, the trolley bus, and the economical position of surface transport generally. At the Convention representatives were present from all the important towns in France, Belgium, Italy, Sweden, and Denmark. One of the most important matters arising out of the meetings was the suggestion that the various operating concerns in this country should be officially represented by their associations at these conferences, so that matters of technique and standards could be discussed and settled internationally.

Smoke from Steam Trains.—It is reported that a final warning has been issued by the Public Control Committee of the London County Council to all companies running steam-driven trains into London, calling attention to the smoke nuisance arising from locomotives, and stating that it is the intention of the Council to take steps to obviate it.—*Morning Post*.

Trade Conditions and Unemployment in the Electrical Industry.—Whilst going to press we have received the following important particulars regarding the work of the Conference of Joint Industrial Councils and other bodies, which was briefly referred to in our last issue:—

The conference having made exhaustive inquiries, addressed a memorandum to Sir Alfred Mond as chairman of the Cabinet Committee upon Unemployment, who received a deputation at the Ministry of Health on Wednesday last. The Minister was supported by Mr. Arthur Neal, M.P., and Sir John Snell, Chairman of the Electricity Commission, and was addressed by Mr. L. B. Atkinson, Chairman of the Conference, supported by Mr. Alderman Beaumont and Mr. Kelly.

The Chairman, having pointed out that the deputation, probably for the first time in the history of such deputations, represented the whole industry through its Industrial Councils, thus including the workpeople as well as the employers, and that the memorandum was a unanimous expression of opinion, outlined the subject and dwelt at some length upon the present position of the industry, which was faced with the prospect of progressive unemployment unless certain conditions could be altered immediately. The memorandum dealt with (1) the steps necessary to reinstate permanently activity and employment in the electrical industry, and (2) the steps necessary to relieve temporarily unemployment in the electrical industry.

The Chairman proceeded to emphasise the following propositions:—

First, that unproductive outlays by the State should be closed down, except those absolutely necessary for security and health.

Secondly, that the electrical industry in particular should be assisted by the removal of uncertainties which were checking its development, (a) by defining as early as possible the Government policy with regard to the future control of electricity supply; (b) by speeding up adjudication on all schemes already submitted to the Electricity Commissioners; (c) by allowing supply undertakings to increase charges to meet the changed economic conditions; (d) by action at the earliest possible moment by the Government to clear up the uncertainties under which the railway companies were labouring, as to the effect on their capital accounts of the groupings proposed.

The Chairman next proceeded to outline the steps recommended for the immediate alleviation of unemployment in the electrical industry.

Inquiries had been made to ascertain the schemes of electrical development which had already been prepared and were ready to be put into operation, but which for one reason or another were at present held up. The replies received from the majority of the undertakings communicated with were summarised as follows:—

“There exists a large amount of potential work and additional employment which is being held up on account of (a) uncertainty with regard to the future legislation or control in certain districts; (b) difficulty in financing extension works which cannot become remunerative until a considerable time has elapsed.”

The important suggestion was made that Government assistance should be given towards interest payments and the postponement of sinking funds for a reasonable period; then it would become possible to put in hand extensive and valuable works, ultimately becoming productive, and immediately affording a large amount of employment.

It was also pointed out that there appeared to be a good deal of uncertainty as to the extent to which such undertakings could apply for assistance in the payment of interest under the memorandum recently issued by the Ministry of Health concerning Government contributions towards the payment of interest on capital expended on productive undertakings.

The question of London transport extensions and railway electrification generally was dealt with at great length, attention being drawn by the deputation to the difficulties existing with regard to carrying out schemes of electrification already prepared because of the uncertainty in connection with the precise form which railway grouping might be expected to take.

Mr. Atkinson also drew attention to the large amount of work which might result from a decision to go ahead with telephone extensions, at present held up, and the attention of the Minister was drawn to the difficult question of the purchase of electrical requirements for the use of the Indian Government in competition with foreign manufacturers under the present conditions of foreign exchange. Suggestions were made in this connection in which Sir Alfred Mond expressed himself extremely interested, and which he promised to pursue further.

In replying to the deputation, Sir Alfred Mond expressed his appreciation of the work of the Conference, and his desire to apply practically some of the suggestions made. He stated

that the paralysing effect of uncertainty as to the future action of Government relative to the electrical industry was appreciated, and that the Transport Department was dealing with it. He referred similarly to the question of railway grouping. On the point of assistance towards payment of interest on municipal loans, he made it clear that the Ministry of Health's memorandum applied to electrical undertakings. He agreed with the view of the deputation that it was unreasonable to ask commercial undertakings to commence the operation of sinking funds immediately the works were completed and before earnings commenced, and thought that Government action could be taken in this direction.

He stated that the telephone extension proposals had received most careful consideration by the Government, and he anticipated being able to make a useful suggestion in a few days. With regard to the Indian Government purchase, he was sympathetic, and the matter was under discussion.

Mr. A. Neal, M.P., added to what Sir Alfred Mond had stated, that the position of the smaller companies had been intended to be dealt with by a clause in the Electricity (Supply) No. 2 Bill, 1920, but that he would endeavour to see that this difficulty was removed, the principle having been agreed in other cases. He stated that a large number of recommendations of the Electricity Commissioners were ready for placing before Parliament for sanction early next session. He thought the question of uncertainty was exaggerated. The policy had already been laid down; the final legislation necessary to give it effect had not yet been carried through, but as far as he could conceive, no delay would take place in pushing it forward, and then giving executive sanction to the policy already clearly understood.

The deputation tendered thanks to Sir Alfred Mond and his colleagues.

New American Washing Machines.—To the making of washing machines there is no end in the United States, and a recent issue of the *Electrical Review* (Chicago) contained descriptions of a number of new designs embodying points worth noting.

A recent incident in a small electrical exhibition, when a lady came perilously near to being entangled in an exposed running belt of a washing machine, has convinced us of the imperative necessity of enclosing all gears and belts. This may be accomplished fairly well by an ordinary belt guard, but one of the new American washers is entirely closed in by a frame in which thin wood panels are inserted.

Another design possesses two or more containers for linen, &c., all operated by one motor. The driving gears are totally enclosed in a cast-iron casing. One of the other machines described is also gear-driven, and the pinions and connecting rods are safely housed. Machines employing reciprocating motion and those with rotary motion appear to be evenly divided, although in the latter case the motion is reversed at every few revolutions. This has led to considerable ingenuity in the devising of reversing gear, the main object being to eliminate the jar when the change of direction is effected. The use of a rotating “dolly” does not appear to be favoured in the latest designs of washing machines.

Electric Service on the Western Ranch.—Under this title the *Electrical World* draws attention to the immense possibilities of electric service on the farm:— In the Pacific Coast and north-west districts, where electric service lines and motor-driven pumps have created veritable gardens, an area of 40 acres is still rated as a ranch. In the San Joaquin Valley, for instance, where these small ranches abound, the public enjoys a real interpretation of electric service that would be a great asset to other sections as well. In that valley farmers or ranch owners are making advance applications for electric service connections and anxiously await station construction that will make these possible. Forest land now used for cattle raising and grain production, at a value of \$150 to \$300 per acre, will have a value of from \$1,500 to \$2,500 as soon as irrigation is made possible. Self-interest there is a powerful influence for electrical development, which is gaining the ear of the public service commissioner and the investor alike. But this same type of self-interest exists in other sections. The San Joaquin Light and Power Co. has simply pointed the way to its application in the development of electric service elsewhere. Only fifteen years ago that company was a struggling concern with just enough generating capacity to take care of the limited needs of a few small communities and with a gross income of \$125,000. To-day it serves a great fertile valley and has a return of \$4,500,000 annually, built largely upon the good will of the rural public it serves.

I.E.E. Model Conditions of Contract.—The model form of general conditions recommended by the Institution of Electrical Engineers for use in connection with contracts has recently been revised. Copies may be obtained from the Secretary of the Institution, Savoy Place, Victoria Embankment, London, W.C.2, or from the publishers, Messrs. E. and F. N. Spon, Ltd., 57, Haymarket, London, S.W.1. The price per copy is two shillings (post free 2s. 2d.).

Polish Electrical Congress.—A three days electrical congress of Polish electricians, reports *Berlingske Tidende*, was to have been held at Thorn commencing on October 30th. One of the principal subjects down for discussion was the electrification of Poland from the technical and the economic points of view.—*Reuter's Trade Service* (Copenhagen).

INSTITUTION NOTES.

The Institution of Electrical Engineers.—A special general meeting of corporate members and associates of the Institution is to be held on November 17th at 5.45 p.m., for the purpose of considering and, if thought fit, passing resolutions to the following effect:—

1. That the Institution be wound up voluntarily, and that Sir James Devonshire, K.B.E., and P. F. Rowell be appointed liquidators for the purposes of such winding-up.

2. That the property of the Institution remaining after the satisfaction of all its debts and liabilities be transferred to the Institution of Electrical Engineers incorporated by Royal Charter dated August 15th, 1921.

Should the above resolutions be passed by the requisite majority they will be submitted for confirmation as special resolutions to a further special general meeting of corporate members and associates on December 2nd, at 5 p.m.

ORDINARY MEETINGS.—In addition to the Ordinary Meetings mentioned in our last issue, the following are announced: December 1st, paper on "The Cyc-Arc Process of Automatic Electric Welding," by Messrs. L. J. Steele and H. Martin; December 15th, paper on "Induction-Type Synchronous Motors," by Mr. L. H. A. Carr; January 5th, 1922, lecture by Dr. S. P. Smith (with experiments), "Single and Three-phase Commutator Motors with Shunt and Series Characteristics"; January 19th, discussion on "The Utilisation of Waste Heat from Electrical Generating Stations" (joint meeting with the Institution of Heating and Ventilating Engineers).

SCOTTISH CENTRE.—The first meeting of the session is to be held on November 8th in Glasgow, when Mr. E. T. Goslin, the chairman, will deliver his inaugural address. A smoking concert is to be held on December 17th, and the annual dinner of the Centre has been arranged for February 22nd, 1922.

The annual report shows that at the end of last session the membership was 567, an increase of 44; the average number present at ordinary meetings was 64.

The Students' Section holds its first meeting on November 11th; Mr. Lindsay will deliver his address as chairman.

Institution of Civil Engineers.—On Tuesday last the new president, Mr. W. B. Worthington, was installed in the chair. In the course of his inaugural address he dealt with the origin and aims of the Institution, and deprecated the modern tendency to regard "civil engineering" as a branch of the engineering profession, on a par with the mechanical, electrical and other branches, whereas it embraced all branches.

Association of Mining Electrical Engineers.—At the inaugural meeting of the session of the North of England branch of the Association that was held at Newcastle-on-Tyne on October 29th, Lieut.-Col. F. R. Simpson, the branch president, delivered an address, in the course of which he said that, with regard to the application of electricity to underground hauling, the aim of mining engineers was to reduce the number of horses employed. So far, no system had been evolved by which the haulage over the first 180 yards from the face could be performed except by hand or by means of a pony, and the cost per ton mile over that short distance was notoriously high—at present it was not less than 6s. per ton mile. The introduction of mechanical conveyors to long-wall faces had to a great extent relieved that difficulty, and by concentration enabled auxiliary haulage to be applied. There were, however, many collieries wherein for various reasons the coal getters worked singly, or in pairs, and the small quantities obtained from the large number of places rendered the application of machinery impossible. For those reasons the abolition of horses was not possible, but endeavours should be made to eliminate horse haulage except in the first 180 yards from the working face. At a colliery in which the speaker was interested, experiments were being made with a storage battery locomotive, and satisfactory results had been obtained. The chief particulars were: Weight, including batteries, 35 cwt.; dimensions, 6 ft. long by 4 ft. high, by 3 ft. wide; speed with load, 5 m.p.h.; batteries, two sets each consisting of 24 cells; voltage, 44; h.p., 2, 300 per cent. overload; motor revs., from 1,400 to 1,600; gearing, 17-1. The work done was 45 sets of 12 tubs per day. The full set weighed 74 tons, and the empties 2 tons 12 cwt.; the distance run per day was 20 miles. It was considered that the locomotive was doing the work of three ponies. The heaviest gradient was 1 in 36. The road was dry; the rails weighed 22 lb. per yard with fishplates. It had been found that if the gradient were more than 1 in 25 with a load of two tons 12 cwt., the weight of the locomotive was not sufficient to avoid slipping of the driving wheels. In his opinion, that method of hauling required the serious consideration of mining electrical engineers who, with their knowledge of underground conditions, should be well fitted to evolve a thoroughly efficient locomotive at a reasonable first cost.

Statements had been made during the last few years as to the want of enterprise in the equipment of British coal mines, but he did not think that on investigation they could be substantiated. In that respect he found that at a colliery capable of raising one million tons of coal per year the electrical plant installed amounted to 2,969 h.p., and within a few months would reach 3,582 h.p. That plant included pumping,

ventilating, winding, hauling, air compressing, coal-cutting and coal-conveying. That was only one place, but he had reason to believe that it was typical of collieries in the North coalfield.

Junior Institution of Engineers.—The following meetings have been arranged to take place at the Birmingham Chamber of Commerce, New Street, at 7 p.m., under the direction of the Midland Section Council of the Institution:—

November 18th, 1921.—Prof. K. Neville Moss, O.B.E., M.Sc., will lecture on "Coal Mining in Great Britain."

December 6th, 1921.—Mr. R. B. Askwith Ellis, A.M.I.Mech.E., will deliver his presidential address.

January 10th, 1922.—Mr. J. Fearn, A.M.I.Mech.E., and Capt. F. W. Spencer will read a paper on "Drop Forgings."

The Institute of Cost and Works Accountants.—The next preliminary, intermediate and final examinations will be held on December 5th, 6th, and 7th, at London, Manchester, Birmingham, Sheffield, Glasgow and Bristol. (Other centres will be arranged should sufficient demand arise.) Forms of application can be obtained from the Secretary, 38, Grosvenor Gardens, S.W.1.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

At a special meeting of the Glasgow University Court, as has been announced already in the *ELECTRICAL REVIEW*, Dr. G. W. O. Howe was appointed professor to the newly-founded James Watt Chair of Electrical Engineering in the University. Mr. Howe, who is at present head of the Department of Electrical Standards and Measurements at the National Physical Laboratory, Teddington, took the degrees of B.Sc. and M.Sc. at Armstrong College, Newcastle-on-Tyne, and received the degree of D.Sc. from Durham University. When at



Photo by]

[Whitlock, Birmingham.

PROFESSOR G. W. O. HOWE.

Adelaide with the British Association he was made an honorary D.Sc. of Adelaide University, and in 1900 he was senior Whitworth Scholar. Dr. Howe served a five years' apprenticeship with Messrs. Siemens Bros. at Woolwich, two years in the cable design department of that firm, two years in the Berlin Works of the Siemens-Schuckert Co., designing and testing electrical machinery, and one year in the dynamo design department at the Woolwich works. His teaching experience consists of two years head of the electrical engineering department at Hull Municipal Technical College, and 16 years at the City and Guilds (Engineering) College (Imperial College of Science and Technology), South Kensington.

ton, from 1905 to 1909 as lecturer, and from 1909 till June, 1921, as assistant professor of Electrical Engineering. Dr. Howe is a member of the Institution of Electrical Engineers and Chairman of the Wireless Section, in which capacity he will deliver an address to the Section on November 9th. He is also a Fellow of the Physical Society, and has been a member of various technical boards and advisory committees, besides being the author of numerous papers contributed to the Royal Society, the Institution of Electrical Engineers, the Physical Society, &c. Since 1914 he has been recorder of the Engineering Section of the British Association.

Last Friday evening the staff and employees of the Bolton Corporation Electricity Department met for a social evening at the invitation of the borough electrical engineer, Mr. W. J. H. Wood. Advantage was taken of the occasion to present Mr. Wood with a mahogany pedestal writing table and chair, and a solid silver tray, as tokens of esteem on the occasion of his marriage. Mr. Edward Jones, secretary, who presided over a very representative gathering, spoke of the excellent feeling which existed between Mr. Wood and the staff and employees, and referred to his own 20 years' association with him. Messrs. B. S. Hornby, C. R. Yates, A. E. Kirkman and J. Boothroyd supported, and Mr. F. L. Garstang (station engineer) asked Mr. Wood's acceptance of the presents from the whole of the members of the department. The recipient very feelingly responded. A miscellaneous musical programme was contributed to by members of the department. The wedding took place at St. Martin's, London, on Wednesday, November 2nd, the bride being Miss Marjorie Richardson, of Bolton.

Mr. WALTER LEWIS, who has resigned the position of goods superintendent on the Great Western Railway at Cardiff on reaching the retiring age, has joined the board of Booth and Bamford, Ltd., electrical engineers, Cardiff.

Major R. W. KLITZ, A.M.I.E.E., late I.O.M. first-class, R.A.O.C., formerly chief assistant electrical engineer with the Wimbleton Corporation, has recently been gazetted out of the Army on completion of service, and is open to take a partnership in an electrical concern.

Mr. E. MOXON, borough electrical engineer for South Shields for the last two years, has resigned his appointment, he having been appointed to a similar position at Southport. The committee, in agreeing to release Mr. Moxon within six weeks from the date of his resignation, are parting from him with regret, and have placed on the records a reference to the valuable services rendered by him to the Corporation during his two years of office. During that period important extensions to the station and plant have been carried out.

The Franklin Institute, acting through its Committee on Science and the Arts, awarded, on October 19th, its Elliott Cresson Gold Medal to Dr. Byron E. Eldred, of New York, for his low expansion leading-in wire for incandescent electric lamps; it also awarded to Mr. Alfred O. Tate, of Cranston, Rhode Island, its Howard N. Potts Gold Medal for his electrolytic process of waterproofing textile fabrics.

Mr. OSCAR BERRY, F.C.A., C.C., has been elected deputy-chairman of the Commercial Education Committee of the London Chamber of Commerce. He is also to serve on the Governing Body of the City of London College, as a representative of the London Chamber.

Mr. G. W. MATTHEW, who for the last seven years has been in charge of the Supply Department of Messrs. Metropolitan-Vickers, Ltd., South Wales Branch, has now joined the board of Messrs. Cescio, Ltd., formerly the Commercial Electric Supplies Co., and has accepted the position of joint managing director with Mr. A. H. Smith, who was previously with the General Electric Co., Ltd., Cardiff branch.

Mr. D. G. DAVIS, B.Sc., of Redditch, has been appointed resident power station engineer under the Clyde Valley Electrical Power Co.

We congratulate Mr. W. VALENTINE BALL, son of the late Sir Robert Ball, upon his appointment to be a Master of the Supreme Court, King's Bench Division.

Mr. H. W. DAUNCEY, manager of the Cantie Switch Co., Ltd., is to be relieved of his duties on the 14th inst., owing to a breakdown in his health. For the present letters for him should be sent to him at his home address: "Bacton," Priory Avenue, Sudbury, Harrow.

Obituary.—LIEUT.-COL. P. J. PREECE.—We regret to read in *The Times* that Lieut.-Col. Percy John Preece, T.D., late 2/8th London Regiment (Post Office Rifles), of Cefn Rhos, Carnarvon, third son of the late Sir William Preece, K.C.B., I.R.S., passed away on October 29th at Wimbledon.

Mr. C. LADLOW.—The death took place at Thorpe Bay, Essex, on October 27th, at the age of 83 years, of Mr. George Ledger, who was for 52 years on the staff of the Telegraph Construction & Maintenance Co.

Prof. F. E. ARMSTRONG.—We regret to record the death, from a tumour on the brain, of Prof. Francis Edwin Armstrong, M.Sc., A.M.I.C.E., Professor of Mining, Sheffield University, at the age of 42 years.

Mr. Ernest COATES, M.I.E.E. The death has occurred under tragic circumstances, at his house at Streattham, of Mr. Ernest Coates, M.I.E.E. According to the first details appearing in the Press, he and the three other members of his household met their deaths through drinking poisoned champagne. Mr. Coates, who was 46 years of age, is stated to have been engaged in business as a commission agent in the City.

NEW COMPANY REGISTERED.

Talbot & Lobley, Ltd. (177,413).—Private company. Registered October 21st. Capital, £5,000 in 41 shares. To carry on the business of consulting, electrical, and mechanical engineers, implement and machinery manufacturers, &c. The permanent directors are: H. J. Talbot, Southill Mansions, Hampstead, N.W.; H. D. Lobley, 122, Albany Road, London, Suffolk, with power to appoint an ordinary director. Qualification: One share. Remuneration of permanent directors, £200 each per annum. Registered office: 27, Victoria Street, Westminster.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

G. Hands & Co., Ltd.—Debenture dated October 5th, 1921, to secure £2,000, and further moneys not exceeding £1,550 which the mortgage may be called upon to pay under a certain guarantee, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: G. Hands, 69-71, Farringdon Road, E.C.

Fuller's United Electric Works, Ltd.—Debentures dated October 11th, 1921, to secure £15,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: National Bank of Scotland.

Gilbert Gilkes & Co., Ltd.—Satisfaction to the extent of £1,000 on September 30th, of debentures dated March 31st, 1921, securing £4,700.

CITY NOTES.

At the annual meeting, held on October 27th, Mr. B. M. Drake said that in spite of the crisis through which the country had been passing, including the coal stoppage and an electricians' strike, they were still able to declare a six per cent. dividend after making allowance for the depreciation which had taken place in their stock. During the 20 years of the company's existence the total profit had exceeded £200,000, of which £134,460 had been distributed amongst the shareholders, this being £9,460 more than the amount subscribed. It was a tribute to the reputation of the company that the issue of 7-year notes was so largely oversubscribed; no outlay for underwriting was incurred. The E.P.D. and Corporation Profits Tax, paid or reserved, had amounted to no less than £17,000, a large proportion of which related to peace requirements. Although they would in future be released from the former tax, the latter, amounting to five per cent. of the profits, still continued. If, as reported, the metal workers in Germany were now putting in full work for the equivalent of 15s. to £1 per week, it was difficult to see how this country could compete when paying anything approaching the present rate of salaries and wages. Before normal conditions could be restored, the general standard of living must be lowered, and labour must be more willing to give proper value for wages received. With heavy taxation and lack of dividends, the number of those who could afford to install electric lighting was necessarily reduced. On the other hand, the use of electric power was daily extending in connection with domestic labour-saving appliances, the utility of which was more in evidence owing to the difficulty of obtaining servants, and as electricity was rendered more widely available, the adoption of such appliances would become more universal. It would be essential for manufacturers who wished to keep themselves up to date, to consider the problem of utilising electric power throughout their works. The severe competition might in the end prove a godsend, as before the war it was found that both Germany and America were using about three times as much horse power per man employed in factories as was used in Great Britain under similar conditions. This was largely due to the senseless opposition of the Trade Unions to labour-saving appliances. It was hoped that those controlling the policy of labour might now appreciate that it was only by the increased use of machinery that our trade could be recovered, and that there was sufficient demand to keep everyone employed indefinitely if satisfactory goods were produced at competitive prices, a result which could not be achieved with hand labour. The company's Manchester office had done exceedingly well, and had in hand important power equipment work in factories as well as a number of private installations. The head office was fully occupied for the first part of the year, but the effects of the depression appeared to have been felt earlier in the Southern than in the Northern counties. The Belfast office showed a small profit in spite of the prevailing difficulties. At the present time many were holding back their orders in the hope of obtaining lower prices, and the effect of this was to intensify the troubles caused by the lack of export trade. It should be considered a national duty for everyone to help the Government by putting in hand forthwith any work they could, and even if they paid rather more for this, it must be borne in mind that they would be getting something they wanted, and at the same time reducing the amount they would have to pay in taxation to meet grants made by the State. They would also be putting money into the pockets of men who were willing to work for their living. The Trade Unions should support this policy by encouraging those out of work to accept temporarily a lower rate of pay.

**Spanish
Electric
Companies.**

Union Electrica Vizcaina.—The accounts presented at the last meeting of this company showed an available balance of 2,490,993 pesetas, which was distributed as follows: To sinking fund, 50,000 pesetas; payment of 4 per cent. on coupon No. 12, 688,600 pesetas; 5 per cent. on coupon No. 13, 860,750 pesetas; taxes, 270,000 pesetas, leaving a balance of 611,643 to carry over to next year's account.

Electra-Metalurgica del Ebro.—The report of this company for the year 1920 showed the series of difficulties with which it had to contend, with overstocked markets, temporary stoppage of exports, a two-months' strike of workmen, and working only possible for six and a half months owing to the drought causing the lowering of the waters of the Ebro. Notwithstanding these hindrances, the liquid profits totalled 410,190 pesetas, from which, after placing 100,000 pesetas to the reserve fund and liquidation of taxes, a dividend of 35 pesetas per share on the 7,000 shares was declared. The company has increased its capital to 7,000,000 pesetas.

**English Electric
Company
of Australia,
Ltd.**

The *Sydney Morning Herald* for September 7th stated that the English Electric Co. of Australia, Ltd. (late Standard, Waygood, Hercules, Ltd.), announced that the option given to the English Electric Co. over 100,000 of the ordinary shares of the English Electric Co. of Australia, Ltd., at 2s. a share, had not been exercised, and had been cancelled. The sale of debentures, which it was hoped would provide new workshops at Clyde, had resulted in £118,100 being applied for. The workshops had already cost £150,000, the additional amount having been provided out of profits. Another £50,000 was required to complete the workshops. The Australian company was, therefore, asking shareholders to grant power to make an issue of £17,520 in ordinary shares to shareholders in the proportion of one new share for every five shares held. These shares were to be issued at par. For every two shares so taken up the shareholders were to receive one fully-paid £1 share in Weymouths, Ltd., Melbourne, as a bonus. This bonus was provided by the English Electric Co. of Australia out of profits. It was also proposed to extinguish the "A" ordinary shares, numbering 100,000, which were issued to obtain certain rights. They have been purchased by the directors as individuals, the purchase price being £10,000. They represented goodwill, and by transferring £10,000 from the reserve fund to pay for them they were to be extinguished, and the goodwill was to be written off.

**Auckland
Electric Tram-
ways Co., Ltd.**

At the recent annual meeting, Mr. C. G. Tegetmeier, in referring to the financial position, said that a year ago he informed them that £117,700 of the 5½ per cent. debentures had been disposed of, and during the year a further amount of £154,800 had been sold, realising an average price of 90½ per cent., and reducing the total held to the amount shown in the balance sheet. The proceeds of these sales had provided them with funds which had been utilised in redeeming their own debenture stock, and at the date of the balance sheet had left them with cash resources of £72,724. For some months past the sale of the Corporation debentures had been discontinued, for the board had not considered it advisable to sell at the lowered price which would have had to be accepted. With regard to the general position of the company, he dealt fully in October last year with the change in the financial position and assets of the company resulting from the sale of the undertaking and eventual liquidation at the time and in the manner that was likely to produce the best results as the alternative to the winding up of the company and the realisation and distribution of its assets, met with the general approval of the shareholders. Progress had been made in carrying out this policy during the past year.

Gwynnes Engineering Co., Ltd.—According to the *Financial Times*, the accounts for the period ended August 31st, 1921, show a loss of £103,164. After payment of general expenses, interest, repairs and renewals, and the writing off of sums amounting in the aggregate to £82,242 in respect of depreciation on buildings, machinery, &c., and all preliminary and formation expenses, there is a deficit of £351,887 to be carried forward.

Tramways, Light & Power Co., Ltd.—Special meetings have been called for altering the name of this company to the Midland Counties Electric Supply Co., Ltd., and increasing the borrowing powers to £1,000,000, so that an issue of debenture stock may be made to repay temporary borrowing.

Electric Welding Co., Ltd.—A financial contemporary reports that the accounts for the year ended November 30th, 1921, show a balance at debit of profit and loss of £46,964.

City of Buenos Ayres Tramways (1904) Co., Ltd.—Dividend of 1s. 3d. per share (being at the rate of 5 per cent. per annum), less tax, for the three months ended September 30th,

Stanton Ironworks Co., Ltd.—Interim dividend of 4 per cent., free of tax.

Capital Increases in Germany.—The prospectus issued by the Bergmann Electricity Works Co., in connection with the introduction of new shares for 20,000,000 marks on the Frankfurt Exchange, states that the turnover in the expired months of the present financial year has exceeded that in the same period of the previous year, and the orders on hand will keep the works occupied during the remainder of the year. The directors of the German Cable Works Co., of Berlin-Lichtenberg, have convened a special meeting to authorise an increase of 22,000,000 marks in the share capital, and the Rheydt Cable Works Co. also proposes to augment its share capital. In addition, an expansion from 8,500,000 to 15,000,000 marks is projected by the Light & Power Co., of Munich.

Yates & Thom, Ltd.—Dividend of 5 per cent., less tax, on the ordinary shares; £10,000 to reserve; carry forward £15,084.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Stock Exchange Committee under Rule 148a:—

Fellows Magneto Co.—124,237 ordinary shares of 10s. each, fully paid, Nos. 100,001 to 224,237.

South Metropolitan Electric Light & Power Co.—45,000 ordinary shares of £1 each, fully paid, Nos. 120,001 to 150,000 and 400,001 to 415,000; and £45,300 four and a-half per cent. first debenture stock.

STOCKS AND SHARES.

TUESDAY EVENING.

The railway companies have lost no time in putting forward their plans for electrification of fresh and existing lines with the intention of obtaining assistance from the Government in connection with the unemployment schemes. The companies want to take advantage, of course, of the opportunity for obtaining money at a reasonable rate from the Government, and they point to the large amount of labour which they could absorb into the work for a fairly long time. Reference was made here last week to the proposals of the Underground Electric Railways of London, and over the week-end the South-Eastern Co. put forward a comprehensive electrification plan, while the Brighton and the Great Eastern have similar suggestions on hand that may assume definite shape before these notes are out. The Government has just offered 20 million pounds local loans 3 per cent. stock at 52; some of the money will be hypothecated towards the necessities arising out of unemployment. Subscription of the full amount is guaranteed by the loan being underwritten, and the money will shortly be available for public use.

The investor in existing securities of the companies mentioned derives no immediate benefit from the proposals. Underground Electric Income Bonds, to take one example, fell to 67½, a drop of 2 points, although the price rallied to 68½. Both classes of shares are lower. Metropolitan and Metropolitan District stocks have lost 10s. London General Omnibus 5 per cent. income debenture stock can be bought at 61. The natural fear is that if large amounts of money are to be raised, the new securities will take precedence of existing stocks and shares. Moreover, the opposition that has arisen to Lord Ashfield's request for a limited period free from fresh competition, is another cause that keeps people a little uneasy. The L.C.C. programme, under which it is sought to take powers for borrowing five million pounds wherewith to build Tube railways, is regarded with interest rather than anxiety.

In the list of electricity supply shares, the week's changes are confined to a fall of 5s. in Bromptons and a rise of sixpence in City of London ordinary. The new County of London debenture is up to 6 premium. Our list last week of preference shares has apparently proved useful, and it may be of service to add another table giving the details of debenture stocks in the London companies:—

Debenture.	Int.	Payable.	Price.	Yld.
	Per Cent.			S. d.
Central Elec. Guaranteed ..	4	J. & A. D.	73	5 9 7
Charing Cross, West End, & City ..	4	J. & J.	65½	6 2 2
Chelsea Electric ..	4	J. & J.	75	6 10 0
City of London ..	4	J. & J.	84	6 9 8
" " 2nd ..	4	J. & J.	68½	6 11 5
County of London ..	4½	J. & J.	69½	6 9 6
" " 2nd ..	4	M. & N.	68	6 12 4
" " Red ..	7	J. & A. D.	100	7 5 0
Kensington and Notting Hill ..	4	A. & O.	71½	5 8 10
London Electric 1st Mort. ..	4	J. & J.	76	5 5 3
Metropolitan Elec. 1st Mort. ..	4½	J. & J.	69	6 10 5
" " 2nd Mort. ..	3½	J. & J.	70	7 0 0
" " Ext. ..	7½	J. & J.	102	7 7 1
Midland Electric 1st Mort. ..	5	J. & J.	80½	6 4 3
North Metropolitan ..	5	A. & O.	78½	6 17 11
" " 2nd ..	7½	J. & J.	108	7 5 0
Notting Hill Electric 1st ..	4	M. & S.	60	6 13 4
St. James' and Pall Mall ..	3½	J. & J.	66	5 6 1
South London 1st ..	5	J. & J.	77½	6 0 0
South Metropolitan 1st ..	4½	A. & O.	71½	5 5 10

It must be added that not all of these are actually on offer. Some are easier to sell than they are to buy, but even stockholders like to see how their securities stand in relation to

other issues, and the above table is comprehensive in giving prices that are not frequently quoted, owing, of course, to the limited character of the market in most of the stocks.

The River Plate Electric Co. is offering to receive tenders from its holders of 5 per cent. debenture stock, at 80½. As the stock can be sold in the market at 81½, there is no object in taking advantage of the company's offer.

Marconi is a better market at 32s. 6d., and Marconi Marines, after dipping to 15s. 6d., recovered to 71s. 3d. There are very vague rumours current to the effect that important wireless developments are taking place in Germany, and that a remarkable improvement in speeding-up messages is on the point of being announced. The report is mentioned merely for what it may be worth. In the cable group, Eastern ordinary stock has come to market, and the price fell 2 points. Indo-Europeans at 30 ex dividend have nominally recovered the deduction.

Most of the manufacturing shares remain depressed. General Electrics are down to 13s. 9d., English Electrics to 7s. 6d., and Edisons to 6s. 3d. The last-named have been 5s. 6d. Henley's gave way to 26s. 3d. Babcock & Wilcox at 45s. regained their dividend, the iron and steel list being a shade harder as a whole. In armaments, Vickers rose to 11s. 3d., but parted with the pence. Rubber shares are practically stagnant.

In Mexicans there is nothing new to record. British Columbia Electric stocks have weakened, Argentines keep steady, and Brazilian Tractions are a little firmer after their long decline. Stock Exchange markets have plucked up a grain of courage in the hope that the latest offer of the Soviet Government may indicate a return to its senses of the ruling power in Russia. The foundation for such optimism is admittedly unstable.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price			
	1919, 1920.	Oct. 31.	1921.	Rise or fall.	Yield.
Brompton Ordinary ..	12	12	6½	—	29 16 0
Charing Cross Ordinary ..	7	8	4½	—	9 2 4
do. do. do. 4½ Pref. ..	4½	4½	5½	—	7 4 4
Chelsea ..	6	6	9½	—	9 4 8
City of London ..	13	14	25/9	+6d.	13 9 6
do. do. 6 per cent. Pref. ..	6	6	17/3	—	6 17 0
County of London ..	8	8	8½	—	9 10 4
do. do. 6 per cent. Pref. ..	6	6	8½	—	7 10 0
Kennington Ordinary ..	7	9	4½	—	9 14 6
London Electric ..	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref. ..	6	6	9	+	10 0 0
Metropolitan ..	6	7	9½	—	9 8 8
do. 4½ per cent. Pref. ..	4½	4½	9½	—	7 13 2
St. James' and Pall Mall ..	12	12	6½	—	9 1 4
South London ..	6	7	2½	—	10 12 2
South Metropolitan Pref. ..	7	7	15/9	—	8 17 10
Westminster Ordinary ..	10	10	6½	—	8 13 10

TELEGRAPHS AND TELEPHONES.

	Dividend	Price			
	1919, 1920.	Oct. 31.	1921.	Rise or fall.	Yield.
Anglo-Am. Tel. Pref. ..	6	6	34½	—	7 2 10
do. do. Def. ..	1½	1½	17½	—	8 14 0
Chile Telephone ..	6	6	5½	—	5 14 8
Cuba Sub. Ord. ..	7	7	7	—	10 0 0
Eastern Extension ..	10	10	10½	—	6 1 0
Eastern Tel. Ord. ..	10	10	16½	—	6 1 0
Globe Tel. and T. Ord. ..	10	10	16½	—	6 1 0
do. do. Pref. ..	6	6	9½	—	6 9 0
Great Northern Tel. ..	22	22	24	+	9 14 0
Indo-European ..	10	10	30½	—	9 8 8
Marconi ..	25	15	1½	—	9 4 8
Oriental Telephone Ord. ..	12	12	2	—	* 0 0 0
United E. Plate Tel. ..	8	8	6½	—	* 7 6
West India and Panama ..	Nil	Nil	5½	—	Nil
Western Telegraph ..	10	10	16½	—	* 6 1 0

HOME RAILWAYS.

	Dividend	Price			
	1919, 1920.	Oct. 31.	1921.	Rise or fall.	Yield.
Central London Ord. Assented ..	4	4	49½	—	8 1 8
Metropolitan ..	12	12	22½	—	6 18 4
do. District ..	Nil	Nil	1½	—	Nil
Underground Electric Ordinary ..	Nil	Nil	1½	—	Nil
do. do. "A" ..	Nil	Nil	4½	—	Nil
do. do. Income ..	4	2	6½	—	* 4 7 4

FOREIGN TRAMWAYS, &c.

	Dividend	Price			
	1919, 1920.	Oct. 31.	1921.	Rise or fall.	Yield.
Anglo-Arg. Trams, First Pref. ..	5½	12½	2½	—	10 9 6
do. do. 2nd Pref. ..	Nil	6½	2½	—	10 4 8
do. do. 5½ Deb. ..	5	5	8½	—	7 7 0
Brazil Tractions ..	Nil	Nil	27½	—	Nil
British Columbia Elec. Rly. Pref. ..	6	6	5½	—	8 9 6
do. do. Preferred ..	9	9	5½	—	* 9 4 0
do. do. Deferred ..	12½	12½	62	—	* 12 4 0
do. do. Deb. ..	4½	4½	6½	—	7 1 8
Mexico Trams 5 per cent. Bonds ..	Nil	Nil	57	—	Nil
do. do. 6 per cent. Bonds ..	Nil	Nil	57	—	Nil
Mexican Light Common ..	Nil	Nil	10	+	Nil
do. do. ..	Nil	Nil	25	—	Nil
do. do. 1st Bonds ..	Nil	5	52½	—	9 10 6

MANUFACTURING COMPANIES.

	Dividend	Price			
	1919, 1920.	Oct. 31.	1921.	Rise or fall.	Yield.
Babcock & Wilcox ..	15	16	24½	—	7 2 8
British Aluminium Ord. ..	10	10	14½	—	10 0 0
British Insulated Ord. ..	15	15	1½	—	10 0 0
Callenders ..	15	15	1½	—	10 8 8
do. 4½ Pref. ..	4½	4½	8½	—	10 18 8
Crompton Ord. ..	10	10	14½	—	13 15 8
Edison-Swan ..	10	10	6½	—	10 0 0
do. do. 6 per cent. Deb. ..	5	5	8½	—	7 7 1
Electric Conservation ..	10	10	10½	—	13 17 0
English Electric ..	8	8	7½	—	9 16 8
do. Pref. ..	8	8	11½	—	10 18 4
Gen. Elec. Pref. ..	6½	6½	16½	—	7 8 6
do. Ord. ..	6½	6½	13½	—	14 18 9
Honley ..	15	15	1½	—	11 5 6
do. 4½ Pref. ..	4½	4½	3½	—	6 12 6
India-Rubber ..	10	10	8	—	10 0 0
Max. Vickers Pref. ..	8	8	14½	—	10 0 0
Siemens Ord. ..	10	10	10	—	* 10 0 0
Telegraph Con. ..	20	20	21½	—	* 6 11 9

* Dividends paid off of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 2nd.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
Acid, Oxalic ..	per lb. 7½d.	1½d. inc.
Ammoniac Sal. ..	per ton 265	..
Ammonia, Murate (large crystal) ..	.. 468	..
Bisulphide of Carbon ..	.. 215	..
Borax ..	.. 281	..
Copper Sulphate ..	.. 280	1½ dec.
Potash, Chlorate ..	per lb. 6d.	..
Perchlorate ..	.. 6d.	..
Shellac ..	per cwt. £16 10s.	..
Sulphur, Sublimed Flowers ..	.. 218	..
" Lump ..	.. 116	..
Soda, Chlorate ..	per lb. 3½d.	..
" Crystals ..	.. 27	..
Sodium Bichromate, cakes ..	per lb. 7½d.	..
METALS, &c.		
Babbitt's Metal Ingots ..	per ton \$80 to \$276	..
Brass (rolled metal 7 to 12" basis) ..	per lb. 10½ to 10½	1½ dec.
" Tubes (solid drawn) ..	.. 11½d.	..
" Wire, basis ..	.. 1½d.	1½ dec.
Copper Tubes (solid drawn) ..	.. 1½d.	1½ dec.
" Bars (best selected) ..	per ton 2101	2½ dec.
Sheet ..	.. 2101	2½ dec.
" Rod ..	.. 2101	2½ dec.
" (Electrolytic) Bars ..	.. 275	..
" " Sheets ..	.. 2145 10s.	..
" " Wire Rods ..	.. 231	..
" " H.C. Wire ..	per lb. 11d.	..
Elbonite Rod ..	.. 8/6	..
" Sheet ..	.. 8/6	..
German Silver Wire ..	.. 2/9	..
Gutta-percha, fine ..	.. 2/6	..
India-rubber, Para fine ..	.. 1½	..
Iron Pig (Cleveland Warrants) ..	per ton Nom.	28 dec.
" Wire, galv. No. 5, E.O. quat. ..	.. 22½	..
Lead, English Pig ..	.. 24 16s.	..
" Mercury ..	per bot. 29 16s. to £10	..
Mica (in original cases) small ..	per lb. 8d. to 3/	..
" " " medium ..	.. 4/ to 5/	..
" " " large ..	.. 10/ to 20/ & up	..
Phosphor Bronze, plain castings ..	.. 1/4 to 1/9	..
" " " rolled bars and rods ..	.. 3/1 to 3/6	..
" " " rolled strip & sheets ..	.. 4/10 to 4/7	..
Silicium Bronze Wire ..	per lb. 1/8.	..
Steel, Magnet, in bars ..	.. 1/8	..
Tin, Block (English) ..	per ton £154 10s.	10/ to 30/ dec.
" Wire, No. 1 to 15 ..	per lb. 3/5	..
White Anti-friction Metals ..	per ton \$85 to \$276	..

Quotations supplied by—

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Hydro-electric Developments in Sardinia.—During the recent debate on unemployment the Government accepted an order of the day expressing the hope that on the resumption of parliamentary work it would bring in a Bill for the purpose of allotting funds towards the construction of new hydro-electric plant in Sardinia. As long ago as 1907 the question of forming artificial lakes for irrigation purposes was taken up and one of them, at Tirso, is on the way to completion; steps have also been taken for the formation of another lake at Coghinna. The first-named lake has a capacity of 416 million cu. m. of water, and the estimated capacity of the second is 254 million, which will place them among the largest artificial lakes in the world. The well-known engineer, Signor Angele Omgeio has proved with exact data that the total capacity of all the reservoirs in Sardinia would amount to 1,500 million cu. m., from which 100,000 h.p. could be produced and 100,000 hectares of land irrigated.

According to other calculations, the Tirso, Coghinna, Temu and Flumendosa installations of hydro-electric plant alone would furnish about 500 million kWh per annum, to produce which by steam would cost not less than 400 million lire annually in combustibles. Of the energy thus produced one fourth would be absorbed by local demands for the purpose of lighting, railway traction, agricultural works, &c., while the remaining three-fourths would serve to give an impulse to the electrical and metallurgical industries, and could be applied especially to a more economical production of metals.

The mining industry of Sardinia, in spite of the disadvantageous circumstances in which it works, is of such important as that its output forms more than a quarter of the entire Italian production. Of zinc alone 200,000 tons are produced yearly, but the prosperity of the industry is limited by the fact that this great quantity of mineral is exported to Belgium (Great Britain, and France for manufacture. If hydro-electric power were available, the zinc, instead of being exported, and reimported in the finished state, could be manufactured on the island itself; in the same way the iron ore which abound might be utilised for the production of pig iron.—Reuters Trade Service (Milan).

THE RATING OF MACHINERY.

[By A Legal Contributor.]

At a time when many of those who own factories in different parts of the kingdom are at a loss to know how to make both ends meet, the question of "rating" and "rateable value" assumes very considerable importance. A factory is not like an inhabited house, the assessment of which is a comparatively easy matter, because the "hypothetical rent" can be easily determined. A variety of new considerations arise when a great building full of machinery has to be assessed. Nor has the legislature done much to assist those who have to fix the amount. It has been out of date for many years. In particular, so far, at any rate, as England and Wales are concerned, the question whether machinery is rateable *at all* has been left to be somewhat imperfectly solved by the decisions of the Courts.

The need for some definite rule on this point is emphasised by a recent decision in Glasgow, where the Lanarkshire Valuation Committee had to settle the rateable value of the property of certain Lanarkshire steel makers. The importance of that case will be apparent after we have drawn attention to the present state of affairs in England.

The whole principle of rating is founded upon the Parochial Assessments Act, 1836, the first section of which provides that "no rate for the relief of the poor in England and Wales shall be allowed by any justices or be of any force which shall not be made upon an estimate of the net annual value of the several hereditaments rated thereunto—that is to say, of the rent at which the same might reasonably be expected to let from year to year, free of all usual tenant's rates and taxes, and tithe commutation rent charges, if any, and deducting therefrom the probable average annual cost of the repairs, insurance, and other expenses, if any, necessary to maintain them in a state to command such rent. Provided always that nothing contained herein shall be construed to alter or affect the principles or different liabilities, if any, according to which different kinds of hereditaments are now by law rateable."

Although the above provision has been subjected to some modification in its application to the Metropolis, it may be stated broadly that "the net annual value," or "the rent at which premises may be reasonably expected to let from year to year," sometimes called the "hypothetical rent," is the groundwork of every rate. How, then, is this hypothetical rent determined? That is the problem with which every Assessment Committee has to deal, and which presents unusual difficulties in connection with buildings having valuable machinery within them.

It is another elementary principle of rating that chattels are not rateable *per se*. Hence it is not unnatural to find that occupiers of factories have contended from early times that the machinery upon their premises must not be taken into consideration by those who have to determine the rateable value. Machinery, it has been urged, resembles furniture and other movable chattels; nothing but the hereditament alone, which comprises the four walls of the factory, is to be regarded. Now it is obvious that if "factory and machinery" are to be included in the term "hereditament," the hypothetical rent is increased enormously, and the rateable value of property at the disposal of the Assessment Committee is enlarged *pari passu*. In these circumstances it is not surprising that the wider construction has been adopted by the Assessment Committees, Courts of Quarter Sessions, and the higher Court of Justice, upon which the duty of interpreting the above statute has very properly devolved.

The leading case upon the subject is the Tyne Boiler Works Co. v. Overseers of Longbenton.

The facts of this case, which may well be termed a leading authority, were shortly these: The appellants

(against a rate) were the occupiers of premises known as the Tyne Boiler Works. Certain machinery and plant of a heavy nature, including an engine, boiler, shafting, travelling cranes, and other machinery (the property of the appellants) had been placed upon the premises, and were required by the appellants for the purposes of boilermaking. They came under the same category as millstones in a mill, which would pass by a demise of the mill. The machinery in question could be moved and rearranged as desired. Some of the machines were not attached either to the soil or to the building; others were what are known as fixed machines. The Assessment Committee ascertained the rateable value of the premises by taking the gross estimated rental which a tenant from year to year might reasonably be expected to give for the use of them, inclusive of the machinery and plant, and by making the usual statutory deductions. The appellants contended that the machinery and plant were not any of them part of the freehold or hereditaments, but were chattels, and that they were not, nor were any of them, rateable, or to be taken into consideration as enhancing the rateable value of the premises. The Court of Appeal, however, refused to adopt this argument. The late Lord Esher thus expressed himself in giving judgment: "The rule as above enunciated has been recognised in Courts of Justice ever since 1886, but, although the rule is universally adopted, methods of applying it are not always identical. The reason for this lack of uniformity is not far to seek, if the rule itself is carefully examined. What does it amount to? It says: 'Machinery is to be taken into consideration for the purpose of enhancing the value of the premises; but there it stops. No criterion is given whereby the enhancing value of machinery is to be determined, and it is definitely laid down that machinery cannot be rated separately.' Thus the late Lord Justice Lopes, another member of the Court which decided the above case, said: 'It is clear that personal property, such as machinery, is not *per se* rateable.' A rule is laid down, but the method of applying it is not described.

The result is that there is no uniformity in the application of the law of rating to factories which contain valuable machinery. The state of things now existing is described in the phrase, *Quot homines tot sententia*, where *homines* represents Union Assessment Committees and *sententia* the various methods which they have adopted in order to render the owners of machinery rateable in respect of that property for the relief of the poor. It is a paradox that machinery should be declared not rateable, and that it should, at the same time, come into rating. But this is not the only anomaly in respect of which the present law requires amendment. It seems that if the Assessment Committee or other rating authority discloses the fact that in arriving at the rateable value of a factory it has valued the machinery separately, the rate will be declared invalid.

The most authoritative pronouncement of the law on this subject is to be found in the case of Kirby v. the Hunslet Union, which was tried before the Recorder of Leeds in April, 1904, and was finally adjudicated upon by the House of Lords on December 18th, 1905 (See 22. *The Times Law Reports*, page 167). The appellant was an occupier from year to year under an expired tenancy of some engineering works at Hunslet, at a rental of £28 per annum. He appealed against an assessment of £67 gross and £45 rateable value, the previous assessment being £29 and £22 respectively. The appellant contended that the value to the user of certain machinery in connection with the occupation of the premises ought not to be considered, but that the question of the benefit ought to be limited to the advan-

tage derived from the fact that the machinery afforded proof of the convenience of the building for the purpose of the business, and a possible value from the tenant being able to take it *in situ*. The respondents, on the other hand, said that the only way in which it could be properly taken into account was by taking the hereditament as found, furnished and equipped with the necessary machinery, and ascertaining what was the rent which the tenant from year to year would give for such premises as they stood, including, of course, the right to use what he found there. Two objections were raised to this: That it involved (a) the rating of machinery, and (b) that the tenant bought the machinery and had to pay the landlord rent for it. Upon these points the learned Recorder said: "I think the answer is that to take the value which machinery may add to the letting value of the premises is not to take the value of the machinery. The added rent has no relation to the value of the machinery. . . . The second point urged was that the tenant buys the machinery, and yet has to pay the landlord rent for it. I think this involves the consideration of the facts of the particular tenancy in question, which I think is fallacious. . . . I am of opinion, therefore, that the principle by which rateable value is to be ascertained is that in ascertaining the rent you must take into account the value of the machinery as contributing to the rental value of the freehold." In the event, he made the assessment £31 gross and £26 net. The case ultimately reached the House of Lords, where the opinion of the Recorder was adopted. Lord Halsbury said: "For half a century or more the judges have recognised the fact that, though the machinery is not so affixed as to become actually part of the land, yet if the whole premises are occupied with machinery in such a manner that the whole becomes a factory, the entire concern becomes a suitable subject of rating, and the machinery ought not to be disregarded in fixing the amount of the assessment."

In the case just mentioned, the learned Recorder had no option. He took the course which many another Recorder will take, namely, that of considering the valuation made by the appellants, and that made by the respondents, and taking the mean between them, guided, of course, by the opinions of the expert witnesses. Apparently all that a manufacturer can do to protect his interests under the existing law is to see that the machinery is not taken into account separately.

In another case (Greenwood & Batley, Ltd., v. Bramley Union) the method by which the overseers should endeavour to arrive at the rateable value was stated. The material facts were very brief. Messrs. Greenwood and Batley were rated in respect of their Albion Works at £10,134 gross and £6,050 net. They appealed against this rate on the ground that it was simply 5 per cent. of the estimated value of the buildings and machinery. The overseers denied that this method of arriving at the rateable value had been adopted.

The question for the Recorder was: How are machinery and buildings to be rated together? The firm pointed out that the value of the machinery *per se* was no criterion, because everything depended upon the adaptability of the premises for a particular machine. Here the premises were inconvenient and unsuitable, having regard to the processes carried on. The Recorder of Leeds, in giving judgment reducing the rate, said: "It is impossible to lay down a principle which will go anywhere near settling other cases which come up for decision; it is purely a practical question. I suggested in my original decision in the Hunslet case that in my judgment it was not a question of taking the capital value and getting a percentage upon it, and I am still of the opinion. What is the true determining factor in the case of rent which is to be added in consequence of the presence of machinery in a mill? That is a practical question. What extra amount will a practical tenant engaged in that particular trade when he comes to look at the premises, in his own mind, add to the rent by reason of the machinery which he sees upon the premises? One practical man has been called

here, namely, Mr. Maclaren. . . . He says that in his opinion the additional rent to be attributed to the machinery in this case would be, as he said in the first instance, about 100 per cent. He subsequently qualified that by putting £3,600 as the rent of the buildings. I take that as including the rent of the land. He adds £3,000 additional rent owing to the presence of the machinery. . . . This is a guide to me certainly in coming to a conclusion as to what, to the best of my judgment, is a proper additional rent. . . . In effect, he says: 'Add 80 per cent. to the value of the land.' I take £4,970 as the rent which would be given for the land and buildings. I add 80 per cent., namely, £3,976, as the amount by which the rent would be enhanced owing to the machinery. That makes a gross rateable value of £8,946. Deducting £4,074 for statables, the net rateable value is £4,872, and I reduce it to that amount with costs."

This is a decision which no manufacturer who is appealing against his rates can afford to ignore. The practical man is wanted to give evidence in rating cases where machinery is concerned.

We now come to the Scotch case which is referred to at the commencement of this article. That the matter was of some importance appears from the figures. The assessment of 18 steel works was in question. Their aggregate valuation in 1919 was £104,586. It was proposed to increase this figure to £336,394 for 1921. In the revised valuation cognisance was taken of the enormous developments which had taken place during the war period, but the ratepayers contended that the works would not stand, economically, rents corresponding to the assessors' valuation. With this larger question we are not here concerned. Indeed, the decision of the Commissioners upon them is not before us; what *are* of interest, however, are certain "rulings" as to the assessability of certain classes of machinery. In Scotland, by an Act passed in 1854, all machinery fixed or attached to any lands or heritages was made rateable, and by an Act passed in 1902, it was declared that, "in any building occupied for any trade, business or manufacturing process, the expression 'machinery fixed or attached' shall be construed as including all machinery, machines, or plant in or on the lands or heritages for producing or transmitting first motive power, or for heating or lighting such building, but, save as herein provided, shall not include machine tools, or appliances which are only so fixed that they can be removed from their place without necessitating the removal of any part of the building."

The following machines, &c., were declared to be assessable: Perforated plates lying on foundations; a large shearing machine; uprights and gantries for travelling cranes outside. The following were held not assessable: Sleeper flooring, loose plates laid on the floor or ground; sand bunkers; iron screens, loose rails, and iron rods; machinery or timber, brick, or concrete, even if held by a rag bolt; pivoted charging machinery, gantries, and travelling cranes inside. To electrical engineers the most interesting of these rulings are those which relate to motive power. The chairman said: "The turbine is assessable, the generator is not. As to the rotary converter, having given our decision on the motor generator, it might be thought that we could split the rotary converter, but we have decided we cannot, and the rotary converter is assessable. Lighting sets as such are assessable, but in connection with the light taken from a power plant, the amount which goes for lighting is so small in comparison with the whole that we cannot split it, and it is not assessable."

Whatever may be said as to the wisdom or propriety of rating machinery at all, it is at any rate satisfactory to have a definite catalogue of machines which are assessable. As has been shown by our review of the English law, machinery in England is taken into account by rating authorities, but in so vague and general a way that no machinery owner knows precisely where he is. Uncertainty, however, is not a characteristic of this point of the law of Scotland.

ELECTRICITY SUPPLY IN THE UNITED KINGDOM.

REPORT OF THE ELECTRICITY COMMISSIONERS.

(Continued from page 583.)

Sanction to Borrowing by Local Authority Undertakers.—Under the provisions of the Act of 1919 the powers formerly exercised by various departments with respect to the sanctioning of borrowing by local authorities in connection with the supply of electricity were transferred to the Electricity Commissioners. It is laid down, however, that in exercising the powers so transferred, the Commissioners shall act in consultation with the former sanctioning authorities. It appeared to the Commissioners that considerable inconvenience and delay would be caused if every application for sanction to borrowing were referred to the former sanctioning authority before a decision could be given. An arrangement was therefore entered into whereby consultation was limited to cases in which the electricity supply undertaking of a local authority involved a charge on the local rates, or where the proposed expenditure was likely to involve such a charge, and in the administrative County of London in certain other special cases. The practice and procedure followed by the former sanctioning authorities differed in many respects, and the first action taken by the Commissioners was to consider how far it was possible to secure uniformity in the treatment of applications received from various portions of the United Kingdom. In this connection, however, it was found that certain difficulties existed owing to the differences between the provisions of the Acts applicable to borrowing by the various local authorities.

After a full review of the past practice, the Commissioners decided to adopt as a general basis the principle of sanctioning separate repayment periods determined by the estimated life of the various assets concerned, and to simplify the system hitherto prevailing in England and Wales by grouping the assets and lessening the number of separate periods. After consultation with the Incorporated Municipal Electrical Association, the Commissioners fixed a scale of maximum periods for the repayment of loans, the main items of which are given in Table 3.

TABLE 3.—PERIODS ALLOWED FOR REPAYMENT OF LOANS.

Purpose of Expenditure.	Maximum Periods. Years.
Land:—	
Freehold	60a
Leasehold (subject to duration of lease)	30
Substantial buildings	30
Plant and machinery	20
H.p. trunk transmission mains	40a
Overhead lines	25
Mains and services	25
Meters	10
Wiring of premises	10
Apparatus to be let on hire	7-10

(a) Note.—Except in Scottish cases, for which the present maximum period is 30 years.

By reason of their powers as the loan sanctioning authority for electricity supply purposes, the Commissioners are in a position to exercise an important measure of control over the development of the electricity undertakings of local authorities, preventing as far as possible unnecessary expenditure, and safeguarding the interests of future ratepayers.

During the period January 31st, 1920, to March 31st, 1921, the Commissioners received 536 applications for sanction to borrowing by local authority undertakers, inclusive of applications transferred to the Commissioners from the former sanctioning authorities. Of these applications the Commissioners sanctioned 432, either in full or in part, and 29 others were refused or withdrawn, or transferred to other departments. Sanctions were issued to 204 out of the 284 local authorities owning electricity undertakings, i.e., to about 72 per cent. In view of their practical experience of the operation and requirements of electricity undertakings, the Commissioners as a rule found it unnecessary to hold Local Inquiries for the purpose of investigating applications for sanction to borrowing, thus saving public time and expense. In three cases, however, such Inquiries were held.

The Commissioners also received several applications for sanction to borrowing for the provision of working capital. They are only in a position to issue such sanction in Great Britain where local Acts contain definite provisions authorising borrowing for such a purpose. In the case of Irish local authorities such transactions do not require sanction. A complete list of the sanctions issued by the Commissioners up to March 31st, 1921, is given in an appendix to the Report. The total amount sanctioned was £15,181,298, the purposes for which this amount was to be expended being indicated in Table 4.

TABLE 4.—ANALYSIS OF LOANS SANCTIONED.
(Period January 31st, 1920, to March 31st, 1921.)

Purpose	Amount.	Percentage of total.
£		
Land	61,040	0.4
Buildings	1,267,742	8.3
Plant	9,805,500	64.6
Cooling towers	210,325	1.4
Mains and services	3,428,161	22.6
Meters	111,014	0.7
Other purposes	297,026	2.0
Total	15,181,298	100.0

The largest individual amounts sanctioned for mains and services were in respect of (a) Sheffield £280,000, (b) Manchester £263,000, (c) Leeds £190,000. In many cases the Commissioners were reluctantly obliged to sanction the borrowing of money for the installation of plant in small and uneconomical stations in order to enable the Local Authorities concerned to meet their statutory obligations, pending the availability of a bulk supply from a larger and better placed station. Such cases serve to emphasise the importance of expediting the improvement and reorganisation of electricity supply and the shutting down of uneconomical and badly placed stations, with the view of avoiding wasteful expenditure of capital.

Special Orders.—The substitution of Special Orders for Provisional Orders enables powers to be obtained at any time, and thus obviates the delay which frequently arose under Provisional Order procedure by reason of the necessity for publishing notices and lodging objections at stated times. The Commissioners prepared draft rules of procedure with respect to applications for Special Orders under the Act, and on August 10th, 1920, made statutory rules, which were laid before Parliament in accordance with the Act of 1919. The rules prescribe the mode of making application for a Special Order, the nature of the advertisements or notices to be published, the authorities and persons on whom copies of the notices must be served, the manner in which the draft Order should be prepared, the nature of the deposits to be lodged with the Commissioners and with other authorities, the procedure for lodging objections to the grant of an Order, the method to be followed in proving compliance with the Electricity (Supply) Acts and Rules, and the steps to be taken for giving public notice after the Order has been granted by the Commissioners. A fee of £35 is payable to the Commissioners to cover ordinary expenses in dealing with an application, and the applicants are also required to defray any additional expenses of the Commissioners consequent upon the necessity for holding an Inquiry or otherwise.

Four applications for Provisional Orders were transferred to the Commissioners by the Board of Trade, and were considered as if they had been applications for Special Orders, and orders were made for Panteg and St. Mellons (S. Wales Electrical Power Distribution Co.).

Up to March 31st, 1921, 38 applications were made to the Commissioners, of which a list is given in an appendix.

Orders were made in respect of Mynyddislwyn and Risca (Urban District Councils). Since March 31st ten further orders have been made.

It has been the policy of the Commissioners in dealing with applications for Special Orders to encourage well-considered schemes for the extension of distribution in areas where bulk supplies are readily available, but to discourage, as far as possible, schemes involving the establishment of small and uneconomical generating stations. In districts, however, where there is clearly a demand for electricity and no possibility of obtaining a bulk supply from another source, the establishment of a small station may be justifiable. The Commissioners have fully recognised the desirability of granting every facility for obtaining increased powers of distribution, with the view of encouraging development in areas at present without a supply of electricity.

Arrangements for Mutual Assistance and Bulk Supply Agreements.—Questions concerning the linking-up of undertakings for mutual assistance, and the giving and taking of bulk supplies, have figured prominently in applications made to the Commissioners in upwards of 80 different cases. It has been the consistent policy of the Commissioners to encourage and promote the taking of bulk supplies by local authority and company undertakers alike where this course has been ascertained to be both technically and economically justifiable. In many instances undertakers were advised or urged by the Commissioners to enter into negotiations for a bulk supply to meet pressing requirements, pending the installation of additional plant, or in preference to extending their existing generating stations. In a few cases only have undertakers shown reluctance in falling-in with the suggestions and advice of the Commissioners, and it has hitherto been unnecessary

for the Commissioners to exercise their powers under Section 19 of the Act of 1919, of requiring undertakers to enter into arrangements for mutual assistance. The Commissioners have approved of the following undertakers entering into, and carrying into effect, arrangements for mutual assistance:

(a) The Corporation of Birmingham, and the Shropshire, Worcestershire, and Staffordshire Electric Power Co.

(b) The Corporation of Bristol and the Keynsham Electric Light and Power Co., Ltd.

(c) The Corporations of Nelson and Colne.

(d) The Metropolitan Borough Council of Bermondsey and the London Electric Supply Corporation, Ltd.

(e) The Metropolitan Borough Council of Hammersmith and the Chiswick Electric Supply Corporation, Ltd.

(f) The Metropolitan Borough Council of Woolwich and the Urban District Council of Erith.

Other applications were still under consideration at March 31st. Special reference may be made to applications in respect of the following undertakers:

(a) The Corporation of Manchester and the Lancashire Electric Power Co.

(b) The Corporation of Wolverhampton and the Urban District Council of Cannock.*

(c) The Corporations of Blackburn and Darwen.†

(d) The Corporations of Leeds and Morley.‡

Under Section 3 of the London Electric Supply Act, 1908, the Commissioners have approved of the following undertakers entering into, and carrying into effect, agreements for mutual assistance or for association:

(a) The Metropolitan Borough Councils of Battersea, Fulham, and Hammersmith.

(b) The Metropolitan Borough Councils of Hackney and Shoreditch.

The Commissioners have also approved of the following undertakers entering into, and carrying into effect, agreements under private Acts:

(a) The Corporations of Manchester and Stockport.

(b) The Corporation of Wolverhampton and the Midland Electric Corporation for Power Distribution, Ltd.

Fringe Orders.—During the period January 31st, 1920, to March 31st, 1921, the Commissioners granted 70 Fringe Orders, and further applications were under consideration. A list of the authorised undertakers to whom orders were granted is given in an appendix.

Standardisation of Frequency.—The Commissioners recognised that financial considerations alone rendered it impracticable at the present time to contemplate a complete change-over to a standard frequency of 50 cycles per second in areas containing extensive developments at 40 and 25 cycles.

The Commissioners called an informal conference of engineers, at which the consensus of opinion was that it was outside the bounds of practical politics for the Commissioners to bring about the adoption in the near future of one standard frequency throughout the country, and that the most that could be attempted at present was to aim at standardising the frequency in particular districts. The Commissioners decided that it should be their policy to bring about the elimination of all odd frequencies, with the object of effecting a gradual consolidation of the prevalent frequencies in various districts, and of reducing the number of main frequencies in use to three, namely, 50 (standard), 40, and 25 cycles per second.

Systems of Supply and Regulations.—For the guidance of undertakers who desired to adopt a system requiring special approval, the Board of Trade drew up a model form of description, and this was provisionally adopted by the Commissioners. At a later stage the Commissioners made further provision in the model description for systems of supply at extra high pressure (voltages exceeding 3,000 volts) with regard to the methods allowable for the protection of mains laid in the ground. They also provisionally adopted the standard codes of Regulations made by the Board of Trade for ensuring a proper and sufficient supply of electricity, and for securing the safety of the public, including regulations with regard to the construction and maintenance of overhead lines. The provisions embodied in these codes, however, were subsequently reviewed by the Commissioners, who came to the conclusion that from the standpoint of present technical practice, revision and simplification of the codes were desirable. A draft code of revised regulations for securing the safety of the public, and for ensuring a proper and sufficient supply of electricity, was accordingly prepared by the Commissioners, and copies were forwarded to the Institution of Electrical Engineers. At the same time a draft of Regulations for the Committee of that Institution were invited on the draft. The question of revising the regulations with regard to overhead lines is still under consideration.

The Commissioners approved the adoption of special systems of supply in the case of 15 applications, and other applications are under consideration. A complete list of approvals is given in an appendix. Special reference may be made to the adoption of a system of 110,000 volts for the transmission of energy from Woolwich to Erith, and of a pressure of 66,000 volts for the transmission of energy between generating stations and substations in the areas of supply of the New-

castle-upon-Tyne Electric Supply Co., Ltd., the Cleveland and Durham County Electric Power Co., and the County of Durham Electric Power Supply Co.

The Commissioners have given their consent to the following three undertakers altering the declared system or pressure of the supply hitherto adopted for the purposes of the undertakings, namely, the Corporations of Huddersfield, Tynemouth, and Rotherham (in respect of the Rawmarsh Electric Lighting Order, 1898).

The Commissioners have served notices, and prescribed regulations for securing the safety of the public and for the protection of the electric lines and works of the Postmaster-General, on 30 owners specified in an appendix, who have laid down or erected electric lines and works without statutory authority in the districts indicated.

Accounts, Statistics and Returns. The Commissioners adopted and prescribed an amended form for the use of Electric Power Supply Companies authorised under Special Acts to supply in bulk and for power purposes.

The non-existence at the outbreak of war of really adequate official statistics relating to electricity undertakings in the United Kingdom was responsible for a great expenditure of time and effort on the part of the Government to secure the proper utilisation and allocation of the resources of the country. They came to the conclusion that the compilation of an annual official return was essential, and an appropriate annual questionnaire form was prepared covering such administrative, engineering, and financial particulars as experience had shown would be necessary for dealing properly with the various applications and problems under consideration. Copies of the draft form were circulated to the associations concerned, and their observations were invited. This matter had not been finally settled by March 31st.

All authorised undertakers are now required to furnish to the Commissioners every four weeks a return as to units generated, fuel consumption, &c. Returns of a similar character were instituted by the Coal Controller during the war, and in view of their utility were continued by the Electric Power Supply Department of the Board of Trade, pending the setting-up of the Electricity Commission. The new form issued in respect of the year 1921-22 contains provision for data as to stocks of fuel in hand, the utility, in an emergency, of the information returned under this heading being apparent. These returns are of considerable help to the Commissioners in dealing with various classes of applications and enable them to ascertain periodically the position with regard to the output and working of an authorised undertaking. An analysis and summary of the returns for the year ending March 31st is being compiled by the Commissioners. A table compiled from the returns in question shows that the total output of 421 electricity supply stations and 80 railway and tramway stations and non-statutory undertakings was over 5,000 million kWh, and the total coal and coke consumed was 7.36 million tons.

(To be continued.)

THE ELECTRICAL POWER ENGINEERS' ASSOCIATION.

ANNUAL DINNER.

ON October 29th the members of the Southern Division of the Electrical Power Engineers' Association gave their third annual dinner to the National Executive Council, at the Hotel Cecil. Mr. J. H. Parker, the retiring President, was in the chair, and among a number of visitors were Mr. A. Page, one of H.M. Electricity Commissioners, and Mr. W. Wyld, lately chief electrical engineer to the Hampstead Corporation.

An excellent menu was arranged, and after dinner Mr. Page rose and proposed the toast of "The Association." He said that the Electricity Commissioners earnestly desired to keep in close touch with all movements in the industry, and it gave him pleasure to be present at this function of the E.P.E.A. The Association and the Commissioners were on common ground, both having as their aim the advancement of the electrical industry. Such an Association was absolutely necessary to raise the status of the electrical engineer. He recalled that when he, as a fully-trained engineer, received his first appointment he was rewarded with the miserable pittance of ten shillings a week, a state of affairs that called for a great deal of pioneer work which the Association had splendidly carried out. In this connection he paid tribute to the labours of Messrs. Lunn, Parker, Heslop, Jones, Thomas and Oswald, among others. The policy of the Association was based upon Whitleyism and all that it meant, the entrenchment of reason as against "hot-headedness" and strikes. Such a policy could not fail to receive public support. Loyalty to the Executive was a factor of success, and he predicted a great future for the E.P.E.A. Touching upon unemployment, Mr. Page said there was no remedy, and the only possible palliative was that each industry should take care of its unemployed. He hoped that now that the Institution of Electrical Engineers had received its Charter, all situations in the industry worth having would be reserved for its members. He congratulated the Association upon its journal, which he thought

* Approval given on July 14th, 1921.

† Approval given on May 7th, 1921.

‡ Approval given on April 2nd, 1921.

was capable of doing valuable work. With regard to the proposed agreement with the E.T.U., he supposed that something of the sort was unavoidable, but he warned the members not to sell their birthright and to still retain the right to stand aside if they considered any issue not just. The speaker was glad to observe that, notwithstanding the existing industrial depression, the output of the country's power stations was increasing. Prospects were very bright; the domestic side of supply had hardly been touched, and large railway electrification schemes were being projected. The task of the Electricity Commissioners was not an easy one, and they depended entirely upon the confidence of the industry. They had been endowed with superhuman powers to institute a "cheap and abundant supply of electricity," but if the Association increased the supply of competent engineers, their task would be lightened and the Association would justify its existence.

Mr. W. J. Jeffery, in a humorous speech, proposed the health of "The Ladies," and hoped that he would soon see lady members of the Association.

Mr. W. J. Oswald then proposed the toast of "The Visitors." He first mentioned the National Executive Council, and explained that as a member of that Council he was in a peculiar position, and could neither praise nor blame. The policy of the Association was formulated by Mr. Lunn, and that policy was still in force. He voiced the members' appreciation of the presence of Mr. Page, and said that the Association could do a great deal in co-operation with the Commissioners to benefit the industry. The Commissioners were sorely handicapped by political interference, but they were overcoming all obstructions. The electrical industry should not be a pawn in national or local politics. He deprecated the "Be-good-boys-and-carry-on" attitude of the chief engineers when the E.P.E.A. was formed, and he felt that to make the movement a complete success the Association should embrace everybody in the profession from the "chief" to the shift engineer. The speaker expressed his appreciation of the work done by the National Joint Board, and spoke of the reasonable attitude adopted by the majority of employers. He asked for the support of contractors and manufacturers to the Association's efforts to develop the technical side of the industry.

Mr. J. H. Heslop then made a presentation of a gramophone, a clock and a wristlet watch to Mr. and Mrs. Parker. He said that Mr. Parker was the finest man he had ever met, and had rendered inestimable services to the Association. Mrs. Parker, too, had sacrificed her husband to their cause. It was largely due to Mr. Parker's patience and persistence that the Schedule had been adopted all over the country. Messrs. Thomsen, Oswald, and Lunn associated themselves with the testimony of Mr. Heslop. Mr. Parker briefly thanked the members for their gifts, and desired the credit to be spread over the whole of the N.E.C. and the Emergency Committee.

Responses to the toast of "The Visitors" were made by Messrs. W. Wyld and A. L. Lunn, and Mrs. Parker responded for the ladies in a few well-chosen words.

Mr. Heslop, the newly-elected President, then answered for the Association. Speaking of the difficulties encountered by the Electricity Commissioners, he remarked that the Electricity (Supply) Act had been framed first for the benefit of the lawyers and then for that of the community. He assured the Commissioners that they would have the aid of the E.P.E.A. in all their undertakings. The agreement with the E.T.U. was imperative. The manual workers had similar problems to their own, and mutual support was essential. To call it an "E.T.U." agreement was a misnomer, for it was an arrangement they wished to make with all associated unions, as well as the Chief Engineers' Association. Mr. Heslop claimed that the fact that there had been no serious stoppage of supply in this country was due largely to the Association's influence. The E.P.E.A. intended to exert all its efforts to secure the retention of the wage boards, and they were glad that they had the Commissioners' support in this direction. Regarding unemployment, he said that there were always depreciation and renewal funds for plant, but nothing of the kind for labour. This should not be; employers should not be permitted to use labour for as long as it suited them and then cast it off. He hoped that employers would soon realise their responsibility in this regard.

Interspersed with the toasts and responses were a number of excellent concert items, rendered by the Misses Hunt, Miss Betty Bunch, Miss Marie Fien and Messrs. Rayson-Cole and Jack Walker.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

ANNUAL FESTIVAL DINNER.

On Wednesday last week the annual Festival Dinner of this Institution was held at the Trocadero Restaurant; Sir Tom Callender, J.P., presided, and for the first time the presence of ladies graced the proceedings. Amongst those present were Lady Callender, Sir William and Lady Noble, Mr. and Mrs. L. B. Atkinson, Mr. W. W. Lackie, Mr. G. Sutton, Mr. J. Y.

Fletcher, Lt.-Col. H. M. Leaf, Capt. R. J. Wallis-Jones, Mr. P. V. Hunter, Dr. H. F. Parshall, Mr. W. A. Chamen, Mr. E. W. Monkhouse, Mr. and Mrs. W. B. Esson, Mr. and Mrs. R. W. Hughman, Mr. H. Bavis, Mr. H. H. Berry, and many other well-known supporters of the Institution.

After the loyal toast, the president said that letters regretting inability to attend had been received from Sir David Salomons (president of the Institution), Mr. H. J. Cash, Dr. S. Z. de Ferranti, Mr. H. Hirst, Mr. E. Manville, M.P., and many other friends.

Introducing the toast of "The Electrical Trades Benevolent Institution," Sir Tom Callender said that it was established with the primary object of granting pensions to necessitous persons, and the fact that so far no occasion had arisen for that purpose spoke well for the electrical industry. But the day would surely come when pensions would be called for, and they were endeavouring while the sun shone to provide for the rainy day. Up to the present the funds amounted to £15,700—a nice beginning, bringing in £700 a year, which met the expenses and helped to swell the total. The Institution also gave allowances in deserving cases; this year they amounted to £52—which again spoke well for the industry. No worthy case was turned away. The benevolent fund of the I.E.E. was applicable only to members of that Institution; theirs applied to persons who were deeply interested in the industry—members of staff, managers, &c. The two Institutions worked hand in hand without clashing of interests, one usefully supplementing the other. Appealing to the audience with confidence to add to the list of donors, Sir Tom invited the vice-chairmen, Sir William Noble and Mr. L. B. Atkinson, to support his appeal.

Sir William Noble, remarking that the department of which he was the head was one of the best customers of the electrical trades, said that as a civil servant he was entitled to a pension, as were his colleagues, but he knew a great deal about benevolent institutions, for they were necessary even in Government service. After citing instances in point, he said that in 1907 he called a meeting of the staff of the London district (of which he was then in charge), and a benevolent fund was formed, which had done a great deal of good. Some 85,000 Post Office officials joined the Forces in the war, and the Post Office Relief Fund was formed in 1914, which between that time and 1918 raised nearly £450,000; 9,000 men were killed and many thousands wounded, and the fund, which maintained two hospitals and three convalescent homes, provided for the needs of the widows and orphans, and sent a parcel to every prisoner of war every week. There were still 3,000 widows and 5,000 children on its books, and many of the orphans were educated and maintained by the fund.

Mr. L. B. Atkinson, expressing his pleasure in supporting everybody's friend—Sir Tom Callender—drew a parallel between the vicissitudes through which the individual passed and those which the industry itself had experienced within a year. Last year trade was booming—now it was in the trough of depression; they ought to have large funds, but no one had any money. They should learn a lesson from that instance of the unexpected changes that might take place in the career of anyone, and to exert every effort now to build up the funds. The engineering trades were carried on largely by big companies which had their own pension and relief funds, and these kept many cases off the funds of the E.T.B.I., so that the small payments made did not represent the real proportion of casualties. That night ladies were present for the first time; "charity begins at home," and as they had brought the best part of their homes with them, the conditions were favourable to the success of the fund.

Mr. Lee Matthews proposed the toast of "The Ladies," to which Lady Callender responded, remarking that she was not sure the invitation was disinterested; no doubt the ladies would use their influence with their husbands on behalf of that worthy fund, and she hoped there would be a splendid response.

Mr. J. Y. Fletcher pointed out that previously they had always met when unemployment was low, that day it was at its maximum, and they were certain to receive calls for aid. Hence they were especially grateful to Sir Tom Callender, whose presidency would ensure a result otherwise unattainable. He proposed the health of Sir Tom, which was accorded musical honours. Returning thanks, Sir Tom Callender expressed his indebtedness to the able assistance of the hon. secretary, Mr. Hawes, and announced the result of the Festival—£410 13s.—which with the amount collected made a total of £1,280, and would be brought up to more than £1,300 before the list was closed.

Sir Tom proposed the health of Mr. F. B. O. Hawes, whose onerous duties carried nothing with them but hard work, and Mr. Hawes, in reply, expressed the great pleasure it had given him to work for the Institution during the past 13 years. The total income when he began was 50 per cent. less than the income from investments now, but £15,000 was not nearly adequate—the fund ought to be 10 times as great. However, they could not but be satisfied with its steady growth.

During the evening musical entertainment was provided by Miss Violet Openshaw, Mr. Edward Dykes, and Mr. C. T. Sterndale Bennett, accompanied by Mr. Bernard Flanders, A.R.A.M. The function ranked as one of the most successful in the history of the Institution.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A 10-ton Pulley Drawer.

The work of taking pulleys off shafts is, as a rule, a tedious and dangerous business, and consequently many ingenious devices are employed to get over the difficulties encountered. Most of these are "rigged up" for the special occasion, but the AUTOMATIC MACHINERY CO., 28, New Union Street, Ancoats, Manchester, has recently introduced an appliance for the purpose which should prove a valuable addition to the equipment of the machine shop or other establishments in which keyed pulleys are employed. This is the "Rightway" drawer (fig. 1), which has a pull of ten tons simply applied. It consists of three equidistant bars fitted into a central block through which passes a thrust bolt. These bars are serrated, and in the indentations fit the links of chains upon the ends of which are claws. These claws are attached to the rear face of the pulley, while the pull is applied by means of the thrust bolt, and is evenly distributed. If the pulley is held

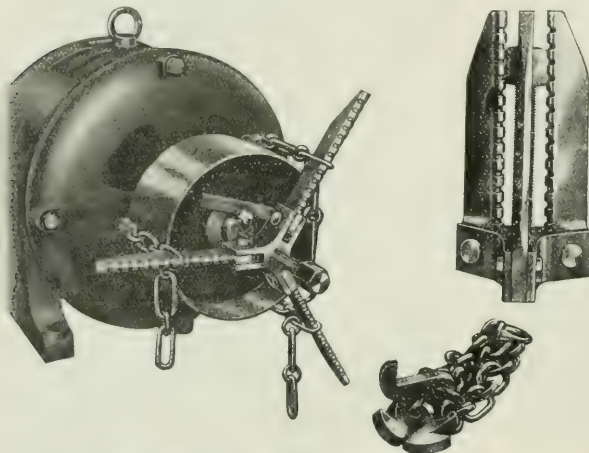


FIG. 1.—A 10-TON PULLEY DRAWER.

by a gib-headed key, a metal bar can be inserted, as shown in the illustration. The serrated bars are so fitted that they can be folded up into a small space when the appliance is not in use, as shown in the figure.

Porcelain Handles with Quick-Break Links.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., have recently put on the market a very useful form of quick-break disconnecting link. consist of a copper link fitted with an auxiliary blade or flicker at both ends, the whole being mounted in a heavy porcelain carrier which is interchangeable with the well-known shrouded fuse carriers manufactured by this company. The arrangement provides a simple means of disconnecting under load, where it is impossible to use quick-

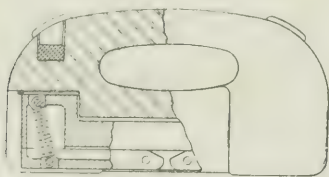


FIG. 2.—PORCELAIN HANDLE WITH Q.B. LINK.

break knife switches owing to a lack of space, as, for instance, in feeder pillars and sub-stations, where the saving of space is an important item. These patent quick-break disconnecting links can be supplied from stock in all sizes from 60 A to 500 A for use on 500-V circuits. Messrs. Henley's are prepared to send a complete sample link for demonstration purposes to any enquirer interested.

The "Aiolite" Power Set.

MESSRS. P. & M. MURPHY, LTD., Clutha Works, Glasgow, have put on the market a "Aiolite" plant for the utilisation of wind power for the generation of electricity. This set (fig. 3) consists of a circular wind turbine 14 ft in

diameter, mounted on a tower, driving a dynamo through suitable gearing. This dynamo is wound to give a constant voltage under varying wind velocities. An accumulator battery forms part of the set, and an automatic switchboard maintains the charge or cuts the battery out as necessary. The capacity of the battery is 120 Ah. The dynamo has an output of 30 A at a pressure of 50 V.

A governor is fitted which throws out the driving gear should the wind velocity be too high.



FIG. 3.—THE "AIOLITE" POWER SET.

This set would seem to provide an economical means of generating electricity for isolated buildings where the wind power is sufficiently great to drive the dynamo for about eight hours a day.

A New Method of Shop Window Lighting.

At night, when all the windows in a locality are similarly lighted, individual distinction is apt to be submerged in the collective brilliance. In colour, however, lies the salvation

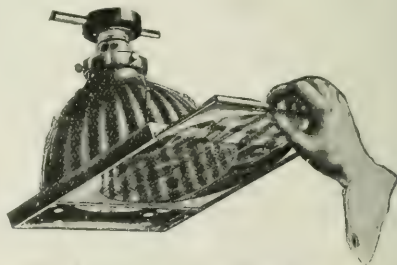


FIG. 4.—B.T.H. X-COLOUR-RAY ATTACHMENT.

of the lighting individualist. The judicious use of coloured illumination can be made to emphasise the message and purpose of a display flooded with a warm amber light. A window enhances the appearance of the goods displayed.

Nobody will dispute the psychological value of coloured lighting, and now a device has been introduced whereby the efficient illumination of shop windows by means of colour slides may be effected.

This device is the "X-colour-ray" attachment, which both in design and construction is the essence of simplicity. The attachment consists of frame, slide, and colour medium. The frame fits over a "Jove" or "Jupiter" "X-ray" reflector, and is attached to the latter by means of four hooks which fix

in the ventilation holes. The slide is made to hold the gelatine colour medium (the only medium that does not rapidly fade) supporting it by means of fine steel wires. Red, amber, blue, and green are the standard colours provided, and an important feature of the attachment is that the colour of the lighting can be changed in a few seconds by the substitution of one slide for another (fig. 4). Thus the trader is able to alter the appearance of his display as often as he likes. The contrivance can be placed in position without the aid of any tools, and the metal part of the frame in no way interferes with the lighting effect. When the ordinary white light is required, it is not necessary to remove the frame; only the slide need be taken out. Ample ventilation is provided and fire risks are entirely obviated. At least one of the largest London stores has already installed the "X-colour-ray" attachment with complete success. Further information can be obtained from the BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, London, E.C. 4.

REVIEWS.

Electric Motor Installations: Their Upkeep and Lay-out. (The Vulcan Engineering Manuals.) Pp. 112; 65 figs. Manchester: Vulcan Boiler & General Insurance Co., Ltd. Price 2s. 6d. net.

This manual, according to the introduction, is intended to be a guide for users and prospective users of electrical machinery to: "(1) The class and type of motor and accessories to be installed in various cases. (2) The attention required." Further, it is considered necessary "to explain the general principles and to define the various terms used in common practice."

The work is divided into eleven chapters, the first two consisting of elementary electricity and magnetism including hydraulic analogy and some general constructional details. Similar matter has existed since Victorian days in countless text and pocket books and in trade "literature." The latter half of the second chapter discourses on the H.O. regulations, and finishes by inviting the reader to study them for himself.

In Chapter 3 four pages are taken up by explaining what a starter is, how it works, and how to use it, half a page is given to speed regulation, and the same amount of space to earthing, or, rather, bonding, as earthing is not mentioned.

Chapter 4 consists of five pages, boiling down to: Choose the right size and type of motor, keep it clean and dry, don't use too much oil or let the bearings wear low.

Chapter 5 is given up to d.c. breakdowns, some good photographs being reproduced. If the machines described were inspected regularly, it looks as if four of the breakdowns could have been avoided.

Chapters 6 and 7 are on somewhat similar lines to the first two chapters, but deal with a.c. The statement that the single-phase repulsion induction motor is not now generally made is incorrect. This type of motor is made by several firms, and is in many respects the finest single-phase machine obtainable.

The next two chapters deal with starting and speed regulation respectively, the subject being dealt with in a general and discursive manner. Two-phase starters are not mentioned. A pulley combined with a clutch is shown, but no information is given as to how it works.

Chapter 10 is devoted to breakdowns of a.c. motors, the photographs showing typical troubles as clearly as it is possible to do so.

The book concludes with five pages on the lay-out of a motor installation. The chief item is the suggestion for finding the size of motor required—namely, to install a temporary machine and take readings.

The title of the manual is misleading as, apart from the chapters on breakdowns, the photographs therein speaking louder than words, it is largely made up of elementary principles and generalities.

The problems connected with the lay-out and operation of electric motor installations are hardly touched upon.

A number of the illustrations and a portion of the text appeared in a small handbook, issued by the same company some years ago.—E. F.

Foreign Trade Tables. By A. J. LAWSON, M.Inst.C.E. Third edition. Pp. xviii+561. London: Thomas Skinner and Co. Price 21s. net.

In our issue of May 17th, 1918, we reviewed the first edition of Mr. A. J. Lawson's tables of metric weights and measures and British equivalents, which was then a book of 200 pages, and was published at 5s. net; we now welcome the third edition, revised and trebled in size, and under a new title. Its sub-title is "Metric Weights and Measures and British Equivalents, Engineering Data, Prices in British and Foreign Money, Exchange, Gold Standards and Currencies, Interest, Depreciation." The book is issued by the British-Italian Corporation, Ltd., whose managing director, Mr. George Manzi

Fà, draws attention to the loss of trade which results from our adherence to complicated non-decimal currency and weights and measures; he points out that the British trader can send a copy of this work to his foreign customer, to enable him to convert British quotations into his own units at the current rate of exchange; or he can quote to the foreigner in the latter's own currency at gold par exchange by mere inspection of one table. Moreover, the author has decimalised the pound and compiled tables which give prices from ¼d. to £10 for each unit of measurement, so that one "can read direct from these tables the corresponding prices at gold par per metric unit in each of a number of foreign currencies," which can be converted by simple multiplication with a factor in another table into "the price at any rate of exchange." New tables give equivalent prices in European, Eastern, and Latin-American currencies for metric weights and measures corresponding to British prices for British weights and measures, enabling users to quote prices directly from the tables without calculation; other new tables give reciprocal values of British and foreign moneys at any rate of exchange.

This remarkable volume represents an enormous amount of labour; in addition to compiling the new tables, the author has again checked the figures in the existing tables. The full significance of this remark can only be gained from a perusal of the pages, containing a mass of items which in many cases run to nine significant figures. In a concluding paragraph he says: "It has involved long and careful research, much computation and difficulty of arrangement in proper sequence and convenient form, added to which, troubles of eyesight have made proof-reading at times a painful ordeal. But on the whole it has been a labour of love . . ." and in congratulating him upon the excellence of the achievement, we tender our sympathy in respect of the physical handicap under which he has laboured.

This volume is by far the most comprehensive work of its kind that we have met with. Every need that can be foreseen has been provided for. For example, after tables giving interest on capital from 1 to 10,000 (pounds or other monetary units) at rates varying from ½ to 10 per cent. by eighths, a table is given of multipliers for the reduction of interest per annum to interest for any required number of days; and a separate table is given for leap years. Another table gives the number of days between any two dates in a year. The same precision and forethought are characteristic of the rest of the contents. The price tables cover the majority of currencies of interest to traders. Conversion tables for apothecaries' weights and measures, and a variety of engineering tables and data are given. The more we study the book, the more we are impressed with its scope and value. Many examples illustrating the uses of the tables are given in the text, together with a wealth of information of a descriptive, critical, or explanatory nature. The author outlines the position regarding the adoption of decimal coinage in this country, and points out that the penny has completely lost its standing as the coin alleged to be the most widely used and the most dangerous to alter. In a lengthy appendix a great variety of information on subjects relating to British trade and finance is given, which alone would deserve a detailed review. The book is one which ought to find a place at the hand of every manufacturer, merchant, or banker interested in trade with overseas countries.

The Electrical Handling of Materials. A manual in four volumes on the design, construction, and application of cranes, conveyors, hoists, and elevators. Vol. II.—Structural work. By H. H. BROUGHTON, M.Inst.M.E., M.I.E.E., &c. Pp. xvi + 292; 358 figs. London: Benn Brothers, Ltd. Price 25s. net.

This book, as we are told in the preface, is a revised edition of the author's book on "Electric Cranes and Hoists," and with the exception of the sections devoted to cranes the whole of the matter is new. Vol. I deals with electrical equipment. Vol. II deals with structural steelwork and mechanical equipment (the present volume), while cranes and crane mechanism are considered in Vol. III, and the machinery used in the mechanical handling of materials, and the methods of handling and storing materials in Vol. IV.

The present work deals with structural steelwork in the first three chapters, covering one-third of the book, while the remaining two-thirds is divided into another 15 chapters devoted to spur and worm gearing, gear arrangements, variable speed transmission gear, transmission chains, axles, bearings, lifting tackle, winding drums, brake gear, &c., and judging by the present book, the whole work must be a tremendous undertaking. It is a very practical collection of formulae, data, and tables, interspersed with worked-out examples showing the use of the formulae, which will prove of great assistance to the student in this class of work, a great feature being the graphical diagrams of stresses. No attempt is made to deal with the theory of the strength of materials, or the elements of machine design, but the authority or source of the formulae is quoted in all cases. The book is also well illustrated, with a number of folding plates showing details of structural work and equipment taken from actual practice, and generally the book is thoroughly up to date, and will be found a most useful work for those engaged or interested in this important branch of engineering.

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THE I.E.E. PRESIDENTIAL ADDRESS.

THE Institution of Electrical Engineers, amongst its many other excellent features, is distinguished by the uniformly high standard attained by its successive Presidents in their inaugural addresses; these are invariably interesting and instructive, and sometimes even epoch-making. The address which Mr. J. S. Highfield delivered on Thursday last week was no exception to this rule; it touched upon a wide range of subjects, and illuminated every topic that was dealt with.

Naturally, the acquisition of the Royal Charter was given prominence at an early stage in the Address, and in leading up to this the President justly emphasised the merits of the constitution which has been slowly evolved by the Institution—a constitution which is a model of its kind, and which, we believe, is far in advance of that of any other Institution of similar standing and composition, combining, as it does, the advantages of centralised government with the largest possible measure of local autonomy and responsibility. The Institution rests upon the broad foundation of its Territorial Centres and their Sub-Centres, each a focus of activity, and all contributing to the common good of the Institution as a whole; the system has succeeded well in the past, but we believe its possibilities are far from being exhausted. The main theme, however, of the address was the meaning and rightful use of "profit," a term which, as Mr. Highfield remarked, had been misunderstood and misapplied by many who made use of it; it was discussed in its relation to the individual, to the public company, to the municipality, and inferentially to the nation as a whole. It may be news to many outside the circle of Mr. Highfield's more intimate acquaintances that while he is best known as a successful engineer, he has also made a special study of the commercial problems with which engineering is almost always inseparably associated, and is thus enabled to pierce through the mists of popular prejudice and to see clearly the principles of sound finance in their true bearings. But he takes a far broader view of the subject than to restrict it to finance and commerce; he applies its doctrines to life itself, and thus he treated at length of education, to which he attached the greatest importance (the right kind of education, of course), especially emphasising the necessity of imparting skill in some art or other to the learner. By "education" Mr. Highfield denotes "all up-bringing, the formation of character, the means of health both of body and mind, the Christian virtues, the love of work, the need of service, and the sacrifice, called duty, that alone should win us rights"—a happy summary of qualities which can be acquired only when the individual makes a "profit."

To this end Mr. Highfield lustily attacked that unfortunate policy of the trade unions which turns a blind eye to merit and ability, and ordains that all men in the same category shall be paid alike; he claimed that every man should be free to work as skilfully and as hard as he liked, and to attain a due reward for his labour—a claim which we cordially endorse.

Turning to the more ordinary and narrower use of the term "profit," Mr. Highfield treated the subject in masterly fashion, showing how, for instance, the business of electricity supply should be conducted on sound lines, whether in private hands or in those of a municipality. We are pleased to see that in Mr. Highfield's opinion, after all due allowances have been made and a reasonable dividend has been paid on the ordinary

shares of a company, any sum that is left over may be called profit, and "should be employed equally to benefit those who direct and work the business, the shareholders who bear the risk, the consumer by way of a reduction in price, and lastly, some share for the business itself"—the last-named portion being available for research in new methods and in new ventures. The importance of making a profit, which is essential to progress, was strongly emphasised, and Mr. Highfield deplored the attitude of mind which, by placing obstacles in the path of private enterprise in the past, had delayed the development of electricity supply in this country. On the other hand, he showed that the advantages enjoyed by municipalities in raising money were largely neutralised by the necessity of providing for repayment of loans and reserve. Some companies and municipalities had misused their profits, the former by paying too high dividends, and the latter by distributing the profits in the form of relief to the rates.

Mr. Highfield struck a responsive note when he said that "progress in electricity supply rests first on a general determination to cease talking and to get to work." Whilst expressing confidence in the Electricity Commissioners, he regretted that they had been burdened with executive duties, and uttered a broad hint that they were showing symptoms of suffering from the red-tape disease which is so highly contagious in Government departments. In order to speed up progress, he urged that the prevalent feeling of uncertainty as to the future created by the Act of 1919 should be dispelled by clear proof that the existing rights of companies and municipalities would be respected—a policy with which we most heartily agree—and that both parties should join hands in promoting the development of electricity supply, thus endorsing the exhortation of Major Richardson at the last I.M.E.A. conference, which we welcomed at the time. Lastly, Mr. Highfield made the revolutionary suggestion that the purchase clause in Provisional Orders should be abrogated: "No single change would do more to promote enterprise and to supply the public at the least cost." Unhappily this can be done only by consent of the municipalities, and we fear it is hardly within the scope of practical politics.

In this brief review we have touched only a few points of the President's interesting and stimulating address; it is replete with original and fertilising ideas, and should be read by all who belong to the electrical industry.

The Urgent Need for Postal Rates Reform.

IF the Postmaster-General and the Government seriously regard the high postage rates as a handicap to the efforts of those who are working to bring about, or to accelerate the rate of, trade revival, it is surely the height of folly to allow the halter to hang about the neck of industry one day longer than is absolutely necessary. The Postmaster-General has recognised the unpopularity of the high rates which were introduced before trade depression had gone so far as it has recently done, but apparently all he can do is to hold out hope of a modification at the end of the financial year. We would re-echo the question of *The Times*: "Why wait till March?" and would strongly support the view of Lord Blyth, who says that modification six months hence is not sufficient, and who calls for the revocation of the recent imposts "roof and branch" forthwith. The higher rates for letter post at home, for printed matter, and for foreign letters, and the obstruction put in the path of the free flow of correspondence and trade by the stoppage of the Sunday collection and delivery, are, considered from the national trade development standpoint, false economy, penny wise and pound foolish. At a time when we require to avail ourselves of every means at our disposal which forms a legitimate vehicle for the circulation of British trade propaganda—the distribution of trade journals, catalogues, price lists, and other literature, and the

free flow of correspondence both at home and in the markets abroad where we are seeking business—the leash held by the Postmaster-General should be released, and the manufacturer and the merchant should be encouraged instead of obstructed. As Lord Blyth points out, cheap postage is wholly productive "and its adoption would assuredly yield to our people ever-increasing millions in ever-expanding trade." The Association of Chambers of Commerce discussed the subject at Sheffield, and urged by resolution that the Post Office direct its efforts to the cheapening of the letter post and the parcel post and postcards and the telegraphic and telephonic services, and to other means whereby manufacturers and merchants would be materially assisted in the re-establishment of trade, "in view of the existing financial state of the country." Mr. W. H. Burchell, in a very telling letter to *The Times* reviewing the position from the point of view of unemployment, says that the master printers of the United Kingdom and 544 heads of leading London industrial firms are convinced that if the P.M.G. could be induced immediately to re-establish the halfpenny postal rate on printed matter he would have cleared up at least one phase of the unemployment question. He remarks that every week of delay means a loss of £500,000 to labour or £26,000,000 per annum! But we need not quote more authorities, for the trading and industrial communities are unanimous in the conviction that the revenue that the State may gain by maintaining the recent increases will be lost many times over immediately by unemployment due to the existence of the handicap, and that we shall permanently lose to foreign rivals business which ought to provide our people with bread for years to come. Government control of industry and trade is a throttling influence, while spoon-fed industries are unlikely to be sound and progressive, but there is a legitimate sphere within which the Government can operate, giving real and permanent encouragement to national trade. It has no more powerful weapon to put into the hands of industry than the cheapest means of communication, internal, between the people of these islands, and external, between ourselves and our kith and kin and all the dwellers abroad who are potential purchasers of our manufactured products—cheap transmission of letters and parcels, of trade journals (alias trade-getters), and of catalogues and price lists; and cheap transmission of telegraphic and telephonic messages everywhere.

UNDER this heading our contemporary Electrical Fires. *The Engineer*, in its issue of October

14th, moralises over the recent fire at the Grands Magasins au Printemps at Paris. As might be safely expected with regard to this or any other considerable fire, the outbreak has been ascribed to "the fusing of an electric wire." We sometimes wonder what was the stock phrase in, say, 1850. In 1666, of course, it was "Papists," and no doubt every age has had its catchword.

The part of the article with which we are hardly inclined to agree is that in which the remark is made that "the use of a pressure such as 50 volts is, of course, now out of the question." If it is meant—it is not quite clear—that such a pressure as 50 volts is out of the question for the street mains, we agree; but if, as the context seems to require, the internal wiring is meant, then we are of the opinion that Silvanus Thompson was right in saying, years ago, that 50 or 100 volts was much better than a higher pressure so far as the consumer was concerned. Now that the current flowing has been cut down, by the use of tungsten lamps, to about a quarter of what it was in the carbon lamp days, it is a matter of some difficulty, if any recognised wiring rules are observed, to wire a house with cable that is likely to be overloaded; so that if a supply at 200 volts is transformed down to 50 volts, the situation is no worse than it would have been a dozen or so years ago, with carbon lamps, at the higher voltage.

That 50 volts is intrinsically safer as regards fire risk than 200 volts is open to question, because there is so little risk, with modern materials and apparatus (and assuming the fuses to be of small size) at 200 volts, that it can hardly be less at any lower pressure. The chief advantages are that smaller and more efficient light units can be used, the lamps have a longer life, and the wiring and fittings can be of cheaper quality.

For heating and cooking appliances, 200 volts is a very satisfactory pressure; since the current required is fairly considerable, it is desirable that the pressure shall be reasonably high. There is much to be said, however, for a pressure of 100 volts. That this is ample for electric cooking has been fully demonstrated by the long experience of the Brompton & Kensington Electric Supply Co., which, as we recently noted, has 500 electric cookers on its mains and supplies them at 100 volts, a.c., with complete satisfaction. Referring to this network, Mr. A. Page, one of the Electricity Commissioners, said that, in view of modern developments, it might very well turn out that other electricity suppliers would have to adopt the system which, in the hands of that company, had proved to be so elastic and convenient, enabling heavy domestic loads to be carried with comparatively light feeders. That is practically the system which we favoured in our issue of September 17th, 1920—namely, the multiplication of street transformers, supplied at 3,000 or 5,000 volts, with short low-pressure distributors. In the same issue Mr. C. H. Wordingham warmly advocated the reversion to a utilisation pressure of 100 or even 50 volts.

Where a supply can be given at 100 or 110 volts, we think that would afford the most satisfactory solution of the problem; but where a supply pressure of 200 to 240 volts is already in vogue it would seem that, from the consumer's point of view—and we see no inherent disadvantage so far as the supplier is concerned—the best course would be to use that pressure for heating and cooking, with a small compensator or auto-coil, taking about 3 watts to excite, reducing the lighting voltage to 50. The use of house-to-house transformers is not thereby rendered necessary, metering problems are not made more difficult, and it appears to enable the best service to be obtained from the supply available.

WE are sure that commercial men connected with various branches of the electrical industry will be eager to avail themselves of the electrical salesmanship conferences that are being organised tentatively this season by the British Electrical Development Association. Their opportunities for discussing purely commercial matters connected with their work have not been very numerous in the past, for they have had no special organisation to look after their interests in this respect; many of them not being technical or only semi-technical men have not attached themselves to the Institution of Electrical Engineers. The latter body nowadays commendably devotes more attention to industrial affairs than ever it did in the past, and in its informal meetings it has provided the opportunity required by the more commercially-minded among its members to get together fraternally and conversationally. But the effort of the B.E.D.A., while enabling these to take part in the new conferences, will especially cater to the at present unmet requirements of the unattached commercial electrical man. The latter, as an individual, and his class as a whole, have a most important place to fill in present measures for giving a new impetus to electrical progress. That, after all, is the main purpose of the Electrical Development Association. Much remains to be done in popularising the uses of electricity and in presenting the advantages of electrification to the consuming public, and we feel that the series of informal electrical salesmanship conferences arranged to that end, and of which particulars appear on a later page, are thoroughly well worthy of support from our commercial readers.

We wish the movement complete success, because it is

in the interests of the industry, and cannot fail to eventuate in better service from, and greater reward to, a class of men who, well informed and properly encouraged, are able to hasten progress.

A Case for Industrial Credit.

To the British exporter of general merchandise New Zealand is one of the most attractive of our Dominion markets. Competition from local manufacturers has scarcely yet seriously affected sales from the old country, whilst foreign rivals have in few instances succeeded in supplanting British goods in face of the patriotic preference for them which has been consistently displayed by New Zealand purchasers. This goodwill is of special interest just now to the British exporter of engineering material, in view of the electrical developments which are taking place in the Dominion. That Britain must not cease to justify the preference shown to her is urged again by H.M. Trade Commissioner in New Zealand (Mr. R. W. Dalton) in the report which has recently been issued by the Department of Overseas Trade and is summarised on another page. The market needs nursing at present for more than one reason. Tariff revision is under consideration and, it is said, will follow the lines adopted in Australia. This signifies that every effort will be made by means of protective duties to foster the growth of local manufacture. Such a programme should certainly not be less successful in New Zealand than in the Commonwealth, in view of the advantage possessed by the former in its sources of cheap water-power. British manufacturers should endeavour to participate in this movement by the supply of the necessary skilled supervision, equipment, and semi-manufactured products. There is yet time, for the Dominion, like every other country, is still suffering from excessive stocks of imported goods and depreciated prices of its exports. The need for economy is likely to lead to the postponement of a portion of the hydro-electric programme. Yet the prospects of a return to normal trade are probably brighter in New Zealand than in most other countries. Meanwhile, if the early realisation of New Zealand's full scheme of hydro-electric generation would lead to contracts for British industry, there seems a good case for a loan under Mr. Lloyd George's new scheme of credits for productive works.

THE decision of the Electricity Commissioners in respect of the West Riding Decision. Electricity District, which has been awaited for five months, was issued last week, and is reported in our pages to-day.

In view of the clash of interests which was manifested at the Inquiry, it was obvious that none of the schemes that were put forward would or could be adopted as a basis for the reorganisation of the supply of electricity in the District; hence the Commissioners have cut the knot by dividing the District into two areas, to be defined by agreement, one to be dealt with by the leading municipalities, whose power stations will be interconnected, and the other to be supplied by the Yorkshire Electric Power Co. A Joint Electricity Authority will be formed for the whole District, on which all parties will be represented, which will control the operation of the interconnected stations, and, in consultation with an Advisory Committee of municipal electrical engineers on the one hand, and with the Power Co. on the other, will supervise the conduct and development of electricity supply throughout the area.

The scheme as now promulgated appears to us to afford a very satisfactory solution of a difficult problem—a give-and-take solution, in which neither the municipalities nor the private undertakers have secured all that they could wish, but which, to our mind, should enable them all to carry on to great advantage, and which presents them with an ideal opportunity to practise that co-operation which is essential to the welfare of the various undertakers and of the community at large.

ELECTRICITY SUPPLY AT SHEFFIELD.

The Blackburn Meadows Generating Station.

(Concluded from page 608.)

With regard to the stokers, these are of the Bennis chain-grate type, and each boiler has two grates 14 ft. long by 7 ft. wide, which gives a total furnace area of 196 sq. ft. per boiler. The stokers are belt driven by means of a central line of shafting which is carried by the underside of the bunkers and runs the full length of the boiler house. The main line driving shaft is divided into two sections, and a driving motor is located at each end as well as in the middle; the 45-h.p. motors

plied by Messrs. J. Thompson, of Birmingham, and have a diameter of 12 ft. at their base, 8 ft. at the top, and a height of 60 ft. To each stack is connected two 45-in. induced draught fans of the Sirocco type, and fig. 8 shows eight of the 14 sets that were supplied by Messrs. Davidson & Co., Ltd., of Belfast. Each fan is capable of creating a draught equal to 2.5 in. water gauge at the inlet, and is direct driven at a speed of 480 r.p.m. by a 40-h.p. Crompton motor.

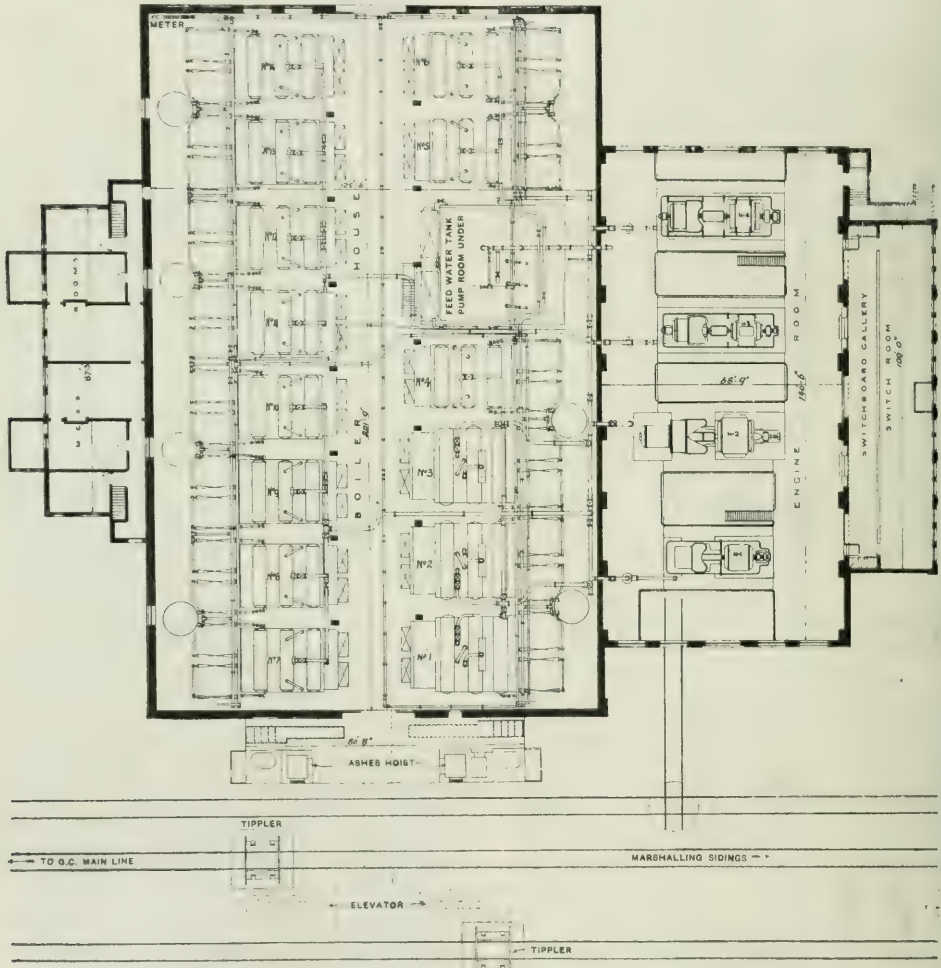


FIG. 10. PLAN OF BLACKBURN MEADOWS GENERATING STATION, SHEFFIELD.

drive the shaft by means of a chain speed-reducing gear of the Hans Renold block type enclosed in dust-proof steel casing. The stoker drive is from the main shaft to small counter-shafts which are located on the tops of the stokers, and thence by means of short belts that drive the six-speed gear with which the grates are provided. As the whole of the main shafting can be driven by either of the three motors it will be realised that ample allowance has been made for any breakdowns that may occur or overhaul that may be required at this important point of the plant. There are seven steel chimneys, one to each pair of boilers, which were sup-

plied by Messrs. J. Thompson, of Birmingham, and have a diameter of 12 ft. at their base, 8 ft. at the top, and a height of 60 ft. To each stack is connected two 45-in. induced draught fans of the Sirocco type, and fig. 8 shows eight of the 14 sets that were supplied by Messrs. Davidson & Co., Ltd., of Belfast. Each fan is capable of creating a draught equal to 2.5 in. water gauge at the inlet, and is direct driven at a speed of 480 r.p.m. by a 40-h.p. Crompton motor.

The boiler ash and clinker fall over the back end of the grate on to a dumping plate formed by the sector of a circle of cast iron. At intervals as found necessary the accumulated ashes are released and fall into a pit from which they are fed to a Babcock & Wilcox ash crusher that is driven by an E.C.C. 10-h.p. motor, fig. 9. The photograph from which this illustration was reproduced was taken without the aid of any artificial illumination whatever, and conveys a good idea of the spacious and well lighted boiler-house basement. The crusher travels on rails, and is moved by hand from boiler to boiler as may be required. It delivers the

crushed ash into cast-iron suction pipes, 8 in. in diameter, laid along the basement floor, which terminate in receiving tanks located at the south end of the boiler house at a height of 55 ft. The ash is drawn into these receivers by means of two sets of Roots blower air exhausters which are driven by 70-h.p. motors. The whole of the ashes and dust are slaked by means of water sprays at the inlet to the receiver tanks; in connection with this plant special pumps draw water from the circulating water inlet for the purpose of slaking in the receiver and for cleansing the foul air which passes along the pipes as it is passed through the filters into the exhausters, and before it is discharged to the atmosphere through silencers. Connected to the same exhausters is a second set of 6-in. pipes that are used to remove all the soot and grit from between the bottom

ing at a speed of 1,500 r.p.m. The condenser, which provides 14,000 sq. ft. of cooling surface, is capable of dealing with 120,000 lb. of steam per hour, and all the moving parts of the Edwards direct-acting air pump are totally enclosed. The buckets are 22 in. in diameter with a 10-in. stroke, and will extract 620 cu. ft. of air per minute. This pump is driven through helical reducing gears at a speed of 95 r.p.m. The 30-in. centrifugal circulating pump will deliver a total of 978,000 gallons of cooling water per hour through the condenser, and is of the Gwynne twin type. These pumps are arranged to be driven by a small steam turbine, or as an alternative, a 250-h.p. motor that runs at 480 r.p.m. is provided to drive these auxiliaries, an illustration of which is given in fig. 3. Attached to this set is a 110-h.p. motor driving a separate fan which provides the cooling air that is required by the alternator.

Nos. 3 and 4 machines were supplied by the English Electric Co., Ltd., and are composed of Zoelly impulse turbines, each producing 8,000 h.p. at a speed of 3,000 r.p.m. and direct coupled to General Electric Co.'s 7,500-kVA alternators. On the generator rotor shafts fans are fitted which deliver approximately 33,000 cu. ft. of cooling air per minute to each machine. Each condenser contains 10,500 sq. ft. of cooling surface and deals with 90,000 lb. of steam per hour, while each centrifugal circulating pump will deliver 438,000 gallons of cooling water per hour against a 53-ft. head. The pumps are 24 in. in diameter, and each is direct driven at 960 r.p.m. by a 175-h.p. motor. Each three-throw Edwards air pump is driven at a speed of 100 r.p.m. by a 20-h.p. motor through a spur reduction gear, and is 19 in. in diameter with a stroke of 11 in.

Each set of plant is provided with a Lea water meter which gives a continual record of the actual steam consumption of the turbine at all loads. The condensed steam is pumped up to the main boiler feed-water tank by means of a small force pump that is coupled to the crankshaft of the air pumps; thus all the heat units in the condensate are utilised. Each generator is coupled direct to three single-phase transformers which are delta coupled on the machine side and star connected on the outgoing busbar side. These transformers,

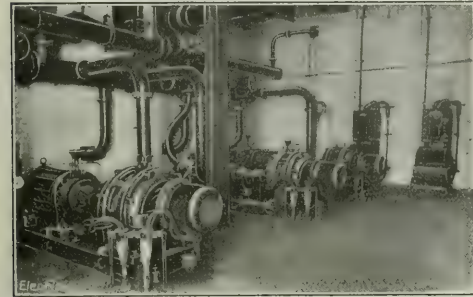


FIG. 11.—BOILER-FEED PUMP ROOM.

drums of the boilers and also from the bottom of the economisers; thus the flues are kept clean whilst in service. The capacity of each receiver is 14 tons of ash, which is discharged through a valve at the bottom into reinforced concrete hoppers; valves and shoots are fitted to the latter to convey the ash into railway trucks. Two separate sets of suction ash plant were supplied by Messrs. E. Bennis & Co., Ltd., of Bolton, each row of boilers being served by one set, and in the event of any dislocation of the plant the necessary stand-by is provided in the form of steel tipping wagons that travel on the same rails as the ash crusher. The wagons can be elevated by means of electric hoists which are so arranged that they cannot be operated unless the wagons are locked in position; on the arrival of a wagon at the top it is automatically tipped into the concrete hoppers.

The engine room contains four steam turbines on a level with the boiler house firing floor; they give a combined normal output of 37,500 h.p., and each machine is direct coupled by means of a flexible coupling to a 3-phase, 50-cycle generator, which generates energy at a pressure of 6,600 volts. The generators have a combined capacity of 35,000 kVA. The four sets of plant are of the following sizes and types:—

No. 1 consists of a Curtis 8,000-h.p. turbine and a 7,500-kVA alternator running at a speed of 1,500 r.p.m. and both of the British Thomson-Houston Co.'s manufacture. Fans are fitted on the alternator rotor, and the quantity of air that is required to be passed through the machine for cooling purposes is 33,000 cu. ft. per minute. The condenser and air pumps for this set were manufactured by Messrs. Cole, Marchant & Morley, of Bradford; the former's 12,000 sq. ft. of cooling surface is capable of condensing 90,000 lb. of steam per hour. The three-throw Edwards air pump has plungers 24 in. in diameter, a stroke of 14 in., and is driven at a speed of 110 r.p.m. by a 40-h.p. motor which runs at 600 r.p.m. The 24-in. centrifugal circulating pump is direct driven by a 200-h.p. motor at a speed of 565 r.p.m., and pumps an average of 576,000 gallons of water through the condenser per hour.

No. 2 machine was supplied by Messrs. C. A. Parsons and Co., and comprises a single-cylinder, pure reaction, 13,500-h.p. turbine and a 12,500-kVA alternator operat-

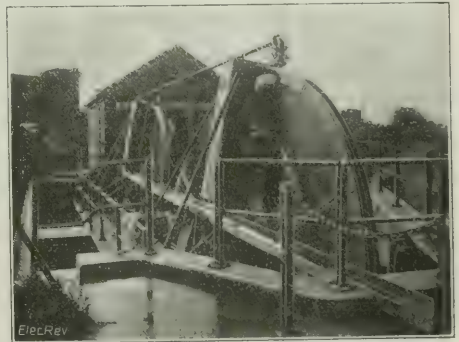


FIG. 12.—CIRCULATING WATER SCREENS.

which were supplied by the British Electric Transformer Co., of Hayes, and are illustrated in fig. 4, step up the generated pressure of 6,600 volts to 11,200 volts on the main busbars. The generators are protected by means of overload relays in conjunction with the Merz-Price balanced current system.

The main switchboard is located on a slightly raised gallery which runs along the whole length of the east side of the turbine room. As will be seen from fig. 5, the switch handles, meters, and other instruments are mounted on switchplates on the front of a substantial glazed brick wall, and the operator is thus effectively separated from any part of the main switch mechanism that is under pressure. The four generator panels, which are fitted with exciter switchgear, are placed at the centre of the board, from which position the operator

can obtain a full view of all the four sets of plant. The remainder of the board is made up of ten split conductor feeder panels, three transformer panels, and one Blackburn Meadows-Neepsend interconnector panel. Behind this brick switchboard is the main switch room, an interior view of which is given in fig. 6. It contains ironclad totally-enclosed gear manufactured by Messrs. Reyrolle & Co.

The auxiliary switchboards are also of the Reyrolle ironclad pattern, and are placed along the west wall of the turbine room. They control all the motor-driven auxiliary plant in the station, and are so arranged that the motors driving the various sets of auxiliary plant derive their energy from their own respective turbo-generators; alternatively, any part of the auxiliary plant can be run from any one of the four generators, which arrangement is effected by means of an automatic throw-over switch on the auxiliary board. All the auxiliary plant throughout the station is operated at a pressure of 440 volts by means of 3-phase, 50-cycle energy, the various motors being of the Metropolitan-Vickers, B.T.H., or Crompton types. All the cables used in the station were supplied by Messrs. W. T. Glover & Co., Ltd.

The condenser circulating water flows in by gravity from a point just below the junction of the South Yorkshire Navigation Canal and the river Don, and passes through two continuously revolving screens made by Messrs. F. W. Brackett & Co., of Colchester. They are each 20 ft. 4 in. in diameter and have a $\frac{3}{4}$ -in. mesh;



FIG. 13.—WATER COOLING SPRAYS.

as each part of the screen reaches the top it is met by a reverse water spray which washes off all debris that may be adhering to it, the debris being carried away by a separate channel. Fig. 12 shows the screens, which are each revolved by a 6-h.p. Crompton motor, and may be driven at varying speeds so as to deal with the changing quantity of solid matter floating down stream. The two pumps that supply the washing sprays are driven by 12-h.p. Crompton motors.

A grating is located at the back of the screens, and behind this a circular penstock 54 in. in diameter forms the entrance to the 4 ft. 6 in. brick culvert which conveys the water a distance of 290 yards to the station. Another 54-in. circular penstock is provided immediately before the water enters the 7-ft. suction culvert; the two penstocks allow of separate parts of the culvert being closed from the river inlet for the purpose of cleaning, &c. The circulating pumps draw their water from the suction culvert, and the discharge from the condensers passes through a 40-in. cast-iron pipe to a spray cooling pond which has a total superficial area of 61,500 sq. ft. From the discharge main the water is distributed by means of 30 pipes which are fitted with 780 spray nozzles, as shown in fig. 13.

All the circulating pipes were supplied by the Staveley Coal & Iron Co., and the cooling plant by Messrs. Harrison, Son & Jobson, of Middlesbrough. The latter was designed to deal with 1,111,000 gallons of water per hour, cooling it down from 100 to 80 deg. F. with the atmosphere at 60 deg. F. and a humidity of 75 per cent. Any section of the distributor pipes can be cut off independently of the remaining ones, and after being cooled the water flows over a sill into a return culvert, from which it can be conveyed

a distance of 350 yards back into the river, which it enters about 100 yards below the inlet, or alternatively, part or the whole of it can be returned to the suction culvert for re-use.

In conclusion, it remains to be said that up-to-date mess rooms have been erected for the use of the boiler house employés as a single-storey annexe to and on the west side of the boiler house. On the east side of the turbine house (the turbine floor being 19 ft. above the condenser floor on the ground level) a three-storey annexe has been built; the ground floor forms the fitting and repair shop containing the necessary tools, &c., for repairs and maintenance purposes, while the first floor over the workshops contains offices for the resident engineer and staff as well as mess-room accommodation for the employés engaged in the turbine house and switch room. For convenience and rapid ascent to all floors of the station, including the top of the coal bunker, a passenger lift has been installed at the south end of the boiler house.

Finally, we have to thank Mr. Fedden for permitting the publication of the particulars set out above, and also Mr. Wilson, superintending engineer at Blackburn Meadows, for facilitating the taking of photographs, &c., at the time of our visit to the station.

THE OPENING CEREMONY.

THE new station was formally opened by H.R.H. the Duke of York, on Friday last week, in the presence of a large and distinguished company. Mr. S. E. Fedden, chief engineer and general manager of the department and designer of the new station, presented the Prince with a knife of Sheffield make with which he cut a length of tape that had been stretched across the main entrance. The Prince then entered the building, and when he had inspected the plant and machinery, the Lord Mayor of Sheffield (Ald. W. F. Wardley) offered him their warmest welcome on his first visit to Sheffield. The city, with its population of half a million people, was the home of the steel industry, and needed, above all, an abundant supply of cheap electricity. The Corporation had endeavoured to give that supply, and its electricity undertaking had made gratifying progress with the capable and efficient help of the Electricity Supply Committee and their general manager. Personally he was hopeful that before long they would be able to introduce electricity into the homes of the working people, and to give them the benefits of lighting by electricity and other modern developments which electricity had made available. Concluding, the Lord Mayor handed to the Prince an album containing particulars of the installation. The chairman of the Electricity Supply Committee (Coun. A. J. Ward) explained that the electricity undertaking had been in the hands of the Corporation since 1888; there had been constant progress, and to-day the undertaking was one of the largest in the country. They had expended on the system nearly three and a half millions of money; the annual income exceeded one million pounds; the h.p. of the plant was 124,000; the charges for electric power were among the lowest in the country, and this year they appropriated £25,000 out of the profits towards the relief of the rates.

Councillor Ward also referred briefly to the assistance the undertaking had given to the Government during the war.

The Duke of York, in declaring the station open, congratulated the Electricity Supply Committee, the chief engineer, Mr. Fedden, and all those associated with him, in their great achievement. If, he said, in order to meet competition in the markets of the world, manufacturers were forced to economise, it was in his view a better policy to seek a solution of the problem in scientific research, than merely to fall back upon a curtailment of wages. In the future the prosperity of the manual worker depended so largely upon scientific development in their industries, that he would appeal to the younger generation to let that truth sink well into their minds.

THE ELECTRICAL MARKETS OF SOUTH AMERICA.

ARGENTINA BUILDING LARGE POWER STATION.

BRAZIL DEVELOPING ITS WATERFALLS.

CHILEAN AND PERUVIAN OPENINGS.

By PERCY F. MARTIN, F.R.G.S.

It is the considered opinion of those who have had the opportunity of studying the States of South America on the spot, that their great industrial future reposes largely in the use made of their potential water-power. Up till now, only the larger and wealthier countries—such as Brazil and Chile—have entered upon the development of their resources in this direction, and then in but a modest manner in no way in consonance with their importance or promise. Clearly, then, in view of the vast strides made by hydro-electrical engineering, there exists a wide and practically unoccupied field for undertakings, the development of which will help to solve some, at least, of the pressing national problems affecting economics in these Latin-American States—such as railway transport and the raising of oil.

Few of these countries are endowed with cheap fuel; some, like Argentina, are without even the necessary water-power to replace it. On the other hand, Brazil, Chile, Columbia, Ecuador, Peru, and Uruguay have been greatly gifted in this respect, their many waterfalls and fast-flowing rivers awaiting but the skill of the engineer and the funds of the financier to bring them into commercial value. Argentina must rely upon central supply stations of large capacity, as, having an installation of many thousands of kilowatts, it is possible to offer rates that are lower than the cost of energy produced upon a small scale in isolated plants. Everything in the way of machinery and plant entering into the production of electricity must be purchased from abroad; hence, one of the most promising of the South American markets is to be found in the premier State, notwithstanding that competition there is of the most acute character. The demand for motors and all kinds of wiring devices has never been more pronounced than to-day, while accessories of all descriptions are upon the invoice-lists of every dealer in the Republic. The only local production of any importance is in connection with electrical devices such as electroliers and fixtures, which can only be brought into the country subject to heavy and almost prohibitive duties.

Unlike Argentina, its near neighbour, Brazil, possessed of entirely different physical characteristics, as a market for hydro-electric equipment has not its superior in the New World. The mountainous nature of over two-thirds of the inhabited part of Brazil, especially in the south, the ever-increasing knowledge that is being gained of the commercial possibilities attending the harnessing of the many waterfalls met with, and the readiness with which both the Federal and State administrations grant facilities—and even financial subsidies—for the exploitation of these power sources, make Brazil a highly attractive field for the manufacturer of electrical plant. The rivers, both large and small, are mostly distinguished by cataracts, very numerous in some cases, many of which are destined to prove important factors in the industrial development of the country. Practically every small town, and certainly every city, has, or shortly will possess, its own electric light installation. There is a steady but ever-growing market for water-wheels and turbines, electrical motors, cables, &c., while throughout the Republic there is an unsatisfied demand for small machinery such as that used in sawmills, &c., which can be run by water-power, and for small installations of baking, laundry, box-making, and similar miscellaneous machinery.

When the writer was last in Brazil he learned that the greater part of the electrical imports were being derived from the United States, not that these manufactures had been successful above those of other countries in securing the favour of buyers, but because the makers' agents

were the more energetic in soliciting orders, and, in the absence of competition, capturing them. Another feature of the American success may be attributed to the fact that the power companies in Rio de Janeiro, Sao Paulo, Santos, and Bahia are controlled by Canadians with pre-conceived ideas of the superior fitness of American machinery for these purposes. The strongest lines in imports of electrical goods are transformers, insulated wire, generators, and motors; in these specialties our trans-Atlantic rivals beat us. But in cables, the United Kingdom stands almost unassailable. Germans, on the other hand, have a strong hold on the Brazilian market for arc-lamp carbons and incandescent lamps. It is believed, however, that incandescent lamps (metallic filament) such as are made by firms like Edison-Swan, the English Electric, the General Electric Co., and the Metropolitan-Vickers Co. would prove good selling articles in this South American State. There should also be a market for British-made miscellaneous small material, such as wiring devices, &c.

Chile has greatly neglected the opportunities presented by her remarkably fine, if not very numerous, waterfalls, several of which are capable of providing immense power for industrial purposes. In a country which cannot supply anything approaching enough coal for its needs, mechanical power can alone redeem its industries. A more complete study of Chilean waterways and potential water-power is now proceeding under the immediate supervision of the Minister of Public Works, and the next ten years are destined to witness a very great transformation in the equipment of factories and railways with plant and machinery for electric operation. Already a commencement is being made in the direction of electrification of the State railways (starting with the important Valparaiso-Santiago line), and this, it is understood, is likely to be followed by similar enterprise in other parts of the State at no distant date.

Large supplies of electrical equipment will be necessary in connection with the fitting up of the new Valparaiso Docks, rapidly approaching completion; with the port improvements, not as yet finished, at Lebu and Constitucion; with the important port of San Antonio, where the new breakwater is all but completed; in relation to the waterworks at the Curico improvement scheme (under the direction of the Inspeccion General de Hidraulica); in connection with the extension of the drainage works at Valparaiso; and many other public, as well as several private undertakings. Although to-day a not very alluring market is presented for British manufacturers on account of the vagaries of the exchange—a complaint applicable to practically every other country in the world, with the exception of Switzerland and Japan—the time is not far distant when Chile will offer great possibilities for the manufacturers of electrical machinery and plant for factory use; for up-to-date appliances for household use; industrial control material; insulators, lamps, line material, medical apparatus, and small motors.

Peru, the adjoining State, is even better provided by nature with potential water-power, but up till now little use has been made of the opportunities available. It may, therefore, be assumed that here, again, is a wide-open field for manufacturers, once normal financial and trade conditions are restored. The most promising openings lie, perhaps, in the direction of mechanical traction; a fair number of towns have already introduced the trolley system, the principal enterprise being the *Empresas Electricas Asociadas*, which has pro-

nounced inclinations in favour of British electrical apparatus and plant, although, so far, only the boilers have been acquired in the United Kingdom.

Big cities like Lima, Arequipa, Cuzco, Huayancayo, Oroya, Casapalca, and Junin have each their own hydro electric plant of various capacities, while in addition to these power stations there are numerous smaller ones ranging in size from 5 to 100 kilowatts. The great field lies in providing other towns with the same facilities, since in the first-named, being fully equipped, there is now little demand for anything except lamps, wire, and wiring devices. There is, however, a favourable opportunity for the formation of a strong foreign syndicate to develop generating stations and transmission lines in certain sections of the country.

Yet another scope lies in connection with the many estates whereon are grown sugar and other crops. Many of these plantations belong to individual owners, who might well be approached with the view to introducing electrical equipments. It was understood, when the writer was recently in Peru, that tenders were to be invited for the electrification of one of the largest of the sugar mills belonging to a British company. House lighting and shop illumination offer also improving opportunities for introducing manufactures that can compete in price with the similar manufactures imported from the United States and Germany. Naturally, the more costly of the appliances are alone in demand in the cities. Shop lighting is carried out mostly by drop-lights, usually without either shades or reflectors. Since Lima has pretensions to become a fine and even luxurious city, there should be little doubt that sooner or later there will come about a change in the present methods employed for window lighting. This is generally an installation of several sockets with unshaded lamps placed upon each side of the window. Some of the establishments, anxious to follow the lead of the larger shops in Santiago-de-Chile, Buenos Aires, and Rio de Janeiro, are now gradually reconstructing their shop windows with a view to a more elaborate system of lighting instead of the method described, sometimes employing ordinary tin shades to keep the light out of the eyes of the gazer upon the goods. So far, there has been hardly any attempt to educate the Peruvians upon the subject of electric signs; it is even doubtful whether they would prove amenable, as, first, sky-signs, where introduced, have not met with the approval of the municipal authorities; and, secondly, the heavy cost of importing the signs would—certainly in the present condition of things—prove prohibitive. But on the other hand, much might be done with the introduction of large high-power lamps for placing outside shops or amusement resorts.

SERVANTS AND HOUSEHOLD MACHINERY.

By MARY GWYNNE HOWELL.

THE education of the housewife in the use of labour-saving appliances is not the only task before the seller of such appliances. Too often success with the mistress is marred by the absolute refusal on the part of the maid to make use of the appliances provided to ease her work, and this is a difficulty which has to be overcome before popularity is assured.

The converted housewife, therefore, however certain she may be personally that household labour-saving equipment means better work, has still two queries to be answered.

1. Is it really economically advantageous to provide such equipment for household servants?

2. How are they to be trained to use it successfully?

Since maids are neither plentiful nor cheap it is obviously to the advantage of the mistress to get the work done as far as possible by one or two maids instead of employing more. This being so it naturally makes a vast difference whether the laborious work is done by

motor power or "elbow grease." In such circumstances the wise housekeeper will reduce the work by means of suitable tools into such a compass of time and effort that she will get full return for the high wages she has to pay her workers.

This point can be urged with advantage whenever a customer raises the question.

But on the second query rests the gist of the matter.

How is it possible to overcome the prejudice and ignorance of the general servant and persuade her that it is to her benefit as well as her mistress's to adopt the use of household machinery?

It is chiefly a matter of tact and patience combined with a study of psychology. There are few servants too stupid to learn under tactful instruction and guidance. Of course, some learn much more quickly than others, and apply their teaching with better results, but each and all can learn if dealt with properly.

There are two problems of human psychology involved in this matter; that of the instructor and that of the instructed. In the first place, the instructor must eradicate from his or her mind any thought that the pupil lacks the necessary intelligence to grasp the instruction. He (or she) must be willing to analyse the operations of the machine and to reduce them to their simplest terms. Having thus made the subject perfectly simple and clear to himself in every detail, the chances are that he (or she) will be able to impart it to someone else.

If the appliance seller has to leave the instruction to the mistress this fact should be emphasised.

If the instructor should be a rather fearful housewife she must eliminate the thought that any slip made by the newly-initiated worker will result in injury to the machine. This is a very natural fear on the part of the owner of the equipment, but it is hardly justified by experience. Luckily these appliances are sturdily built, and are made as nearly "fool proof" as possible. A novice may delay her work or discommode herself by turning a switch the wrong way, but she seldom does any actual damage to the machine.

The antagonism of the servant to "new-fangled" tools is largely a matter of fear of the unknown and untried. However "superior" these servants may appear to be, beneath the talk of old-ways-being-good-enough-for-me is a real nervousness of appliances of which they have had no experience.

The tactful teacher will, therefore, go to work slowly and patiently.

The machine should be operated for her one step at a time, making everything as simple as possible and using no technical terms. After a little while the servant should be persuaded to help a little with the machine until she has gained confidence. Once she has reached the stage of being pleased with herself, when manipulating the appliance, the teacher can then tactfully point out how advantageous such appliances are in general use, and thus gain the whole-hearted co-operation of her worker.

After a maid has mastered the operation of all the labour-saving appliances her mistress has provided, she should be left to carry on alone, but it is advisable for the mistress to examine the equipment from time to time, and thus make sure that the after-care is not neglected.

If such points as emptying the dust bag after each use of the vacuum cleaner; rinsing and drying the washing machine at the end of washing day; and turning off the gas in the gas heater of the ironing machine when the ironing is finished, are not recognised as important by the servant using the appliances, it is incumbent on the mistress to stress these details and to see that her instructions are duly carried out.

Whilst all this training must, in most cases, fall to the lot of the housewife rather than the appliance supplier, yet the latter by coaching his customer in the art of teaching her servants can help on the cause of labour-saving appliances, and thus overcome the present all too common antagonism on the part of domestic workers resulting in the "scrapping" of household machinery and the triumph of the "good old ways."

ELECTRICITY IN ISOLATED BUILDINGS.

By E. H. FREEMAN.

(Continued from page 560.)

So far consideration has been given to plants for a lighting load only. The advantages of the electrical installation, however, include many other possibilities as has already been mentioned. Pumping and firewood sawing are often desirable; small cooking and heating appliances can be utilised and the power supply adopted for many other purposes, such as chaff cutting, root pulping, &c. It would also be possible to charge the battery of a small electric vehicle, and with a house located several miles from a railway station, to which regular visits were made, such a vehicle might be of great convenience.

Every such addition emphasises the advantages of the ordinary non-automatic plant over the automatic. The increased demand involves a greater disparity between the maximum load of which the plant must be capable and the average load required, with consequent greater difficulties of governing, &c. The non-automatic plant, with a battery of substantial capacity to help the engine in case of need, can deal comfortably with a temporary load much in excess of the engine capacity, whereas the corresponding automatic plant could not manage it at all. A belt drive for a pump or a saw bench is often difficult with a high-speed vertical engine, and the efficiency losses, if motor drives are adopted, are considerable with small units. The conditions, on the other hand, are all favourable for the horizontal engine. The plant can often be located near the well, and a convenient belt drive, direct from the engine, provided (fig. 8). Often sawing can be done immediately adjacent, and the saw also driven direct off the engine, with or without a countershaft, as shown in fig. 3, p. 558, and in fig. 9 herewith. The engine can in such circumstances be run under ideal conditions, viz., always at about its full load. If large enough to do more than the pumping or sawing, the surplus power can be used for battery

exceed a few hundred watts. The battery will easily stand this, and, if of capacity to run the normal lighting load for two or three days, will stand even excessive use of such appliances for a day or more without recharging. If examined daily, as it should be, to ascertain its condition, such a demand will do no damage as the battery can be recharged before any damage is done.

In considering what size of plant should be adopted it is best to deal first with the lighting load. The number of lamps and size of these must be settled by inspection of the building or its plans. With a non-automatic plant the battery should be provided of capacity to run

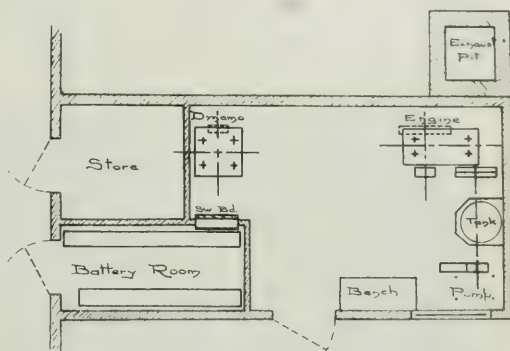


FIG. 8.—PLAN OF EXISTING BUILDING UTILISED FOR ELECTRIC AND PUMPING PLANT

the normal maximum lighting load for a full week-end, as trouble with an attendant, who only runs the plant at intervals each week, may arise if he is asked to charge up on Saturday afternoon or Sunday. It will usually be found that a battery of size to run 40 per cent. to 50 per cent. of the connected load for ten hours will be amply large. The dynamo and engine should be of size suitable for charging the battery in about six hours. If first cost is of importance a purchaser will, however, often be willing to face the extra trouble of more frequent and longer charging and to use a smaller battery, dynamo, and engine, and this is more often the case to-day, with the present high cost, than in pre-war times. The disadvantages are not really serious, as the worst trouble only occurs during a month or so of mid-winter, and the battery of a smaller plant will often provide all the lighting required for a week or ten days in summer when the Daylight Saving Act is in operation.

Once the plant for lighting purposes has been worked out, additions can be made to suit other electrical appliances. It is impossible to lay down any hard-and-fast rules on this. A gentle cross-examination of the purchaser may elicit valuable information, or alternatively a plant may be put forward as suitable for a defined and limited use of such appliances. In many cases no increase is necessary, as, in winter, when the lighting load is at its worst, irons and kettles can be heated on the kitchen range. In summer when the range is only lit in absolute necessity, the electrical heating apparatus can be used instead of the unnecessary lighting.

If pumping, sawing, and other similar operations are to be carried out, each such process must be considered on its merits. Apart from occasional special cases, such as an extra deep well, it is surprising how frequently the lighting plant fits into the needs of a house for such outside demands. Water supplies vary with the size of the house, as does the lighting load; sawing can



FIG. 7.—A RUSTIC ENGINE ROOM.

charging, whilst when used for charging only the engine is naturally running on about its full output.

With regard to the more definitely electrical uses for the installation, it is usually advisable with a small plant of 5 h.p. or under, to avoid entirely all use of electric radiators or similar apparatus that may be kept on load for considerable periods. The load on the plant from such apparatus is enormous in comparison with the lighting. A 1,000-watt radiator may be left in use for many hours on end—possibly by an oversight—and no small plant will stand up to such a demand. Kettles, vacuum cleaners, irons, and similar appliances can, on the other hand, be used fairly freely with ordinary care. No such appliance is likely to be used for more than 30 to 40 minutes at a time, and the load does not

be done with almost any engine with care, and other power requirements also work in with a little adjustment.

An engine of 4 to 5 h.p. will do almost all the work that an ordinary farm or country house of, say, eight or ten bedrooms will need. In a recent case such an engine has been cross-cutting wood up to 15 in. diameter for firewood, and this is a heavier load than is usually necessary.

If circumstances permit, it is usually best to locate the plant near the pump, wood yard, or stables, and drive the machinery through belting and countershaft

sulted in a substantial saving of building expenses to the purchaser.

In designing the engine room, whether existing buildings are used or not, it is advisable to find room for an oil storage tank of about 100 to 120 gallons capacity. This will hold a couple of barrels of oil in excess of a safe reserve. A pump, piping, and cocks on some such scheme as is shown in fig. 10 will be found very convenient. It enables the storage tank to be filled from a tank wagon or a barrel, and the running tank to be filled from either, or from the storage tank. Its use avoids the wastage that always occurs when oil is stored in barrels, and also the mess and waste of filling the tanks by hand.

Reference should also be made to the silencing arrangements. Unless the engine room is a considerable distance from the house this is of great importance. Fig. 11 shows an arrangement which is almost always effective with the exhaust pipe from the engine running to a silencer in a pit from which an escape pipe runs up 10 or 12 ft. above ground. The pit should be covered with an iron plate loaded with non-friable stone and adjusted so that it will just lift enough with a back fire in the pit to allow the expanding gases to escape without damage to the structure. If the cover is rigidly fixed such damage may be serious.

The mains between engine room and house are, of course, very important. They should be of section to suit the normal maximum load with a voltage drop of 1 to 1½ volts on a 50-volt scheme, or 2 to 3 volts on a 100-volt scheme. The internal wiring should be designed to give a drop well below the I.E.E. allowance, so that the total drop to the worst point in the house will be about 5 per cent. on the normal maximum load. If on special occasions a much heavier load should occur, arrangements must be made for varying the number of cells in circuit to suit the load. It is, of course, possible for this to be done automatically, but the apparatus is expensive and complicated.

The mains can be run overhead or underground according to local conditions. The former is, of course,

direct off the engine. One man can then attend to the whole operation, and there is no irregular load on the battery. If the machinery is motor driven, and is located some distance from the engine, the attendant must give some attention to the engine, with consequent loss of time in travelling between engine room and machines if running off the dynamo. He is also apt to run off the battery when only working for short periods, and this puts an undue and irregular strain on a small battery.

The location of the plant raises the question of the best voltage to adopt. It is rarely advisable to put in a plant for less than 50 volts. It may cheapen the cost of the plant to adopt 25 or 30 volts, but there will be an appreciable increase in the mains and internal wiring, particularly if any heating apparatus is to be used. Also such apparatus is difficult to obtain for less than 50 volts—and particularly difficult for 30 volts, the pressure for which many American plants are designed. Greater efficiency can be attained with the lower voltage lamps, but this is only transient as gas-filled lamps of low candle power for the higher voltages will surely be on the market before long. In many cases the 100-volt scheme will be found to pay, and even at a slightly higher cost it will be preferable in the long run. The best voltage can only be settled in each case on its own merits. The plant is more expensive with the higher voltage, but mains and wiring will cost less. A balance must be struck in each case, and the decision taken on total cost in each case with, if anything, a preference for the higher voltage. A comparatively expensive high-voltage installation may be cheapest in the end by enabling existing buildings remote from the house to be used for the engine and battery. The extent to which existing buildings can be utilised is illustrated by some of the engine-room plans reproduced. These all show plants actually installed, and have been selected as being rather different from standard with this object in view. None of them is ideal perhaps, but each re-

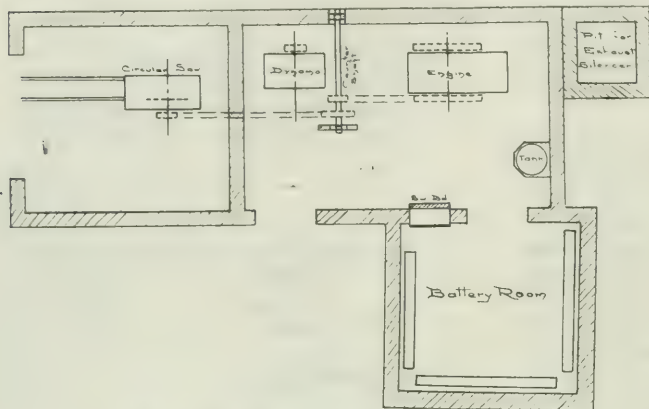


FIG. 9. PLAN OF ELECTRICAL INSTALLATION AND SAW-MILL.

volts on a 50-volt scheme, or 2 to 3 volts on a 100-volt scheme. The internal wiring should be designed to give a drop well below the I.E.E. allowance, so that the total drop to the worst point in the house will be about 5 per cent. on the normal maximum load. If on special occasions a much heavier load should occur, arrangements must be made for varying the number of cells in circuit to suit the load. It is, of course, possible for this to be done automatically, but the apparatus is expensive and complicated.

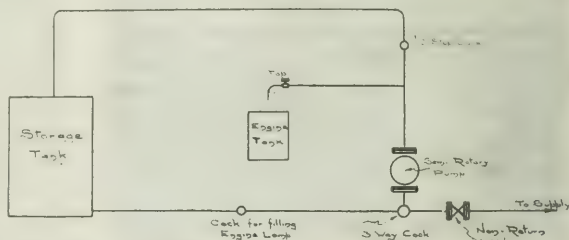


FIG. 10.—ARRANGEMENT OF OIL STORAGE TANKS, PUMP, AND PIPING.

much cheaper. If run overhead it is as well to avoid running through trees; natural growth of boughs makes regular attention necessary to avoid leakages and breakages. If run underground, in all except a few districts where special conditions of soil exist, a plain lead-covered and armoured cable laid direct in the ground is quite satisfactory, and is as cheap as anything. It is always advisable to avoid running rubber-insulated cables underground. Even for runs to single lamps for entrance gates and road lighting it will nearly always pay in the long run to put in paper-insulated lead-covered and armoured cables if conditions are not favourable to overhead conductors.

The final question for consideration is the system of wiring to be adopted in the house itself. As regards

this point also it is impossible to give any definite answer. No system is always the best, but in the writer's opinion a lead-covered twin system is more often right

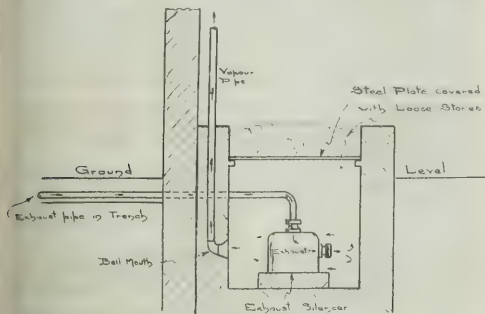


FIG. 11.—ARRANGEMENT OF EXHAUST SILENCER PIT.

than any other. Tubing would perhaps have decided advantages in a new building, but it increases the cost substantially, and its use involves much more damage and consequent redecoration in an old building.

It is very doubtful if earthed return systems are worth while. The saving in first cost is very small, and there is the disadvantage that some day a public supply may be available almost anywhere. Most companies would not connect up an earth return installation on a d.c. supply, and would only connect up on a.c. through a double-wound transformer, and the consumer would then be saddled with a permanent transformer loss for all time.

It is of course impossible to lay down any rules for the lighting fittings for the individual rooms. The personal taste of the purchaser must play an important part in settling this point. Bowl fittings for indirect or semi-indirect lighting are advisable when conditions suit, as larger and more efficient lamps can then be used instead of a greater number of small lamps. Bracket lighting is seldom advisable unless the character of the room calls for this form of lighting. The lamps are badly placed, coming at about eye level, and must be screened with silk or other shades with consequent loss of light—which implies an increase in current for efficient lighting. For the same reason cornice and other concealed lighting is seldom advisable on a small private plant installation in which efficiency of the lighting system is necessarily important. It is, however, best



FIG. 12.—LIGHTING DIRECT BY PENDANT AND PORTABLE LAMPS.



FIG. 13.—LIGHTING INDIRECTLY FROM CORNICE FITTINGS AND DIRECTLY BY PORTABLE LAMPS.

With Stannos wiring the writer's experience has not been satisfactory. It may be ideal on a work bench, but is not sufficiently "fool-proof" on the actual job.

Careless wiring or accidental strains behind skirtings and under floors involve risks of trouble that cannot be discovered and that may not be developed for years. Cab tire sheathed cable has advantages, but its cost does not differ greatly from twin lead, and it is certainly not so neat in appearance for surface work. The sheathing also is very liable to deterioration (rapid in unfavourable conditions) where in any state of stress—for example, where bent at too sharp an angle or where pinched too tight in a cleat.

Lead-covered wiring can be badly installed like every other system, but it is probably more fool-proof than any other, and it has the merit that any fault shows up strongly. A nail driven through one conductor of a C.T.S. cable into a wood joist might nevertheless be a source of future danger. A similar happening on a twin lead job would show a dead earth.

to decide this question specially for every room in every house. Some actual examples are given in figs. 12, 13, and 14, herewith.



FIG. 14.—SEMI-INDIRECT AND ORNAMENTAL LIGHTING.

LEGAL.

THE ATTORNEY-GENERAL v. LIVERPOOL CORPORATION.

An action by the Attorney-General at the relation of a number of ratepayers of Liverpool against the Liverpool Corporation, was commenced before Mr. Justice Russell in the Chancery Division on Thursday, November 3rd. The ratepayers were A. Angers, D. Cornack, F. Collins, F. B. Hellor, E. C. Marr, S. A. McLeish, Pulford Bros., Ltd., A. E. Stanwell, R. A. Harrison-Watson, and F. Wilde, all of whom, it was stated, carried on business as suppliers of electrical fittings, &c.

What they desired were two declarations that the Corporation had no power to carry on the same kind of business as themselves either within or without the city, and that it had no power to use for this business the funds, plant, property, premises, or staff of its electrical undertaking. They also asked for an injunction restraining the Corporation from carrying on the business.

The Attorney-General was represented by Mr. Alfred Page, K.C., Mr. Cartwright Sharp, and Mr. H. G. Purchase; and the defendants by Mr. F. H. Maugham, K.C., Mr. Courthope Wilson, K.C., and Mr. Harold Mather.

Mr. Page said the defendants were the local authority for the purposes of the Electric Lighting Act, and they now claimed that they were entitled, by virtue of that Act and various provisional orders granted to companies that they had bought out, to carry on the business in question throughout the whole of the city of Liverpool and its extensions; and the city was now ten or twelve times as large as it was in 1835, when its boundaries began to be enlarged. He referred to the provisional orders granted to the Liverpool, Toxteth Park, and Garston Electric Lighting Companies, the powers under which had been transferred to the Corporation, and said that the latter purported to act in pursuance of those powers in carrying on the business. He submitted that the Corporation had no such power, that it had unlawfully spent and was spending capital borrowed for the purpose of its electrical undertaking, and that it was unlawfully using for the purpose of the business the plant, &c., of the undertaking.

With regard to the defence that had been raised, counsel said he was prepared to admit that the defendants were a common law corporation, and that they had the powers granted to such a corporation by the various Royal Charters. But he did not agree that under any of those charters they had the power to act as they were now doing, and he denied altogether that any charter could be held to give them that power. Even if they had that right, however, he said that they were still limited in the use of it by the provisions of the Municipal Corporations Act of 1882.

Mr. Maugham: Your second proposition is not denied. With regard to the first, I do not suggest that the charters expressly give us power to trade. What we say is that under the charters we became a common law corporation, and therefore have all the rights of a person at common law. The conclusion I shall ask his Lordship to accept is that once we are recognised as a common law corporation, we have got every power, subject to the Municipal Corporations Act.

His Lordship: There does not seem to be much between you on that point.

Mr. Page: I say that from the time of King John down to the present, Liverpool have in fact never claimed any such power, and have never carried on any trade in their own name, and that all the charters intended to do was to create them a municipality with powers to regulate their own concerns, and the only persons mentioned in the charters as entitled to trade are, not the Corporation, but the various inhabitants of the city. Even if Mr. Maugham is right, I am instructed that I should be able to show that the Corporation do in fact use their funds for the purpose of this trade in a way which is not specified by the Municipal Corporations Act, and that therefore it is illegal.

One of the points of the defence, he said, was that inasmuch as Parliament had allowed the Corporation to buy, not only the whole electrical undertaking of the Liverpool company, but all their property and assets and all their rights, powers, and privileges, among those rights was that of carrying on this extensive business.

Mr. Maugham said they were admittedly carrying on the business, and they claimed the right to do so.

Mr. Page then referred to the provisional order of the Garston Electric Lighting Co., which gave them the power, not only to manufacture and supply energy, but also to sell electrical fittings, &c. The Corporation had stepped into the shoes of the Garston Co., but he submitted that when that company sold out, although they rid themselves of the power to sell electrical fittings, &c., they did not hand them over to anybody else. He contended that before the Corporation were entitled to do that power they were bound to get specific authority from Parliament. Neither in the case of Garston nor in that of any of the other districts had they obtained that authority.

He then called Mr. Robert Tweedy Smith, of 80, Chancery Lane. He said he was the solicitor for the ratepayers, and also solicitor to the Electrical Contractors' Association, chairman of the Sun Electrical Co., Ltd., and of Rawlings Bros., Ltd., a member of the Electric Light and Tramways Committee of

the Southend Corporation, and a Fellow of the Royal Society of Arts. He had had considerable experience in the carrying on of electrical undertakings, and special experience in dealing with the accounts of local authorities. He had examined the accounts of the Liverpool Corporation over a number of years, and found that they had traded not only within their own area, but outside. Among the instances he gave were the supply of fittings to the General Electric Co., of London, and the Birmingham Electric Supply Co., and they had also supplied materials to a Southport gentleman. That was some years ago—about 1896.

Mr. Maugham: It may very well be that they were contracts that we were compelled to complete. But I am not here to say what happened 40 years ago. The question is what we are doing now?

The witness came to the year 1910, when he said he found that the Corporation did work at Oswestry; in 1916, at Woolton, Allerton, and Wallasey; and, in the estimates book for 1917, he found references to Chester, Normanton, and Manchester.

Mr. Maugham said quite a number of the references were to people within the area, such as at Woolton and Allerton, and others were to people who were engaged in business in the area and lived outside.

His Lordship said if there was no better evidence than this of work done outside the area, it was a waste of his time.

Mr. Page: I won't say any more about trading outside the area except this, that if the defendants are right in their contentions, they are not doing anything wrong.

The witness then went through the accounts of the electrical undertaking, and in cross-examination said that the fittings department made very few bad debts, and that was one of the complaints of the contractors in Liverpool.

Mr. Maugham: You mean the members of your Association?—Yes, and the relators. The Corporation is in a most exceptional position in this matter.

When the case was resumed on Monday, Mr. MAUGHAM K.C., continued his cross-examination of Mr. Tweedy Smith, upon his evidence concerning the work done by the Corporation's fittings department for other departments and the methods of charging. The practice adopted, said counsel had been to charge the department wanting the work done plus certain percentages.

The WITNESS said that varied in different years.

COUNSEL: Has your investigation of the accounts shown you that the profits charged to the departments were less than those charged to outsiders?—No; more. There were a few exceptions.

I put it to you that with a few exceptions the practice throughout has been to supply goods to Corporation departments at a lower profit than is ordinarily charged to outsiders. Is your answer "No"?—Yes.

Are you confident of this?—I am confident of the figure that I will give you. I can only speak of what I find in the books. I took specific years and it is on those years that I am speaking, viz., 1916 and 1920.

Well, then, take 1916. Are you pledging yourself that the books of the Corporation for 1916 show that the Corporation charged a higher profit to the departments than to outsiders? Can you say "Yes" or "No" to the question?—I haven't the figures.

You mean you cannot answer the question.

He asked the same question with regard to 1920, and the reply was that the percentage charged to outsiders was 35 to 45 per cent. and to the Corporation departments between 2 and 10 per cent.

Is there a single year for which you can pledge yourself that the profits charged to outsiders were less than those charged to departments?—No, I cannot without the books. I would rather go by the books.

His Lordship is not going to allow you to take an account in court.

The sales book for 1915-16 was handed to the witness, but objection was taken to the quotation of single items.

WITNESS: If I cannot quote single items it would mean a analysis of the whole year.

COUNSEL: I have a gentleman here who has made an analysis and he can tell the court what the facts are.

Mr. HENRY JAMES CASH, managing director of H. J. Cas and Co., Ltd., electrical engineers, of Caxton House, Westminster, said he had had 23 years' experience in the trade and particular experience of supplying wires in buildings with electricity. He gave his interpretation of the meaning of establishment charges and what they included. He said the included rent, rates, taxes, insurance, stock, employers' liability, salaries, commissions, &c., and he estimated that the would account for some 15 per cent. of the turnover.

Mr. LEONARD GEORGE TATE, secretary of the Electrical Contractors' Association, said a fair percentage to add for establishment charges would be from 15 to 18 per cent. on contracts of about £20,000, down to 10 per cent. on big contracts anything up to £100,000.

Mr. R. HARRISON-WATSON, partner in the firm of Jol Hunter & Co., electrical contractors, of 11, Paradise Street, Liverpool, said he was a member of the local branch of the Electrical Contractors' Association, and hon. assistant secretary, and one of those who initiated the present proceedings. There were about 40 members of the Association in Liverpool being the principal electrical contractors on building work.

Mr. PAGE: Can you speak of two recent cases where the Corporation have carried out complete electric installations for private customers?—Yes.

Are you a ratepayer?—Yes.
Do you object to the ratepayers' money being utilised for this purpose?—Yes. I think it is unfair to us, when the Corporation have unlimited capital behind them.

His LORDSHIP: I assume all that. He would not be here if he didn't.

Mr. COUTHOPPE WILSON, K.C. (cross-examining): How many electrical contractors are there altogether in Liverpool?—About 60.

I suggest that there are at least 100?—I cannot say.

Do you suggest that the Corporation are in any way unfair in their treatment of the contractors?—No except by trading against us.

Is it not a fact that when they want work done in schools or fire stations they give the contractors the opportunity of tendering?—The surveyor's department has always done that.

Tendering, that is, as against the fittings department?—I don't know whether they ask the fittings department.

COUNSEL asked the witness if he knew that since 1909 the electrical work placed by the surveyor represented 59 installations, and that of these the fittings department took 12 and the contractors 27.

His LORDSHIP: The witness cannot possibly say that.

COUNSEL: Are you prepared to dispute that the contractors do a good deal more work on the Corporation public buildings than the fittings department?—I don't know that, but I should not have thought so.

I suggest that it is to the advantage of the electrical industry in Liverpool as a whole that the Corporation carry on this fittings department?—We don't agree with that.

His LORDSHIP: Neither hardship to them, nor the benefit you say you confer on the public, moves me in the slightest. What I have got to try here is a legal question.

This ended the evidence for the relators, and Mr. CARTWRIGHT SMITH gave a short summing-up. He submitted that the Corporation were carrying on the business with money which they had no right to use for the purpose. It was clear, he said, that the borough fund, the rates, and the takings of the electricity department could not be used.

For the Corporation, Mr. ARTHUR COLLINS, the treasurer to the City of Birmingham, was called. He said he had examined the accounts of the undertaking since 1911, and in each year from then, with the exception of 1913, the fittings department had shown a profit.

From your investigation of the accounts, asked Mr. COUTHOPPE WILSON, are you able to say whether the carrying on of the fittings department has involved a charge on the borough rate?—There has been no loss. On the contrary, the general funds of the Corporation, so far as they have been affected by this trading, have been benefited.

What loading for profit to outside people and the Corporation departments are shown in the accounts?—The results I found were: In 1916, on Corporation business, the loading was 15½ per cent., which amply covered the whole cost, and on private business 35 per cent. The prices charged were precisely the same as private contractors made.

In your opinion has there been any improper inflation of this business?—No.

JAMES WITTER, the Corporation superintendent of electrical installations, said he was with the Liverpool Electricity Supply Co. when the Corporation took over their business. That company used to sell all sorts of electrical fittings. When the Corporation took it over they confined installation work to the City of Liverpool. They continued the company's showroom for five years and then gave it up. They had now no showroom, and the Corporation did not now carry on any line of business that the company did not carry on.

PRINCIPAL JAMES ROBERTSON, deputy city electrical engineer, said he was with the Garston Electricity Supply Co. before it was absorbed by the Corporation. That company carried on a fittings business which was confined to its area. So far as he knew the Corporation did not engage in any work outside the city.

This completed the evidence for the Corporation, and Mr. PAGE began his address on the law. The defendants, he said, claimed that they had statutory authority to carry on the business and were therefore not affected by the provisions of the Municipal Corporations Act.

His LORDSHIP said he thought the defendants claimed that they got their authority from the Liverpool Transfer Act, 1896.

Mr. PAGE said the question was whether that Act had conveyed to the Corporation any power whatever from the company to carry on any business except that of the statutory undertaking, and he submitted that the Act contained no provision entitling them to use the rights of the company as if they were a trading company. He suggested that all that vested in the Corporation was what was described in section 4 as "all the powers, duties, and obligations in relation to the business of the company."

The hearing was resumed on Tuesday, when Mr. PAGE concluded his speech, and Mr. MARCHAM, on behalf of the Corporation, submitted that the relators had failed on the allegation that the Corporation had spent part of the city fund on the business. His lordship intimated that in view of the importance of the case to the parties he would put his judgment into writing.

AN UNEMPLOYMENT DOLE CASE

A SOUTHPORT electrician who drew an unemployment dole whilst doing spare time work was fined £10 by the Southport magistrates last week. During May and June the defendant, a youth of seventeen years, applied for and received a dole of 20s. per week, at the same time working as an electrician at the Southport Pier Pavilion during the evening performances. For the defendant, it was stated that he was entitled to receive unemployment pay if he was doing spare time work which he had been accustomed to do before receiving the out-of-work pay, providing his wages did not exceed the amount of the dole.

BRITISH THOMSON-HOUSTON CO., LTD. v. CORONA LAMP WORKS, LTD.

The hearing of this appeal from the decision of the Court of Appeal, confirming the decision of Mr. Justice Sargant that the plaintiffs' patent was invalid, came on in the House of Lords on Monday. The appeal is being heard by Lords Haldane, Finlay, Cave, Dunedin, and Shaw. Sir Arthur Colefax, K.C., opened the case for the appellants, who ask the House of Lords to say that the judgments of the courts below are erroneous and should be reversed. The original action, it will be remembered, sought an injunction to restrain the Corona Co. from infringing the B.T.H. half-watt lamp patent.

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Lighting Bakers' Ovens

With reference to "Electro's" letter in your issue of October 8th, and Messrs. R. W. J. Stark's and "C. A. B.'s" communications in your issue of the 21st inst., re lighting bakers' ovens, Messrs. Moncrieff Bros., Leven, were in the same position as "Electro" a few years ago, having experienced similar trouble. This was one of the problems laid before the writer when he returned from Government service, and a drawing was got out and protected for an air-cooled light for this purpose which is not so complicated as that proposed by "C. A. B." The cooling air enters at a bottom passage, passes round the lamp, and exhausts at a top passage; the difference between the temperature of the outgoing air and that of the incoming air is 100 deg. F. Two models are manufactured; one is for an induced flow of cold air past the lamp due to the heated air rising and passing out of the top opening; in the other model, known as model "B," the top passage is connected to the flue of the oven, thus drawing a strong current of cold air past the lamp.

We enclose herewith for forwarding to "Electro" a photograph of the original experimental model, showing the centre part, which slips inside a metal case fitted in the oven wall. This original model has since been improved to take gasfilled lamps.

The original model was made for Mr. D. K. Robertson, baker, Leven, and has been in successful operation with one lamp for the past two years without one complaint, using ordinary metallic lamps. A switch is fitted to the outside case, and the centre portion can be withdrawn for cleaning the glass front or replacing the lamp without disconnecting any electrical connection, the wires passing to the lamp being encased in flexible steel tubing. The glass front is specially manufactured for this purpose, and there has not been an instance of its fracturing. This lamp is fitted in a steam-heated oven, but where ordinary fired ovens are used, this firm supplies as an addition a metal cover for the glass, which is lowered when blowing through the oven, although the latter is really not required.

J. B. Moncrieff.

Leven.

October 27th, 1921.

The Principles of Wages Determination.

I was interested to read what Dr. Gisbert Kapp said in your issue of the 28th ult. about the margin left for division between Capital and Labour. The experience of the past few years has led me to the same conclusion, namely, that there is no margin for readjustment.

What is wrong with Capital and Labour (taking Capital to mean the captains, and Labour the rank and file of industry) is that both are victims of burdensome taxation on the one hand, and restricted opportunity on the other. The latter is due to our refusal to open up natural resources by taking the public revenue from the public value of land. Secure tenure is necessary for industry, but it should be conditional upon the payment of ground rent to the rightful owners of the realm for common services, instead of allowing the fund to go into private pockets. There is no security while industry is regarded as fair game for plunder, and there will be inevitably misdirected production so long as the reward of industry is not

there to be equitably divided, whether by the Whitley method or any other. No conciliatory spirit is possible between those who have to apportion miserable profits.

John E. Grant.

London.

November 3rd, 1921.

In your leading article which appeared on October 21st, you refer to my advocacy of a living wage based on the size of the average family, and, while you agree with this in principle, you foresee difficulties in practice. But, Sir, the noble savage practises this very principle, and the fact that, thanks to false economic ideas, our Government consists of men who do not know how to govern, is surely an argument against a Government fulfilling its first duty, viz., the provision for all of their full necessities of life. According to K. L. Stevenson, "Politics is perhaps the only profession for which no preparation is thought necessary," and when a Government is composed of engineers, doctors, men of science, and organisers (not, be it noted, a "business" Government of bankers, merchants, and shopkeepers), right principles may, after all, be put into practice.

Mr. Hichens advocates payment by results, but if you refer to my book you will find that this is also insisted upon. But what is the first result of man's efforts? Why, the production of the aforesaid necessities. Thus payment according to the size of the average family is payment by results, and does not permit a man to slack or live upon his fellows, as at present.

Further, whence comes this objection to payment by results, but from acceptance of the law of supply and demand? Goods are the product of labour. If the price of goods falls as their supply increases, so must wages. Consequently the labourer is fully justified in his foolish ideas, so long as price fluctuations are permitted.

There is, however, no virtue in reducing prices under normal conditions, and what is wanted is a stable currency. This can only be obtained by fixing the prices of all necessities of life permanently, and by paying higher wages only *pari passu* with the increased production. Thus only can the workers earn and receive higher wages without raising prices, and thus only can a constant and real living wage, i.e., one which will always purchase these necessities, be established.

J. S. Hecht.

Lausanne.

November 5th, 1921.

Telephony—or Telepathy?

I wonder if you or any of your readers can explain the following occurrence:—A lady staying at a country house, wishing to use the telephone, took off the receiver and distinctly heard a conversation between her host and his agent; thinking that they were using other phones on the same line, she put back the receiver and waited till later for her call. Afterwards it transpired that her host and his agent had not been on the phone at all, but had held their conversation out in the park, somewhere near the telephone wires.

I should like to know the explanation of this; it beats me altogether.

T. W. Best.

Norwich.

November 5th, 1921.

[Perhaps there was a trunk line in the park, or the host's remarks may have electrified the agent. We know that Major-General Squier uses trees for wireless telephony; perhaps he could throw light on the occurrence.—EDS. ELEC. REV.]

The Durability of Lead-Covered Wiring.

In my experience the system of wiring in lead-covered cables is unsatisfactory as, apart from the action of certain acids, the writer found the following troubles on different installations:

1. Twice pierced by nails at switch drops.
2. Complete breakage at some point under plaster (cause unknown).
3. Twice nibbled by rats or mice.

In cases 1 and 2 the wiring had to be cut away at the point of entry into plaster, joints to be made, and the leads re-run on the surface in steel conduit. In case 3, new wiring had to be let in under the floors.

Again, if lead-covered cables have to be run in steel chases, tubes down walls, &c., what is the advantage? The conduit system undoubtedly, in the eyes of an engineer, is the job, and if only the electrician carrying out the work will make a mechanical job of it, there is nothing better—either C.J. or screwed, as the installation calls for.

With inspection fittings, the whole of the conduit well fixed (not thrown together throughout with saddles and cramps), the wiring being afterwards drawn in, the ultimate result is unquestionable, both for accessibility and long life.

The finished job becomes a mechanical one, which is so essential, and a good man will cover as much ground on this as on any other system.

But there is always the half-trained mechanic to upset these excellent systems. I have found only recently a beautifully

made wood reducing piece, reducing $\frac{3}{4}$ in. to $\frac{1}{2}$ in. tube, joints in conduit, no conduit down partitions or through walls, conduit on surface badly kinked and fixed with nails bent over, and a few days ago I discovered in a modern installation several conduits led into a rough wooden box without a lid, and nailed to the joist under the floor.

This box was packed with wires joined to outgoing leads, and feeding the numerous points, and possibly to other wooden boxes!

What system this is I have so far failed to comprehend, but it was certainly a contractor's nightmare.

R. H. Andrew.

Excessive Heating of Armature.

I shall be glad if you can give me any information regarding a fault on a machine which recently came under my notice. The machine in question is a 400-kW d.c. generator, running direct coupled to a steam set at approximately 550 r.p.m., the voltage being 480-520. After a short run an excessive heat is set up right round the armature core tips and outer windings. The heat is quite general, and is not greater at any one point, the inner windings and the bottom of the slots being comparatively cool. A fan, fitted on the main shaft, has been suggested, but this, while possibly reducing the heat, would, of course, have no effect on the fault itself, and would consequently be rather an unsatisfactory way of surmounting the difficulty. The air gap is quite uniform, and the field (the machine is shunt wound) appears to be all right. It may possibly be that some of your numerous readers have experienced similar trouble, in which case I shall be indebted to them for any information on the matter.

A. R. M.

Glasgow.

November 1st, 1921.

Rapid House Wiring.

With reference to the letter in your issue of the 21st instant from Mr. H. H. Pearson, may I say that I can substantiate this gentleman's remarks, as I am at present carrying out several schemes on the system he mentions (the J. & P.), and am obtaining results even better than those Mr. Pearson claims. So far from Messrs. Jessop & Boydell's claim being extravagant, I agree with Mr. Pearson that it hardly does justice to the full possibilities of the metal-sheathed surface fixing system in its most up-to-date and perfected form.

In my case, the pendants are made ready before going on the site, and a good deal of time is saved by this means.

Cyril F. Barrow.

Bury.

October 31st, 1921.

Electricity in Isolated Buildings.

The article under Mr. Freeman's signature in your issue of October 29th has apparently been written with insufficient knowledge of the trend of present-day products and lack of consideration for the initial and running costs of isolated plants.

There are so many points at variance with the practical comparison of the old and new methods that in justice to the industries concerned in this country, exception should be taken at the outset.

There is no doubt at all that, had it not been for the semi-automatic lighting sets with their isolated installations working with practically no attention all over the country, a great many more men would not have secured employment, and the fact that these sets are still being bought is proof that they are still being wanted.

However much conservatives may hold to old methods, progress will not be gained.

Truth to tell, comfort with economy is what is selling the modern semi-automatic lighting set, and it is doing this in a field, and at a price, untouched by the older and obsolete method.

R. F. Long.

M.C., A.M.I.E.E., A.F.Aer.I.

Stockport.

November 3rd, 1921.

Argentina.—The Review of the River Plate gives the following particulars of a new joint stock company authorised to operate by a recent decree of the National Government:—

"Compania Platense de Electricidad, Siemens Schuckert. Authorised August 5th, 1921. Domicile: City of Buenos Aires with right to establish branches. Duration: 20 years, with right to prolong. Object: to do business industrially and commercially in all classes of electrical goods, machinery and installations, &c., &c. Capital \$3,000,000 m/n in 3,000 shares of \$1,000 m/n each, divided into five series, each of 600 shares. Board: President Emilio Albert; Vice-President, Carlos Ley; Director, Richard Diercks; Director-alternate, Pablo Klappenback; Syndic, Silvestre H. Blousson; Syndic-alternate, Otto E. Frederking."

BUSINESS NOTES.

Bankruptcy Proceedings.—W. F. C. JAMES (Darlaston and District Electrical Engineering Co.), electrical engineer, 45, King Street, Warrington.—Receiving order made November 2nd on debtor's own petition. First meeting, November 16th, at the Official Receiver's Office, Wolverhampton. Public examination, December 7th, at the Court House, Walsall.

F. C. NICHOLS, 19, South Street, Scarborough (Scarborough Motor & Accessories Supply Co.).—The following are creditors herein:—

Moore & Son	£	100	Scattergood & Johnson	£	11
Scarborough Electric Supply Co.	£	75	Partridge & Co.	£	60
Woodall & Wood	£	105			

Company Liquidations.—HUDSONS ELECTRICAL ENGINEERING CO., LTD.—At the meeting of creditors a Committee of Inspection was appointed to investigate the position of affairs and decide upon the best method of realisation. This committee, consisting of Ald. J. Stringer Hinchcliffe (Hinchcliffe, Green Manufacturing Co., Ltd.); Mr. F. Thornber (George Ellison), and Mr. J. H. Carrick (Greenwood & Batley, Ltd.), decided to offer the whole of the stock in trade, plant, fixtures, fittings, &c. The sale by auction was announced to take place on 8th and 9th inst. at Leeds, by Messrs. Whittam & Sons.

GUILDFORD ELECTRICITY SUPPLY CO., LTD.—Meeting of creditors to-day, November 11th, at Guildford. Particulars of claims must be sent to the liquidator, Mr. B. D. Holroyd, by December 1st.

RENEW LAMP CO. (EASTERN), LTD.—Meeting December 5th, at 3-4, Great Winchester Street, E.C., to hear an account of the winding up from the liquidator, Mr. H. D. Carey.

HEADS (ELECTRICAL), LTD.—Meeting of creditors is called for November 17th, at 151-2, North Street, Brighton. Liquidator: Mr. A. E. Orbell.

For "Phonophone" Construction Co., Ltd. (ELEC. REV., November 4th, p. 600), read "Phonopore".

ELECTRIC FISHING CO., LTD.—Meeting of members called for December 10th, at Barclay Bank Chambers, Newborough, Scarborough, to hear an account of the winding up from the liquidator, Mr. F. C. Gardiner.

Trade Announcements.—An electrical engineering department has been opened by Mr. F. C. BATH, of the Gordon Road Works, Camberley, Surrey.

THE MANCHESTER ELECTRICAL CO., of Bull's Head Yard, Corporation Street, Manchester, wishes to receive catalogues and price lists of lamps, cables, domestic appliances, &c.

MR. L. G. COADE has relinquished his appointment as works engineer to Messrs. Simplex Conduits, Ltd., Birmingham, to enter into partnership with Mr. Robert Sell, A.M.I.E.E., proprietor of The Industrial Engineering Co., 190, Ashted Row, Birmingham, who have been appointed technical representatives for the Park Royal Engineering Works, Ltd., Messrs. Royles, Ltd., and the Titan Lift Co., Ltd., in the Midland district.

MESSRS. BELLING & Co. have opened showrooms on the ground floor at 18, Berners Street, Oxford Street, London, W.1, where a full range of their electric heating and cooking appliances is on exhibition. The firm are issuing, as a sales stimulating measure, a very large five-colour poster illustrating a girl switching on one of their electric fires.

With reference to our notice regarding the dissolution of partnership of the ELECTRIC BLOCK CO., of Halifax, Mr. F. E. Crowthorpe informs us that he is attending to debts and will continue the business.

MR. H. N. SHORROCK, late manager for Mr. Geo. Morrison, 6, Victoria Street, Morecambe, has bought this branch of the business, and will carry it on under his own name. He asks for catalogues of electrical goods.

Catalogues and Lists.—MESSRS. J. W. BROOKE & CO., LTD., Adrian Works, Lowestoft.—An illustrated and priced description of the "Brooklite" 1-kW power set.

STERLING TELEPHONE & ELECTRIC CO., LTD., 210-212, Tottenham Court Road, W.1.—Leaflet No. 307, giving revised list prices of standard apparatus.

THE CONSOLIDATED PNEUMATIC TOOL CO., LTD., Egyptian House, 170, Piccadilly, W.1.—Three illustrated leaflets dealing respectively with an oil rivet-heating forge, the "Boyer" hammer pick, and electric stone and chipping hammers.

MESSRS. DEWHURST & PARTNER, LTD., 28, Hatton Garden, E.C.1.—An illustrated publication giving particulars, dimensions, and prices of one-, two-, and three-phase motors.

MESSRS. DANIEL ADAMSON & CO., LTD., Dukinfield, Manchester.—An illustrated guide to the firm's manufactures, which include boilers, steam turbines, condensing plant, turbo-blower sets, &c.

THE BRITISH ALUMINIUM CO., LTD., 109, Queen Victoria Street, E.C.4.—A postcard detailing the many uses of aluminium for household purposes.

WATT MOTORS, LTD., Premier House, 150, Southampton Row, W.C.1.—An illustrated description of "Watt" motors.

THE VISCO ENGINEERING CO., LTD., 21, Bedford Row, W.C.1.—An illustrated pamphlet describing the "Visco" air filter.

THE BRITISH ELECTRIC TRANSFORMER CO., LTD., 50, Oxford Street, W.1.—A coloured card advertising "Tricity" "flame" fires.

MR. GEORGE ELLISON, Perry Bar, Birmingham.—An illustrated booklet giving a very full description of electric crane control equipment.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Leaflets N2451 and N2456 giving respectively revised catalogue prices and addenda to the company's list of low- and medium-pressure switchgear.

ELECTRICAL COMPONENTS, LTD., 90, Great Charles Street, Snow Hill, Birmingham.—Abridged price list of electrical accessories (No. 92), including cut-outs, bowl fittings, switches, lamp-holders, &c.

MESSRS. JAMES MCMILLAN & CO., Clun House, Surrey Street, Strand, W.C.2.—An illustrated price list of telephone apparatus for local and central battery service instruments, switches, &c.

MESSRS. LANG & SQUIRE, LTD., Wales Farm Road, Acton, W.3.—An illustrated price list of d.c. dynamos and motors, double wound d.c. to d.c. converters, and tapped d.c. to a.c. rotaries. Full dimensions are given.

THE B.E. CO. (OF LONDON & BIRMINGHAM), LTD., Hendon House, 57, Upper Thames Street, E.C.4.—A priced and illustrated leaflet advertising the "Beco" cigarette, cigar, and pipe lighter.

MESSRS. BRUNTONS, Musselburgh, Scotland.—Illustrated booklet fully describing the construction, method of operating, and typical results obtained by the use of Haigh's alternating stress testing machine.

Copper and Lead Prices.—Messrs. F. Smith & Co. and Messrs. James & Shakespear report, November 9th, no change in last week's quotations.

Book Notices.—*Punch Almanack for 1922* (one shilling) comes to hand reminding us of the nearness of Christmas. It contains many a laugh, and is well worth its cost.

"Foreign Exchanges and How to Profit by Them," by V. L. Gerard. London: Pall Mall Industrial Investments, Ltd. Price 1s. M. Gerard is a French banker and, naturally, his views favour France. He considers that the franc is greatly undervalued, and that French Government Loans are a better investment than British Consols. He states that the mark is purposely depreciated, and thinks that the internal purchasing power of this unit of currency is greater than the foreign exchange quotations indicate. He admits that the low level of the mark looks a tempting gamble, but the recent series of falls somewhat alters the position. The Italian lira is looked upon favourably. He criticises severely the financial methods of the United States, and accuses British banks of withholding, at America's command, the people's credit from national industries, to the detriment of British trade. In his last chapter the author advocates a return to the "gold standard," however imperfect it may be.

"Hardening and Tempering Engineers' Tools," by G. Gentry, pp. 61, illustrated, price 9d. net. London: P. Marshall and Co. This small book is full of practical information about the heat treatment of steel in ordinary workshop practice, dealing with the apparatus employed, the methods of hardening and tempering steel (in detail), with many hints for special cases, forging tools, and case-hardening. The novice is apt to think that the hardening and tempering of steel are very simple matters because they look simple, but this book will show him that there is a great deal more in them than is evident to the casual observer. In its higher developments, the heat treatment of steel is a science in itself, but for the small workshop this handbook contains all that is necessary for the user to know. A coloured frontispiece showing the tints of the "colour scale" is a useful feature.

"The French Polishers' Handbook," Pp. 114. Illustrated. London: P. Marshall & Co. Price 2s. net.—This book, the fruit of practical experience, gives numerous receipts for staining wood, grain fillers, French polishes, &c., and detailed explanations of the accessories and processes employed, with excellent illustrations. It will be most useful to the amateur worker, and even the professional may derive valuable hints from it.

Journal of the Institution of Electrical Engineers and Index to Vol. 59. Vol. LIX, No. 303. July, 1921.—This issue contains the following papers: "Present Conditions and the Hopkinson Principles," by Mr. J. R. Blaikie; "Multi-part Tariffs for Domestic Electricity Supply," by Mr. J. W. Beauchamp; "Abnormal Pressure-rise in Transformers," by Mr. R. Torikai; "Development of Army Wireless During the War," by Lt.-Col. A. G. T. Cousins, R.E.; and "Electric Oscillations in Straight Wires and Solenoids," by Prof. J. S. Townsend, F.R.S.

"Modern Gasworks Practice," by A. Meade. Second edition. Pp. xii+815, figs. 474. London: Benn Bros., Ltd. Price 55s.

"Modern Electrical Theory"—Supplemental Chapters—Chapter XV, "Series Spectra," by N. R. Campbell. Pp. 5+110. London: Cambridge University Press. Price 10s. 6d. net.

"O-Kai, a Fantasy of Now and Then," by E. C. Reed. London: O. W. Daniel. 3s. 6d. net.

Social Events.—The entertainment section of Tucker's Athletic and Recreation Club (J. H. Tucker & Co., Ltd.) held their opening social evening of the season on Saturday, October 29th, in the works canteen. The proceedings opened with a musical programme, with Mr. W. A. Smith (superintendent of assembly) in the chair, followed by a whist drive. Mr. S. Green (club secretary) acted as M.C.

Last Saturday evening at Justice Miles's Restaurant, Charing Cross, there was held the first of a series of social dances by the staff and friends of Messrs. J. & W. B. Smith, Ltd., of Harrington Road, E.C. Mr. Frederick Nottelmann is president, and the organiser is Mr. A. Matton, the firm's advertising manager, who organised the charitable outings held during the summer. The company at the whist drive on Saturday numbered just on one hundred. After the "drive," eleven presents were distributed to the winners. Following the "drive" came a programme consisting of songs, monologues, and recitations, interspersed with dancing.

Unemployment.—The "live" registers of the labour exchanges for the week ended October 28th showed that there was a further increase in the number of unemployed, from 1,423,792 in the previous week to 1,606,900. There was a slight fall in the number on short time. The Ministry of Labour attributes the large increase to the re-appearance of those whose right to benefit had lapsed, these having re-registered to qualify for the new period of relief which commenced on November 3rd.

Algeria.—The general electrification of the French Colony of Algeria is now under consideration by the Governor-General. A Commission authorised to examine the conditions under which the transport and distribution of electricity is to be effected, both for the service of the railways and supply to manufacturers, has made its report, on the strength of which a new commission of three technical specialists has been appointed, whose decision is now awaited.

The Nottingham Electrical Wholesalers' Association.—The second annual dinner of this Association was held on Friday last at the Black Boy Hotel, Nottingham. Invitations were extended to the local contractors, and a large combined gathering was the result. The toast of "The King" was given by Mr. Crammond, and that of "The Visitors" by Mr. H. M. W. Royce, Mr. A. Markwick responding. Musical and other items were provided by Messrs. F. G. Skerritt, H. M. W. Royce, E. Bryan, and J. H. Poxon. The "hit" of the evening was the reading of an original and humorous "Ancient Document" by Mr. Royce. The function was a success, and augurs well for the maintenance of the good fellowship already existing between the wholesalers and the contractors of the city.

For Sale.—Birmingham Corporation Electricity Supply Department has for disposal one 750-kW generating set, consisting of a Yates & Thom compound engine direct coupled to a G.E.C. d.c. generator, complete with surface condenser, air pump, and circulating water pump.

Edinburgh Corporation Electricity Department invites offers for one 600-kW Howden-G.E.C. triple expansion non-condensing set and one 600-kW Belliss-Bruce Peebles triple expansion non-condensing set.

(See our advertisement pages to-day.)

Trade Conditions and Unemployment in the Electrical Industry.—In reporting the proceedings of the deputation that met Sir Alfred Mond last week, we were unable to spare space for the following list of bodies represented on the Joint Conference of the electrical industry, which shows how comprehensive and representative it was:—

Joint Industrial Council for the Electrical Cable-making Industry, comprising: The Cable Makers' Association and Independent Cable Makers' Association, and the following Trade Unions: National Amalgamated Union of Labour; the Workers' Union; the Amalgamated Society of India-Rubber Cable and Asbestos Workers; the National Union of General Workers; and the Electrical Trades Union.

Joint Industrial Council for the Electricity Supply Industry, comprising: the Incorporated Municipal Electrical Association; the Incorporated Association of Electric Power Companies; the Conference of Chief Officials of the London Electric Supply Companies; the Provincial Electric Supply Committee of the U.K.; and the following Trade Unions: The Amalgamated Society of Gas, Municipal, and General Workers; the Dock, Wharf, Riverside, and General Workers' Union; the Electrical Trades Union; the National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen, and Electrical Workers; the National Amalgamated Union of Labour; the National Union of General Workers; and the Workers' Union.

Joint Industrial Council for the Electrical Contracting Industry, comprising: The National Federated Electrical Association and the Electrical Trades Union.

The British Electrical and Allied Manufacturers' Association Incorporated, comprising 210 manufacturing companies and firms.

The Electrical Wholesalers' Federation, comprising 73 wholesale distributors of electrical apparatus and appliances.

The British Electrical Development Association, comprising 379 electrical supply undertakings and 950 manufacturers and contractors.

Birmingham Fittings Trade.—Our local correspondent reports that the Birmingham electrical fittings manufacturing industries are suffering from the prevailing depression rather more than recently. He says: "The relapse which has caused a good deal of unemployment is attributed largely to the severity of German competition, which has been possible only by reason of her depreciated currency. From an export point of view, too, the situation is by no means satisfactory. Many of the foreign markets are overstocked with electrical fittings, and both the Indian and the Australasian demand is considerably below the post-war normal."

A Demonstration Kitchen.—The Metropolitan-Vickers Electrical Co., Ltd., has recently opened a new showroom and demonstration kitchen in Bristol. The kitchen, which is shown in the accompanying illustration, is equipped with a number of modern electrical appliances, which are demonstrated for inquirers by trained assistants. Cooking, washing, ironing, and clothes-drying are done.

In the showroom is an exhibition of all kinds of lighting



METROPOLITAN-VICKERS DEMONSTRATION KITCHEN.

fittings, fires, small cookers, and other appliances. Here assistants show the efficiency of vacuum cleaners for carpet sweeping, &c. The room is very tastefully furnished and decorated. The building has two show-windows, in which are displayed lighting fittings, fans, and other apparatus.

Local Electrical Exhibition.—From October 31st to November 5th, Messrs. Baxendale & Co. held a special exhibition and demonstration of electrical appliances in their show-rooms, Grass Market, Edinburgh. The usual articles were shown—kettles, grills, irons, percolators, &c., and visitors were shown the working of an electric washing machine. A special line of "Miller" lighting fittings was exhibited, including table standards, bowls, &c.

An Industrial Lighting Campaign.—We have received from Benjamin Electric, Ltd., full details of its efforts to induce manufacturers and others to install efficient lighting, or to aid factors to secure this.

A mass of literature advising as to the best means of gaining the attention of those who may prove good customers has been published in bound form. This commences with an introductory note and some extracts from the report of the Home Office Committee on Lighting in Factories and Workshops, detailing the effects of bad lighting upon efficiency and production. A selection of letters follows, and a number of illustrated pamphlets are also included. A special point is made of convincing works' managers of the inefficiency of their lighting by means of a simple but effective "Light-meter."

The Training of Ex-Service Men.—The Minister of Labour, speaking at the Preston instructional factory for the training of disabled ex-Service men, said that the number of the men still remaining unabsorbed by industry was still very great. There were 28,500 firms upon the King's Roll, and these were employing 345,000 disabled men; but still much remained to be done. Mr. Macnamara said that when men left the instructional factories they were really first-class craftsmen. The reason why there were men waiting to enter the factories was that the Local Technical Advisory Committees feared that particular industries might be overcrowded, but the speaker thought that their view should be broadened somewhat.

Lead.—In their report dated November 5th, Messrs. James Forster & Co. says that with trade as it is and a resumption of shipment here, both from Spain and Australia, they can see no sustained improvement in the price of lead, which is higher relatively to other metals.

British Samples, Ltd.—The Federation of British Industries has sent us particulars of a scheme for maintaining exhibitions of British samples in the leading foreign commercial centres. To this end a company has been formed with the title "British Samples, Ltd.," and the Federation sees so much promise in the scheme that it has consented to act as the British agents of the company. A booklet accompanying the Federation's letter describes the first of these sample "rooms," which is at 9, Rue de l'Église, Brussels. The suite comprises a main hall, measuring 50 ft. by 40 ft.; an inner hall, 25 ft. by 40 ft.; and an upper floor in which is a range of rooms available for private displays. The height limit of the showcases is 7 ft., and ample advertising space is therefore available on the walls of the halls. A number of varied services are rendered by the company and the F.B.I., 39, St. James's Street, S.W.1, will be glad to supply full details to those interested.

Ukraine Electrical Provision.—According to the *Ekonomicheskaya Zhizn*, the electrical industry in the Ukraine has made poor progress. The big V.E.K. factory of the Ukraine was transferred from Riga in 1915. The pre-war electrical factory of Kieff has a modest output of 5,000-6,000 pounds of copper cable. There is a number of small repair shops and small armature concerns that arose during the revolution, also the radio-telegraph plant in Odessa. At present there are seven more or less important town stations in the Ukraine of from 1,000 to 10,000 kW capacity, some small stations in the local towns and villages, and a number of peasant industrial electric stations distributed over the Donetz and Krivoi Rog basins, of a total capacity of 50,000 kW. Practically everywhere the electrical stations are in a half-ruined condition, and their rehabilitation proceeds slowly for want of repair material and because of labour trouble. But the state of the V.E.K. is on the whole satisfactory; its difficulties arise chiefly over lack of materials of second rate importance. Most of the qualified workmen came from Latvia, and, being dissatisfied with the conditions, they have mostly returned home.

Tube Extension Scheme.—The Government has decided to appoint a Committee of Inquiry consisting principally of financial experts, to investigate and report upon the schemes of extensions proposed by the Underground Railways Co. of London, Ltd. The object is to decide whether this work will be eligible for guarantees under the Trades Facilities Bill.

The *Times*, however, is informed that the scheme does not come under the Trade Facilities Bill. Lord Ashfield's proposal is to raise the £6,000,000 capital required in the City in the usual way. What he asks from the Government is a short Bill giving effect to the safeguards which he has proposed.

The Premier, in reply to a question in the House of Commons, on November 7th, stated that Lord Ashfield had been informed that the Government could not promote legislation to protect the companies against competition, but at the same time the Government wished the important work to proceed. It is probable that a revised scheme will be drawn up.

Electrical Appliances in Canada.—The popularity of electricity in Canada for lighting homes and operating household appliances is shown by the fact that 74.9 per cent. of the residences, so situated that electricity is available for use, are wired. Electric flatirons are used in 45.7 per cent. of these; electric toasters in 18.2 per cent.; electrically-operated washing machines in 5.9 per cent.; electric fans in 5.4 per cent.; electrically-operated vacuum cleaners in 5 per cent.; electric ranges in 3.1 per cent.; electrically-operated sewing machines in 1.2 per cent.; electric dishwashers in 0.7 per cent.; and electric refrigerators in 0.6 per cent.—*Electrical Review* (Chicago).

Public Works, &c., Congress.—The Congress which is being held in connection with the Public Works, Roads, and Transport Exhibition, commences on November 19th. A conference on "The Purification of the Atmosphere" has been arranged for the first day. The last day, November 25th, is being organised by the I.M.E.A., and, up to the present, two papers have been announced: "Electric Vehicles for Municipal Purposes," by Mr. F. Ayton, M.I.E.E., and "The Application of Electricity to Municipal Services," by Mr. S. J. Watson, M.I.E.E. The chair will be occupied alternately by Bailie W. B. Smith, O.B.E., a member of the Glasgow Electricity Committee, and Mr. S. T. Allen, M.I.E.E., president of the I.M.E.A.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions associated with the electrical trades and industries:—

Elgon. No. 417,063. Class 18. Electric alarms as systems in buildings.—Richard Dittmayer, 8, Striesenstrasse, Blasewitz, Dresden, Germany. July 19th, 1921.

Meriditt. No. 417,069. Class 18. Electric alarms as systems in buildings.—Richard Dittmayer, 8, Striesenstrasse, Blasewitz, Dresden, Germany. July 19th, 1921.

Minirisk. No. 416,258. Class 18. Electric alarms as systems in buildings.—The Minirisk Co., Ltd., 47, Victoria Street, London, S.W.1. June 18th, 1921.

British Made (lettering and design). No. 405,480. Class 8. Electric cables made in Great Britain.—Ward & Goldstone, Ltd., Sampson Works, Salford, Manchester. June 24th, 1921.

Vec. No. 416,199. Class 13. Electric lamps.—Lamp made in Holland.—Victoria Electrica (Manchester), Ltd., 27, Berry Street, Buxton Street, Manchester. June 16th, 1921.

Red Dragon. No. 416,362. Class 13. Electric lamps and fillers, &c.—W. F. M. Rose, trading as Moskan Rose & Co., Blackhorse Garage, West Street, Bristol. July 14th, 1921.

Surlinde (lettering and design). No. 417,057. Class 8. Electric accumulators (and for medical purposes).—Chloride Electric Storage Co., Ltd., Clifton Junction, Manchester. August 16th, 1921.

C. & O. (lettering and design). No. 409,523. Class 13. Electric lamps (ordinary) and fittings for electric lamps.—Crowther & Osborn, Ltd., 7, Blackheath Street, Salford, Manchester. November 2nd, 1920.

An A.E.G. Absorption.—The A.E.G., of Berlin, proposes to absorb the undertaking of the Mix & Genest Telephone and Telegraph Co., of Berlin-Schöneberg, by means of an inter-change of shares. Curiously enough, the offer is not being made to the shareholders in the latter directly, but by a banking group in the name of the Berlin Electricity Works Co., whose supply works were expropriated by the Berlin municipal council.

Bradford Health and Home Exhibition.—Amongst the exhibitors at the first Bradford Health and Home Exhibition, opened at Belle Vue Barracks on November 4th for a fortnight, are the Corporation Electricity Department; Rycoff and Co., Ltd., Aldermanbury, electric fitters; Henry Wilson (Bradford & Birmingham), Ltd., electrical contractors, of Foster Square; the Unit Electrical Co., Hall Ings; and Electrical Services, Ltd., Aldermanbury.

Electricity Salesmanship Conferences.—A series of conferences has been initiated by the British Electrical Development Association, Inc., having for their object the bringing together of persons interested in the sale of electricity or electrical material and appliances, and the promotion of discussions on short papers or lectures dealing with the various aspects of load building and salesmanship. Admission to the conferences will be by tickets, to be obtained from the E.D.A. Offices (Hampton House, 84, Kingsway, London, W.C.2). All persons engaged in the industry and coming into contact with the public in the course of their work are eligible to attend and take part. The subjects dealt with will be commercial rather than technical. It is not intended that the conferences should in any way replace the work of existing organisations for discussing the technique of the business, but that they should concentrate upon methods of popularising the use of electricity, and presenting the advantages of electrification to the consuming public. The proceedings will not be open to members of the general public. It is proposed to deal with salesmanship in relation to some different aspect of the domestic load at each meeting, getting different persons in the industry to take the chair and different experts in each branch of electrical merchandising to read short papers and open discussions. Six meetings will be held in London this session, but we have no doubt that provincial electrical men will see the need for similar gatherings elsewhere.

The first conference is to be held on Friday, November 18th, at 8 o'clock, at the Institute of Chartered Patent Agents, Staple Inn Buildings, W.C.1. Mr. S. T. Allen, M.I.E.E., will preside, and Mr. E. H. Freeman, M.I.E.E., will speak on "Salesmanship in Wiring and Installation Work." Brief records or minutes of proceedings will be made with a view to circulation for the assistance of provincial centres doing similar work in affiliation with the E.D.A.

Austin Motor Co.—It is reported that debentures for £200,000 (10 per cent.) in this company have been taken up by Sir John Leigh, Bart., and that the company's affairs are to be taken out of the hands of the receiver. A Manchester newspaper reports that the company has booked a large contract for cars (£2517,500) from a Manchester company, also other important contracts.

New French Company.—La Co-operative d'Électricité de la Région de Peronne is the name of a new undertaking which has lately been formed to establish an electricity generating plant to supply electricity for lighting and power purposes to 35 communes in the Peronne war devastated area. The capital of the concern is 3,000,000 fr., of which the French Ministry of Agriculture is advancing 2,000,000 fr., repayable in thirty years.

The Belgian Electrical Industry.—According to the *Belgique et Force Motrice*, the improvement in electrotechnical business in Belgium seems to be increasing. As a matter of fact, the last reports of the correspondents of the Ministry of Industry and Labour show that demand continues good for electrical machines and apparatus. One firm at Mons is about to make extensive enlargements of its works. Orders are growing both in number and value. There is marked activity in installation material, and good craftsmanship are being sought after. At Antwerp, notwithstanding the stringency which has prevailed generally, the local electric supply company has been compelled to undertake the building of a new transformer station near the Central Railway station to satisfy the growing demand for power from the large manufacturing firms. The new station will be of a capacity of 5,000 kW, and will be equipped with two transformer groups of 1,000 kW each. It is expected to be working by the end of the year.

New Belgian Companies.—There has been formed at Brussels (Place Louise 1) the "Electrolux," to trade in all appliances relating to electricity and especially electric vacuum cleaners. Capital, 100,000 fr.

Under the style of *Constructions Electriques du Centre*, there has been launched at Godarville a company, with a capital of 275,000 fr., for the building of motors and other apparatus and the installation of lines, networks, central stations.

With a capital of 1,250,000 fr., there has been formed at Brussels (Rue Berthelot 152-4) the *Compagnie Industrielle et Commerciale d'Electricité* for trading in and the construction of electric material, for its own account or for third parties.

H. De Lannoy & Cie. 1489 Chaussee de Waterloo, Brussels) has been constituted a company, with a capital of 200,000 fr., for the representation of Belgian and foreign metallurgical and electric construction firms.

The *Société Anonyme Chauffage Flamen et Mignot* has been established at St. Gilles (17 Place Maurice Van Meenen) for the purchase, sale, and manufacture of all kinds of heating, ventilating, cooking and washing apparatus, &c. Capital, 200,000 fr.

LIGHTING AND POWER NOTES.

Australia.—NEWCASTLE (N.S.W.).—The annual report of the Municipal Council's electricity supply undertaking for the year ended December 31st, 1920, shows a total revenue of £96,439 as compared with £36,983 in the previous year. Working expenses totalled £55,325 (£27,460), leaving a gross profit of £11,173. After payments to sinking fund and interest, &c., there was a net surplus of £8,990.

Barton-on-Humber.—STREET LIGHTING.—The Urban District Council has declined to entertain an application from the Barton Electric Supply Co. for an increase in the contract price for street lighting.

Bedford.—EXTENSIONS.—The extensions which were put into commission on October 29th consist of a Parsons reaction turbine coupled to a 1,500-kW single-phase alternator. The steam-raising plant comprises four B. & W. land type boilers in two pairs, with the chimney between them. These are each guaranteed to produce 15,000 lb. of steam per hour at 200 lb. per sq. in., superheated 250 deg. F. Chain-grate stokers are fitted, and can be used for either forced or natural draught. The chimney is of brick-lined steel and 100 ft. in height. In order to use the new boiler plant to greater advantage, a connection has been made with the old steam range so that the Westinghouse turbine in the old works can be supplied with steam, through a reducing valve, at 130 lb. per sq. in. The exhaust steam from the auxiliary plant (a small steam turbine driving two pumping sets) is used for heating the condensate and make-up water which is returned to the boilers at about 200 deg. F. The 6,600-V switchboard consists of stone cubicles containing oil switches, isolating switches, &c. The cubicle doors are interlocked with the switches to prevent opening while the power is on. The switches are electrically operated from a top gallery. The 6,600-V gear is linked up to an older 2,000-V board through three transformers. A battery of 57 cells has been installed, and this is charged by means of a mercury vapour rectifier.

Brentwood.—ELECTRICITY SUPPLY.—The Urban Council has appointed a committee to consider the details and figures of two electric lighting schemes submitted to it.

Canada.—The Winnipeg Electric Railway Co. has announced that satisfactory arrangements have been made for the financing of a new power development at Great Falls on the Winnipeg River, some 63 miles from the Manitoba metropolis. When completed the plant will have a capacity of 168,000 h.p., and is expected to cost about \$10,000,000. Work on the construction of the plant is already under way, about 200 men being employed at the present time, though it is expected that from 1,000 to 2,500 men will be required at later stages.—*Railway Gazette*.

Cannock.—ELECTRICITY SUPPLY.—An agreement has been arrived at between the Urban District Council and the West Cannock Colliery Co. for the supply of electricity to the district, and arrangements are being made for the erection of a transformer station and the laying of cables.

Continental.—ITALY.—By a decree appearing in the *Gazzetta Ufficiale* the provinces of Venezia, Treviso, Belluno, Padova, Rorigo, Vicenza and Ferrara are authorised to form an autonomous group for the utilisation of the hydraulic forces of the basins of the Brenta and the Piave, and their tributaries, as well as the other watercourses of the provinces. The bodies entitled to form part of the group include the various communes, reclamation and irrigation consortiums, chambers of commerce, savings banks, and other public bodies and companies. The group will construct plant and distribute and sell electricity; its capital is unlimited, and will consist of shares of 50,000 lire each, redeemable within fifty years. The

group is also empowered to raise loans and issue bonds.—*Reuter's Trade Service* (Rome).

Belgium.—At the recent meeting of the *Société d'Electricité de l'Est de la Belgique*, the directors reported that in order to meet the increasing demands for electricity, the laying down of further plant had become necessary. The capacity of the company's central station at Verviers has been extended from time to time, but no further extensions there are not possible, the demand on the local water supply for the boilers having reached the maximum. The directors have, therefore, entered into an arrangement with the *Société Intercommunale Belge de l'Electricité*, which already operates one of the largest power stations in the country, whereby the last-named company will establish on the banks of the river Meuse a new central station with a capacity of not less than 20,000 kW, from which to supply the whole of the power required for the clients of the *Société d'Electricité de l'Est de la Belgique*. The *Intercommunale Co.* will also take over the management of the Verviers power station which, while the new Meuse station is completed, will be used as a reserve plant.

France.—A concession has been applied for to set up distribution network for public services between Bernay Lisieux, Glos, Cambremer and Bonnebecq in the department of Calvados, Eure and Orne.

La *Société Normande d'Electricité* has recently secured concession for the supply of electrical energy for lighting and power purposes in the Departments of l'Eure and Seine Inférieure.

The *Forces Motrices de la Vallée d'Aspe* has in hand two schemes for electrical developments. The first comprises the extension of the existing generating station called Forge d'Abel to 3,600 h.p.; the erection of a 6,000-h.p. station at Esquet, expected to be completed by the end of 1922; the building of a station of 3,300-h.p. capacity on the Lake of Estans, and the construction of a high-pressure distribution network to serve, from these stations, the districts of Oloron Pau, and Bayonne. The second scheme includes the erection of four generating stations, on as many falls, the energy supplied being distributed in the districts of Bordeaux and Auch. The total yield will be 70,000 h.p.

Application has been made by the *Société de Transport d'Energie des Alpes* for a concession to set up three main lines and a number of minor ones in the Alpine regions connected with various existing generating stations. The main lines are intended to carry 35,000 kW, and will be equipped for 120,000 volts and eventually 150,000 volts, if technically feasible. The total power of the generating stations is estimated at 550,000 kW.

Glasgow.—ELECTRICITY EXTENSIONS.—The Clyde Valley Electrical Power Co. has had installed at its power station at Yoker a turbo-alternator supplied and erected by the Metropolitan-Vickers Electrical Co., Ltd. The maximum output of the installation is 30,000 h.p., the set operating at 1,500 r.p.m., generating 3-phase, 25-period, a.c. at 11,000 volts. Cooling water is drawn from the river Clyde by centrifugal pumps, supplied by Messrs. Drysdale & Co.

Grampian Scheme.—TREASURY ASSISTANCE SOUGHT.—The company which has been formed to develop the water power of the Grampians is seeking Treasury aid for the scheme. The project will absorb a considerable amount of unemployed labour and encourage the introduction of new industries to Central Scotland.

Hackmondwyke.—YEAR'S WORKING.—The revenue account of the electricity undertaking shows a net loss of £3,668 for the year ended March 31st last.

Hove.—PRICE REDUCTION.—The Electricity Committee has decided to reduce the charges for lighting purposes to 1½d. per unit as from the meter readings after January 1st next. No reduction is to be made in the charges for power until the price of coal becomes stable and further experience has been obtained as to the working of the bulk supply from Brighton.

India.—PUNJAB.—The Punjab Government intends to encourage as far as possible alternating current generation and transmission, and has decided upon the following standard frequencies and voltages: Frequency, 50 cycles (or 25 cycle for special cases). High pressures: 11,000 V, 6,000 V, 3,800 V and 2,200 V at generator terminals; primary pressures for transformers, 2,000 V, 3,000 V, 6,000 V, and 10,000 V; secondary transformer pressures, 115 V, 230 V, 460 V, and 525 V at no load. Standard low pressures: At generator terminals 115 V, 230 V, 460 V, and 525 V; at consumers' terminals 110 V, 220 V, 440 V, and 500 V, or 400 V, between phases. When a lower pressure than 110 V is desired 55 V or 75 V may be employed. The standard pressure for tramway supply is 500 V.

Jersey.—STRIKE.—A dispute has arisen between the Dock and General Workers' Union and employers, over a proposed reduction of 2d. per hour for "unskilled" labour. The employers have refused to agree to arbitration until the district secretary of the Union apologises for making a statement regarding the profits of the builders and allied trades. The power station engineers have stopped work in sympathy with the building workers, and the island is in darkness.

Keighley.—**YEAR'S WORKING.**—The annual report of the electricity department shows a total revenue of £61,517, as compared with £47,782 in the previous year. Working expenses amounted to £50,164 (£41,360), leaving a gross profit of £11,353. After deduction of interest and sinking fund charges there was a net deficit of £6,554. In the previous year there was a deficit of £5,942.

Kells.—**ELECTRICITY SUPPLY.**—A committee has been appointed to consider a scheme submitted by Mosses, McEntee, Lavelle & Gregory for the supply of electricity to the town. The scheme provides for a revenue of £2,400, which, after deduction of working costs, will leave a gross profit of £1,572.

Kilmallock.—**COST OF LIGHTING.**—The District Council has appointed representatives to meet the Electric Lighting Co. to consider the question of renewing the Council's grant towards the cost of lighting the area.

Lancaster.—**EXTENSIONS.**—The Town Council has decided to carry out plant extensions, to meet the increased demand for electricity, at a cost of £8,000.

Law.—**ELECTRICITY SUPPLY.**—The County Council has applied for a Special Order for the supply of electricity to the parish. It is proposed to obtain a supply of electricity from the Wilsons & Clyde Coal Co.

Liverpool.—**ELECTRICITY SUPPLY EXTENSIONS.**—With a view to providing work for unemployed electricians, the local branch of the E.I.U. has approached the town clerk with regard to expediting electrical work now in abeyance, including the erection of a new transformer station at Antice. The town clerk has informed them that the work will be proceeded with as soon as a suitable site can be obtained for the sub-station.

Llanfairfechan.—**ELECTRICITY SUPPLY SCHEME.**—The proposal to spend £10,000 upon a supply undertaking for the town is meeting with strong opposition. The Council is holding a special meeting to discuss the proposals. It is stated that the question of electricity supply has been under consideration for eight years.

London.—**WILDESDEN.**—The Electricity Commissioners have sanctioned the borrowing of £30,000 for mains extensions.

REPLACEMENT OF FUSES.—The Highways Committee of the London County Council submitted the following recommendation at the Council's meeting on November 8th: "That the attention of the Electricity Commissioners be drawn to the practice adopted by some electricity undertakers of charging consumers for the time and attendance of their workmen in cases in which safety fuses within consumers' premises have to be renewed and to the fact that, in view of the regulations made by the Board of Trade under Section 6 of the Electric Lighting Act, 1882, the levying of such charges would appear to be unjustified; and that the Commissioners be asked to consider taking such steps as will acquaint electricity consumers with their rights in the matter."

Newcastle (Co. Down).—**ELECTRICITY SUPPLY.**—The Urban Council has approved the agreement for the lighting of the town by electricity.

New Zealand.—**DUNEDIN.**—The report of the engineer (Mr. M. C. Henderson) upon the electricity undertaking, which is one of the largest in the Dominion, for the year ended March 31st last, records a total revenue of £95,925, as compared with £84,720 in the previous year. Working expenses amounted to £37,016, as against £28,958, leaving a gross profit of £58,909 (£55,762). The net result was a profit of £20,043, an increase of £1,900 on the previous year's result. The number of units sold rose from 14,292,787 to 16,338,291, and the average price per unit fell from 1.490d. to 1.409d.

Singapore.—**EXTENSION OF SUPPLY.**—The municipality is extending its supply of electricity to the European residential quarter of the town. Work is now in hand, and energy is expected to be available by the spring.—*Eastern Engineering.*

Sevenoaks.—**CURTALMENT OF ORDER OPPOSED.**—The Urban District Council is opposing the local Supply Co.'s application to the Electricity Commissioners for the cancellation of the portion of the Provisional Order relating to the supply of electricity to the Oxted district, on the ground that if the local Supply Co. at Oxted succeeded in obtaining the monopoly of the lighting rights of that area, the inhabitants of the supply area of the Sevenoaks Co. would be indirectly affected.

South Africa.—**MUNICIPAL ELECTRICITY SUPPLY.**—In 1919 there were 40 municipal bodies in the Union operating electric light and power stations; 15 in the Cape, seven in Natal, ten in the Transvaal, and eight in the Orange Free State. The number of consumers was 63,408, the units sold 91,671,331, and the working cost per unit ranged from .77d. at Aliwal North to 9.58d. at Pietersburg. Johannesburg, Durban, and Cape Town, in the order named, accounted for more than half of the consumers; Johannesburg numbered 20,222 consumers, who took 29,539,513 units at a cost of 1.68d. per unit; Durban, with 8,462 consumers, supplied 25,377,961 units at .69d. per unit; and Cape Town numbered 9,361 consumers, who took 15,366,505 units at 1.55d. per unit.

KRUGERSDORP.—The municipality has resolved to give up its power station and take a supply from the Victoria Falls

Power Co. on a ten years' contract, in addition to the supply from the Randfontein Mines, which it has been taking for some time past. It is expected to save between £5,000 and £7,000 per annum by this arrangement.

JOHANNESBURG.—At a recent meeting of the Town Council the question of supply from the Victoria Falls Power Co. was raised. The chairman of the Finance Committee stated that the Council would be authorised by the Administrator to borrow £119,900 for the development of the lighting plant. The Electricity Committee suggested that terms should be obtained from the V.F.P. Co. for a supplementary supply of electricity. Both recommendations were carried.

Tullamore.—**WAGES DISPUTE.**—The Electricity Supply Co.'s works were closed down for some days last week owing to a dispute regarding wages, which was ultimately settled on the men accepting £3 7s. 6d. per week at 56 hours.

Winchester.—**LOANS.**—The Town Council has applied for loans of £1,000 for a water spraying plant for the electricity works and £1,200 for the provision of "Olipel" remote control gear and switches for street lighting purposes.

Worcester.—**ELECTRICITY WORKS EXTENSION.**—The Electricity Committee has under consideration the acquisition of generating plant at the Southampton Rolling Mills. The scheme involves the expenditure of £50,000, and a loan is contemplated.

Workshop.—**LOANS.**—The Urban District Council has applied to the Electricity Commissioners for sanction to the borrowing of £4,500 for carrying overhead electrical wires to "Rhodesia," a newly-erected model village near Shireoaks.

Application has also been made to the Liverpool Victoria Friendly Society for a loan of £27,000, at $\frac{5}{4}$ per cent., for electric light extension, to be repaid in periods of from 18 to 25 years.

TRAMWAY AND RAILWAY NOTES.

Australia.—**VICTORIA.**—The Victorian Railways Department is instituting a service of electric freight trains on the Melbourne suburban system, a great part of which is served by electric traction. Several long guards' vans have been fitted with a pantograph and the necessary motors and other equipment, and it is proposed that these vans, running between the passenger time-tables, shall relieve the fast electric passenger trains of the work of dealing with suburban goods traffic.—*Reuter's Trade Service* (Melbourne).

Black Country.—**CONTROL OF TRAMWAYS.**—A committee of the Dudley Town Council reports the receipt of letters from the Birmingham and Midland Joint Committee of Electricity, Tramways, and Motor Omnibus Undertakings with regard to the Black Country tramways being continued as one undertaking. The companies concerned are about to promote a Bill in the ensuing session of Parliament with that object, but if the local authorities concerned are considering the promotion of a Bill themselves to form a Joint Board with a view to acquiring and operating all these tramways, the Joint Committee would be willing to co-operate with the local authorities to that end. The committee appointed the Mayor and chairman to attend any conference of local authorities convened on the subject.

Burton-on-Trent.—**ACCIDENT.**—On November 4th, a double-deck tramcar proceeding along Station Street at a moderate pace suddenly overturned after leaving the track. Eleven people are reported to have received injuries, the driver and conductor escaping with slight shock.

Clayton-le-Moor.—**EXTENSION OF TIME OPPOSED.**—The Council has placed an objection to the application of the L. & Y. Railway Co. for an extension of time in which to construct a light railway in the Clayton district. The Council states that an extension might mean the cancellation of the scheme, and prevent others attempting the enterprise.

Continental.—**FRANCE.**—It is stated that the municipal authorities of Paris are contemplating the introduction of railless electric traction owing to the high cost of petrol. It is thought that this would permit of a considerable reduction of fares.

SPAIN.—Application has been made to the Dirección General de Obras Públicas for a concession to construct an electric railway from San Fernando to Chiclana. The Vizconde de Escoriaza is the applicant, and he is willing to forgo both subvention and guarantee of interest. If no competitor appears within one month, his application will be granted.

Guatemala.—**NEW ELECTRIC RAILWAY.**—A new electric railway is being built from San Felipe to Quetzaltenango, the capital of the district of Los Altos. It will be of metre gauge, will have a length of 27 miles, and commencing at an altitude of 2,058 ft., will terminate at 7,058 ft. above sea level. Owing to the mountainous nature of the country the maximum grade over one-third of the distance will be at least 9 per cent., the average for the remainder being from 2 per cent. to 3 per cent. The latest type of cars for passenger and goods

traffic will be employed, the former having a seating capacity for 40 persons and the latter a carrying capacity of 15 tons. Hydro-electric power will be employed, the energy being obtained from the Salamá river, of which the Santa Maria Falls, two in number, and of a height of 250 ft. and 100 ft. respectively, are capable, it is estimated, of producing 10,000 h.p., and after supplying the needs of the line, the surplus power will be utilised for the lighting of towns and coffee plantations over a wide area. The total outlay is put down at \$2,200,000 United States currency.—*Londoner of Commerce Journal*.

Hull.—**INTRODUCTION OF POSTAL BOXES.**—The Tramway Committee intends to institute postal collection boxes on the tramcars, to facilitate postal services locally. Such cars will be indicated at night by a special light. It is expected that delivery of letters will be expedited by twenty-four hours in some cases.

India.—**NEW TRAMWAY.**—The Dehra Dun Mussoorie Electric Tramway Co., Ltd., has been registered with the object of building a tramway between Dehra Dun and Mussoorie. The U.P. Government has granted a concession. The capital of the company is Rs. 50 lacs. The preliminary estimate is Rs. 36,62,000. The managing agents are Messrs. T. Beltie Shah (Gilani), Rajor Road, Dehra Dun, U.P.—*Reuter's Trade Service* (Bombay).

Keighley.—**RAILLESS CARS.**—The Tramway Committee has decided to give a trial to a new type of railless car for the hilly routes at present served by the department's railless 'buses, which have been running at a heavy loss.

Leeds.—**TRAMWAYMEN'S EMPLOYMENT SCHEME.**—An admirable arrangement has been come to by the employees of the Tramways Department to ensure that each man has an equal chance of being employed when the staff has to be cut down for any reason. The requirements of the department for the ensuing week are ascertained, and a ballot is taken; those men who fail to secure a place have to stand aside for the week. They are not neglected, however, for those who are retained are invited to contribute to a pool which is shared among those who are "stood off." Should a man refuse to contribute, he renders himself ineligible for this relief if he is out of work. No overtime is to be worked while the scheme is in operation.

London.—**LINKING-UP.**—Lord Ashfield recently told a representative of the *Morning Post* that the London General Omnibus Co. had experimented upon the linking-up of tramway "dead ends," for which the L.C.C. was recently refused Parliamentary Powers. The result was a failure, and the company had saved the public considerable expense.

ACCIDENT.—A delay in the tramway service was caused last week through the collision of a London United car, travelling in the direction of Acton, and a steam wagon. The car was thrown off the lines, and windows were broken. The front of the wagon was smashed and caught fire. Nobody was seriously injured.

New Zealand.—**DUNEDIN.**—The manager of the city tramways (Mr. W. H. McKenzie) reports that the total receipts for the year ended March 31st last were £115,865, as compared with £106,954 in 1919-20. Working expenses amounted to £77,925, as against £63,625, leaving a gross profit of £37,940 (£43,329). The net result was a surplus of £9,092. The car mileage rose from 1,350,318 to 1,498,997, and the number of passengers carried from 71,707,302 to 18,744,010.—*Commonwealth Engineer*.

TELEGRAPH AND TELEPHONE NOTES.

Belgium.—**RAILWAY COMMUNICATION.**—Hitherto the telegraph only has been used in working the railways in Belgium. At the beginning of last month (October) the telephone was installed on the Brussels-Namur line and on the Schaerbeek quadrilateral. The special material was supplied by the Bell Telephone Co., Antwerp, and the American Western Electric Co.

China.—**TELEPHONE EXTENSIONS.**—The business men of northern China have started an agitation to link up all their principal cities by telephone toll lines, declared Mr. Clark H. Minor, formerly manager of the China Electric Co. of Peking, who arrived in New York a short time ago on his way to London, where he will become commercial manager of the associated and allied companies of the International Western Electric Co. in Europe. "Work has already begun on a long-distance line between Shanghai and Peking that will connect with the toll system now in operation between the northern capital and Tientsin," he said. "The latter line, which has the distinction of being the only inter-city cable now existent in China, is only 100 miles long. The new artery of communication probably will be completed late this year. It will cost about \$500,000, and will be constructed according to

American standards. The Chinese are great admirers of the telephone. They have become tired of the difficulties which beset their use of the telegraph, where the many characters of their alphabet force them to send all their messages in code, and want to enjoy the time-saving methods. Consequently new exchanges are being erected in most of the larger cities to augment the 55,000 subscribers' lines already in use in the republic. Girls are being trained as operators in Shanghai for the first time. Hitherto, on account of the cheapness of male labour, all work at the Chinese exchanges has been done by men. In the three years since its organisation the China Electric Co., which really is a joint undertaking of the International Western Electric Co. and the Ministry of Communications at Peking, has raised its capitalisation from \$250,000 to \$1,000,000, a growth fostered by the increasing demand for telephones and other electrical material in the republic."—*Electrical Review*, Chicago.

Italy.—**NEW WIRELESS STATION.**—There has been formed at Fiume a joint stock company with the object of erecting and working a large wireless station there. The new company has no connection with the local Marconi Co., but is locally formed and managed, one-third of the capital being reserved for private subscription and 25 per cent. for the Commune of Fiume. The style of the company is the Società Fiumana delle Radio-comunicazioni.

London.—**NEW WATERLOO SWITCHBOARD.**—In the September issue of the *South-Western Railway Magazine*, Mr. W. J. Thorowgood, M.I.E.E., describes the new automatic telephone switchboard recently installed at Waterloo (L. & S.W. Railway). This is a 50-line board capable of dealing with all the telephone business of the offices of the Superintendent of the Line and the London District Superintendent, and it is the first of its kind to be installed on a British railway. To make it easy for the operator on the manual switchboard to quickly determine which jack she has to plug into, it is being arranged to prefix the number ascribed to each office connected to the automatic switchboard with the letter A; thus the telephone number of No. 20 on the automatic switchboard at Waterloo will appear in the company's telephone directory as Waterloo A 20. Hence No. 61 will ask the operator on the manual switchboard after he has removed the receiver from the hook of his telephone instrument for "A 20." The operator will then connect No. 61 on the manual board direct through to No. 20 on the automatic switchboard without in any way interfering with the automatic portion of this board, the operations being practically similar to those on the manual switchboard at present. This has been arranged to save time in switching through at the switchboard and incidentally to give a quick service.

Storm Damage.—The telegraph department of the General Post Office announces that the gale of Saturday night caused considerable dislocation of telegraphic traffic. The dislocation was most pronounced in the Eastern Counties. There apparently the gale had been most severe, wires being down extensively, as the result, it was assumed, of trees being blown across them.

The daily Press also announces that on the following day, Sunday, telegraphic and telephonic lines of communication in Belgium suffered greatly.

France and North Germany also suffered, and on November 7th there was no telegraphic communication between London and Germany, Holland, and Belgium, says the *Evening News*. There were interruptions and delay in the service between London and France, Italy, Switzerland, Russia, and some other countries. The east coast communication suffered more owing to the fact that the main lines on overhead poles were brought down in big bunches all over East Anglia, including all those which connect London and East Walsham, where the cables to Germany and Holland enter the North Sea.

The *Times* announces that serious delays owing to storms are reported by the Eastern Telegraph Co. from Natal.

The Telephone Service.—The announcement is made that automatic telephones are to be installed at Preston telephone exchange, which now controls over 1,500 local lines.

In reply to a question in the House of Commons last week, the P.M.G. said that contracts were being proceeded with for over 800 miles of main cable. The cables would connect 69 cities and towns with the main underground trunk system, and, in addition, some 500 miles of cable would be laid to connection with the development of the local telephone system.

U.S.A.—**NEW WIRELESS STATION.**—President Harding, on November 5th, sent out from the White House the first message to be transmitted by the New York Radio Central on Long Island. Over a land wire connected with the station and looped into the White House, the President dictated his message for wireless transmission. The radio plant occupies a tract of ten square miles, and with its ten units in full operation will utilise a transmitting power of 2,000 kW.—*Reuter's Trade Service* (New York).

NEW CABLE.—Arrangements have been completed, says a Washington message to *The Times*, for the opening of the Yap-Guam cable during the Armaments Conference.

The agreement will be signed by the United States and Japan and approved by Great Britain, France, and Italy probably next week.—*Reuter's Trade Service* (Washington).

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Australia.—MELBOURNE.—City Council. February 20th. One 2,000-kW rotary converter with transformer, also 6,600 V, 50-cycle, 3-phase switchgear.—*Reuters Trade Service* (Melbourne).

January 17th. P.M.G.'s Department. Telegraph instruments, galvanometers, keys, relays, sounders, &c. (Schedule 1718).*

January 4th. Victorian Government Railways. One set pyrometer equipment (cont. 34,705), electrical equipment for cargo shifter (cont. 34,723), electric rivet heater and accessories (cont. 34,735).*

ADELAIDE.—January 4th. P.M.G.'s Department. Telephone apparatus and material, including cords, hand sets, supervisory lamps, plugs, jacks, &c. (Schedule No. 604.)

SYDNEY.—April 24th, 1922. City Council. One 10,000-kW turbo-alternator and two 2,000-kW rotary converters.—*Reuters Trade Service* (Melbourne).

February 22nd. N.S.W. Government Railways and Tramways Department. One 5,000-kW, 50-cycle turbo-alternator, with condenser and accessories, for the Newcastle power house.*

BRISBANE.—February 10th. City Electric Light Co., Ltd. Six miles of 3-core, 0.15-in., paper-insulated cable.*

VICTORIA.—January 4th, 1922. Railway Commissioners. Five electric road trucks.—*Reuters Trade Service* (Melbourne).

Argentina.—BUENOS AIRES.—January 19th, 1922. Board of Sanitary Works. Plant and accessories for a new generating station, comprising three four-cycle Diesel engines of 375 h.p., and three 3-phase alternators each of 250 kW, 2,200 V, 50 cycles.*

Bendley-with-Arksey (near Doncaster).—November 16th. Urban District Council. Supply of electric lamps. Particulars from the Architect, Council Offices.

Bristol.—November 16th. Board of Guardians. Electric fittings for three or six months. J. Simpson, Clerk to the Board. St. Peter's Hospital.

Bulgaria.—January 10th. Direction of Posts & Telephones. Sixty 50-line telephone exchanges, fifteen 100-line ditto. (See this issue.)

Churchstoke (Mont.).—One 1-kW Lister electric lighting set and battery; wiring the village hall, with distribution boards, fittings and lamps. Specifications (5s.) from Mr. Dervis Ward, Court House.

Dublin.—November 16th. G.N.R. Co. of Ireland. Three months' supply of stores including electrical fittings, lamps, cable, wire, &c. (November 4th.)

November 17th. Electricity Supply Committee. Steel chimney, draught fan and accessories. City Electric Engineer, Fleet Street, Dublin.

Egypt.—November 15th. Egyptian Postal Administration. Stores for six months, including metal-filament lamps, &c.*

Estonia.—The municipal authorities of Tartu, a town of 52,000 inhabitants, situated on the river Emmejegi, are inviting offers for the construction of a system of electric tramways in the town. Estonia Consulate, 25, Rue Saint Thomas, Antwerp.

France.—PARIS.—November 30th. Post and telegraph authorities. Installation of electric clocks throughout the Post and Telegraph administration buildings. Direction de l'Exploitation Postale, 103, Rue de Grenelle, Paris.

November 26th. Three lots of 100 each of portable mouthpieces, with sound dampers. Direction de l'Exploitation Télégraphique, 103, Rue de Grenelle.

November 16th. Electric lamps in four lots—76,000, 12,000, 25,000, and 7,000. Etablissement Central du Matériel Spécial du Génie, 39, Rue de Bellechasse.

November 15th.—15,900 metres of telephone cable, rubber, paper, silk, cotton and lead covered. For Rabat, Morocco. Office National du Commerce Extérieur, 22 and 24, Avenue Victor Emmanuel III.

Glasgow.—November 30th. Gas Department. Two electric locomotives to haul 30 tons. (See this issue.)

Greece.—November 15th. Supply and installation of a central telegraph station, with network cables. Ministry of Communications at Athens.

Halifax.—November 15th. Electricians' work in connection with the lighting of the Wesleyan Church, King Cross. Specifications from W. W. Longbottom, architect, 35, Commercial Street, Halifax.

London.—Metropolitan Asylums Board. November 23rd. Installation of electric lighting cables throughout the training ship *Exmouth*, off Grays, Essex. (November 4th.)

Paddington.—November 21st. G.W. Railway. Three months' supply of electric wire and cables, and telegraph instruments, apparatus, and stores. (See this issue.)

Manchester.—November 14th. Public Health Committee. Four-core a.c. cable, switchgear, and electric lighting of portion of Monsall Hospital. Specifications (£1 ls.) from City Architect, Town Hall.

November 22nd. Electricity Department. In connection with Barton Power Station. Contract No. 5. Steelwork, cast-iron work, builders' work, &c., in cable bridge over Bridgewater Canal, at Longford Bridge, Stretford. Mr. F. E. Hughes, secretary, Electricity Department, Town Hall, Manchester.

November 25th. Electricity Committee. Circulating-water flow and level recorders. (See this issue.)

November 16th. Education Committee. Electric lighting installation at the Cavendish, City Road, Burgess Street and Abbott Street Municipal schools. Specifications (21s.) from the Education Offices, Deansgate, Manchester.

New Zealand.—WELLINGTON.—January 31st. Public Works Tender Board. Two sets 3-phase, 6,600-V automatic oil circuit breakers, four sets disconnecter switches, and one 66,000-V air-break, lever-operated switch for main transformer switches, for Lake Coleridge power house.*

Jugo-Slavia.—November 15th. Minister of War and Marine. 1,000 kilometres of field telephone cable.*

Sheffield.—November 26th. Health Committee. Plant and machinery for refuse disposal works, including cranes, switchboard, pumps, &c., steam-driven electrical plant and condensers, motors, and starters, &c. (October 28th.)

Tunbridge Wells.—November 21st. Electricity Supply Department. One wooden cooling tower, cast-iron circulating water piping and valves. (See this issue.)

Wexford.—November 23th. Corporation. Overhead l.p. distribution mains, street lanterns, &c. (See this issue.)

Whitehaven.—December 1st. Electricity Supply Department. Two water-tube boilers with superheaters, economisers, pipework, &c.

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Argentina.—A Government decree has been issued providing for the purchase of a quantity of rolling stock, 17 cranes, and various other materials from German firms to the value of 850,000 pesosas, for use in the port.—*Reuters Trade Service* (Buenos Aires).

London.—L.C.C.—Highways Committee. H. and l.p. switchgear, for the Holborn and Streatham sub-stations:—

Sprecher & Schulz Co., £13,769.
General Electric Co., Ltd., £14,642.
British Thomson-Houston Co., Ltd., £15,037. Recommended.
Johnson & Phillips, Ltd., £15,113.
Ferguson, Pailin, Ltd., £15,116.
Metropolitan-Vickers Electrical Co., Ltd., £16,418.
A. Reyrolle & Co., Ltd., £16,792.
Pilk Royal Engineering Co., Ltd., £17,064.
Bertram Thomas, £17,282.
Switchgear & Cowans, Ltd., £17,282.
British Thomson-Houston Co., Ltd. (alternatives), £17,325.
Metropolitan-Vickers Electrical Co., Ltd. (alternative), £18,355.
Whipp & Bourne, Ltd., £22,305.

The Committee states that the lowest tender is not in accordance with the specification, and is advised that the switchgear offer on the British Thomson-Houston Co., Ltd., is most suitable for the Council's requirements. The company is at present supplying the rubber converters for the sub-stations, and it will be an advantage to have one contractor responsible for the complete erection of the substation plant, thus minimising the difficulties of keeping the existing plant running during the work of reconstruction.

Mexborough.—Seventeen tenders were submitted to the Urban Council for the electrical wiring material required for its housing scheme, it having been arranged that the actual wiring was to be done by the Council's own workmen. After the electrical engineer, Mr. J. B. Feltham, A.M.I.E.E., had inspected and reported upon various wiring jobs, it was decided to place the order with Messrs. Mylan & Smith, Ltd., of Sheffield, for J. & P. wiring system cable and fittings.

Peterborough.—Town Council. Accepted:—

C. Bedy, for 600 tons of coal for the electricity works, at 43s. 2d. per ton.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, November 11th. At the Imperial College, South Kensington, S.W. At 5 p.m. Presidential address by Sir W. Bragg, F.R.S.

Junior Institution of Engineers.—Friday, November 11th. At the Carlton Hall, N.W. At 8 p.m. Dinner and general discussion evening.

Friday, November 18th. At 7 p.m. Annual general meeting. (Midland Section). Friday, November 18th. At the Birmingham Chamber of Commerce. At 7 p.m. Lecture on "Coal Mining in Great Britain" by Prof. K. N. Moseley.

Electro-Harmonic Society.—Friday, November 11th. At the Grand Hotel, Cannon Street Hotel, E.C. At 8 p.m. Ladies' night.

Chief Technical Assistants' Association.—Saturday, November 12th. At the Engineers' Club, London. At 3 p.m. Discussion on Messrs. Ewer's paper on "The Sales Department."

Salford Technical and Engineering Association.—Saturday, November 12th. At the Royal Technical College. At 7 p.m. Members' short papers.

Association of Engineers-in-Charge.—Saturday, November 12th. At the Huddersfield, Yorkshire, and district. (Continued from p. 645.)

Birmingham and District Electric Club.—Saturday, November 12th. At the Lecture Hall, N. 7, 7th. Paper on "The Grassroots Committee," by Mr. H. F. S. S.

Institution of Civil Engineers.—Tuesday, November 15th. At the Institution, Great George Street, S.W. At 6 p.m. Paper on "The Indian Railway," by Mr. E. S. S.

Illuminating Engineering Society.—Tuesday, November 15th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Reports on "The future of the electric and gas industries in gas lamps and electric lamps and the application of the electric lamp." by Mr. E. S. S.

Northampton Engineering College Engineering Society.—Tuesday, November 15th. At St. John's Street, Northampton. At 5.30 p.m. Paper on "The future of the electric and gas industries in gas lamps and electric lamps and the application of the electric lamp." by Mr. E. S. S.

Industrial League and Council.—Wednesday, November 16th. At the Caxton Hall, Victoria Street, S.W. Annual general meeting; lecture on "The future of the electric and gas industries in gas lamps and electric lamps and the application of the electric lamp." by Mr. E. S. S.

Paisley Association of Electrical Engineers.—Wednesday, November 16th. At the Victoria Hall, Paisley. At 7.30 p.m. Paper on "The future of the electric and gas industries in gas lamps and electric lamps and the application of the electric lamp." by Mr. E. S. S.

Chelmsford Engineering Society.—Thursday, November 17th. At the East Anglian Institute of Advanced Education, Chelmsford. At 7.30 p.m. Paper on "The future of the electric and gas industries in gas lamps and electric lamps and the application of the electric lamp." by Mr. E. S. S.

Manchester Wireless Society.—Thursday, November 17th. At the Albion Hotel, Piccadilly, Manchester. At 8 p.m. Annual general meeting.

Chemical Society.—Thursday, November 17th. At Burlington House, Piccadilly, W. At 8 p.m. Ordinary scientific meeting.

Institution of Electrical Engineers.—Thursday, November 17th. At the Institution, Victoria Embankment, W.C. At 5.45 p.m. Special general meeting. At 6 p.m. Paper on "Telephone Line Work in the United States," by Mr. E. S. S.

(North-Eastern Centre).—Monday, November 14th. At the Armstrong College, Newcastle. At 7.15 p.m. Paper on "Telephone Line Work in the United States," by Mr. E. S. S.

(North-Midland Centre).—Tuesday, November 15th. At the Hotel Metropole, Leeds. At 7 p.m. Chairman's (Mr. W. J. Burnard) address and smoking concert.

(North-Western Centre).—Tuesday, November 15th. At the Engineers' Club, Manchester. At 7 p.m. Paper on "Telephone Line Work in the United States," by Mr. E. S. S.

(South-Midland Centre, Students' Section).—Tuesday, November 15th. At the University, Birmingham. At 7.30 p.m. Paper on "The Testing of Meters used in the manufacture of electrical machinery," by Mr. C. Dawson.

(Liverpool Students' Sub-Centre).—Thursday, November 17th. At the University, Liverpool. At 7 p.m. Paper on "The future of the electric and gas industries in gas lamps and electric lamps and the application of the electric lamp." by Mr. E. S. S.

(London Students' Section).—Friday, November 18th. At the Institution, Victoria Embankment, S.W. At 7 p.m. Paper on "The future of the electric and gas industries in gas lamps and electric lamps and the application of the electric lamp." by Mr. E. S. S.

Institution of Mechanical Engineers.—Friday, November 18th. At the Institution, St. James's Palace, W. At 8 p.m. Paper on "The future of the electric and gas industries in gas lamps and electric lamps and the application of the electric lamp." by Mr. E. S. S.

British Electrical Development Association.—Friday, November 18th. At the Institute of Patent Agents, St. James's Palace, W. At 8 p.m. Paper on "The future of the electric and gas industries in gas lamps and electric lamps and the application of the electric lamp." by Mr. E. S. S.

Diesel Engine Users' Association.—Friday, November 18th. At the Institution of Electrical Engineers, Victoria Embankment, S.W. Discussion on "Some Recent Developments in Mechanical Injection Oil Engines Using Heavy Oils."

Public Works, Roads, and Transport Congress and Exhibition.—Friday, November 18th to November 25th. At the Royal Agricultural Hall, Islington, N.

NOTES.

Educational.—UNIVERSITY OF BRISTOL.—A 48-page set of photogravures, forming a pictorial record of the activities of the University, has just been published. It is believed to be the first production of its kind, and it certainly conveys a better idea of all sides of the institution—educational, recreational, and social—than the usual "calendar." Accompanying this is an appeal for funds whereby it is hoped to raise a million pounds, which is necessary if the University is to carry on and expand as it should. The appeal is illustrated by two Raemaekers drawings.

Domestic Efficiency.—The discovery that a great deal of the labour entailed in the running of a home is superfluous appears to be of quite recent date. A correct study of the possibilities with regard to the elimination of this superfluous work leads inevitably to electricity as a means to the desired end. This is not the result of researches on the part of electrical engineers, which are liable to lack the "human" value, but the conclusion arrived at by an expert in domestic science. Consequently, in an exposition organised by Miss Mary Gwynne Howell to point the way to domestic efficiency, electricity plays a considerable part. Miss Gwynne Howell, who is a contributor to our pages, holds no brief for electricity as electricity. She is an investigator into the means for lighting the home with the least expenditure, and as such has had to acknowledge the pre-eminence of electricity as an agent for accomplishing a variety of household tasks. The exhibition mentioned includes cooking, washing, cleaning, and heating appliances, and Miss Gwynne Howell is able to explain all these to her visitors from the point of view which counts—the user's. In fact, this exhibition is really a "consulting domestic engineer" and her efforts will surely do more towards the popularisation of electricity methods than the cold, hard facts of the salesman, which, although true (generally), lack the force of actual experience.

Irish Water Power.—At a recent All-Ireland Industrial Conference, in Dublin, Mr. T. Tomlinson, B.A., B.A.I., read a paper on "Economic Production of Power for Irish Industries." He said the electrical energy in the country was five times that at present developed from imported

coal, and perhaps more. The Irish Commissioners of the Fuel Research Board had reported that the peat deposits would satisfy the power requirements of the country at the present rate of consumption for more than 250 years; and that period could be prolonged by the use of water power. A small water-power plant at the Salmon Leap on the Liffey delivered electric energy at the city boundary at a cost per unit of 0.325d., while the present cost per unit delivered at the switchboard in steam stations, for coal only, exceeded one penny. He suggested the institution of an experimental hydro-electric station on the best and most easily exploited fall on one or more of the four main water-powers, supplying therefrom some four or five small towns willing to take bulk supply, feeding into standard systems of distribution.

Prof. P. R. Purcell said in certain industries cheap power was of secondary importance; in others it was vital. Power from the river Shannon and from the Erne might be obtained at an average capital expenditure of £50 per e.h.p. In the case of the Liffey and the Barron, the expenditure would be from £100 to £150.

Mr. L. J. Kettle, city electrical engineer, Dublin, said that the principal trouble about water-power in Ireland was the variable flow of the rivers. Dublin Corporation, anxious to develop the Liffey, had decided to supplement the expert advice of Sir John Griffith by that of a Continental expert on water-power. The Liffey and the Bann would be first exploited. Of course, the Shannon and the Erne had the greater water power, but they had not the population near them.

International Conference on h.p. Transmission Systems.—The Union des Syndicats de l'Electricité, of which Mr. Tribot Laspierre is the general secretary, has invited the following countries to send delegates to a conference to be held at Paris to discuss the various technical problems relating to h.p. transmission systems:—Great Britain, Belgium, Spain, United States, France, Holland, Italy, and Switzerland.

The following delegates have been nominated by the Institution of Electrical Engineers to represent the British interests: Mr. W. B. Woodhouse, Mr. P. V. Hunter, and Mr. E. B. Wedmore.

The various National Electrotechnical Committees of the International Electrotechnical Commission have been asked to assist in making this conference as representative and as successful as possible. The Union des Syndicats de l'Electricité desires it to be known that in addition to the delegates from the different countries specially nominated, the meetings will be open to all engineers who wish to attend. It is proposed that the conference should be divided into three sections, dealing with (1) power-station operation, including sub-stations; (2) construction of lines; and (3) distribution. It is hoped that the delegates from each country will submit papers on the subjects brought forward for discussion.

The meetings will be held at the offices of the Union des Syndicats de l'Electricité, Paris, and will commence on Monday, November 21st next, continuing until Saturday, November 26th. No afternoon meeting will take place on Thursday, November 24th, as the celebrations in honour of Ampère will be held, which will be presided over by the President of the French Republic.

Reports of the conference will be issued in French and English, and interpreters representing seven languages will be present for the purpose of translating, if necessary, the decisions arrived at. A dinner will be offered to the delegates on Thursday, November 24th, at the Palais d'Orsay, and a number of visits and excursions are being arranged, comprising an excursion to the devastated regions in the North of France and a visit to some of the new electrical installations already completed or in course of completion. A detailed programme of the meeting will be supplied free of charge on application to the secretary of the International Electrotechnical Commission, 28, Victoria Street, S.W. 1.

Electrical Gas Lighting.—The E.D.A. informs us that a misguided German genius has devised a gas-lighting appliance consisting of a single lead attached to the electrical circuit and a handle with a sparking point. The gas is turned on and the point applied to the burner; an earth return is provided by a bare wire connected to the gas pipe or by the stove itself. As the E.D.A. remarks, "No doubt when used this device does light the gas, but it may do all sorts of other things also." At the same time, we refuse to believe that this is an "electrical development" likely to have any vogue in this country (or any other), and we are therefore not unduly alarmed.

All-Russian Electrical Congress.—On October 9th the eighth All-Russian Electro-Technical Congress was closed. It was the first such congress since the year 1913. We are informed that there were about 1,000 delegates, and 320 reports were submitted.

According to a report which the Congress has presented to the Soviet Government, the electrification of Russia is progressing rapidly. A few months' time will see the completion of the Kashirsky electricity station, of 12,000 kW capacity, in the Moscow district, and it is expected to greatly assist the industries of the capital by placing at their disposal more electricity than was the case before the war. At Petrograd a large station will have been established on the Neva no later than the spring of 1922. In the Don Basin, all the local plant is being united to form a large new station in the centre of the anthra-

cite region. In the Urals a new station is being built at the Kizilovsk coal pits, and at the same time dozens of small installations are being constructed throughout Russia to meet the needs of local agriculturists. According to the *Economic Life*, of Moscow, the Soviet aims at nothing less than the electrification of all Russia.—*Daily Mail*.

Appointments Vacant.—Lectureship in electrical engineering (£510), for the Bradford Technical College; telegraph foreman (£440 +), for the Government of Nigeria, Railway Construction Department; cable joiner (87s. 4d.), for the Eccles Corporation Electricity Department. (See our advertisement columns to-day.)

War Memorial at Rugby.—On Saturday, October 29th, at Rugby, Field Marshal Sir William Robertson unveiled the imposing memorial which has been erected near the Brownsover Road entrance to the works of the British Thomson-Houston Co., Ltd., to commemorate the making of the supreme sacrifice by 245 employés of that company in the European war. The ceremony was performed in the presence of between 4,000 and 5,000 persons. Special accommodation was provided for the employés of the company and their relatives, for the guests of the company, and for the discharged soldiers. Useful service in marshalling the crowd was rendered by the B.T.H. Fire Brigade, the B.T.H. Boy Scouts, and the local police. The memorial, which was designed by Sir Edwin Lutyens, R.A., consists of a broken cross on a large circular base. It has been executed in Portland stone and weighs approximately 130 tons. The height of the cross is 24 ft. and the diameter of the base 22 ft. On the front of the cross, facing east, is the inscription: "In memory of the men of The British Thomson-Houston Company, who gave their lives in the Great War." The names of the fallen are inscribed round the base; they include the men from all the English and foreign branches of the company. Mr. H. C. Lewis, chairman of the company, called upon Sir Wm. Robertson to unveil the cross, and in doing so Sir William mentioned that 1,795 men from the company's works joined the Services, and the memorial would be an abiding testimony to the patriotic response made to the call of duty by the workers of the company. The Archdeacon of Warwick subsequently dedicated the cross, and six buglers from the Territorial Association at Birmingham sounded the "Last Post."

U.S. Electric Vehicle Market.—Manufacturers of electrically-operated trucks, who exhibited their products at the New York Electrical Show early in October, report gratifying results, both in actual and prospective sales. One company, which manufactures a truck with a locking differential and other new features, headed the list with a total of 12 sales; the buyers were large users of petrol-propelled vehicles, who wanted to make comparisons between the two makes when operating under identical conditions.

Manufacturers of electric passenger cars say that while actual business continues dull, more inquiries have been received.

The Trackless Transportation Co. reports that final tests on its improved type of trolley 'bus were entirely satisfactory. The 'bus, which will be used for demonstration purposes in Detroit, is an adaptation of the electric drive to the standard low-centre-of-gravity petrol 'bus built by the Trackless Corporation. The driving motors and control are placed beneath the hood. The collector consists of a standard United States trolley base, a fourteen-foot Shelby seamless steel trolley pole with a double-contact sliding-type collector head, which is swivelled on the pole and provides sufficient flexibility for making close contact with the overhead wire under all service conditions.

The Packard Motor Co. and the Westinghouse Electric Manufacturing Co. have also developed a railless tramway 'bus; it is electrically driven, and is capable of hauling a maximum of 30 passengers and of attaining a speed of more than 25 miles per hour. Energy for driving the 'bus is furnished by a two-wire trolley circuit, which permits marked freedom in turning to the right or left according to the demands of traffic.—*Reuter's Trade Service* (New York).

A Claim for Siemens German Shares.—On Tuesday last the Anglo-German Mixed Arbitral Tribunal began the hearing of a claim by Mr. Alex. Siemens against Siemens & Halske, of Berlin, for the value of 390,100 mark shares in the latter concern (which were valued at £37,164 on August 10th, 1914), and interest at the rate of 5 per cent. thereon, and a sum due by way of dividend on the shares on July 31st, 1914.

The s.s. "Barrabeel."—This large twin-screw passenger steamer built for the Peninsular and Oriental Steam Navigation Co.'s branch line service, by Messrs. Harland & Wolff, Ltd., was successfully launched on November 3rd at Belfast. The principal dimensions of the vessel are 590 ft. long 61 ft. broad 41 ft. deep, with a gross tonnage of about 13,000. The vessel has a very complete electrical installation, consisting of four main generators, in addition to which there is a vertical oil engine driving an emergency dynamo situated well above the water-line. The electrically-generated watertight doors are all controlled from the captain's bridge. Among the other electrically-driven gear are included large forced-draught fans for the boilers, refrigerating fans, and large ventilation fans.

INSTITUTION NOTES.

Institution of Electrical Engineers.—There was a very large attendance at the first meeting of the session of the 3rd inst., when Mr. L. B. Atkinson distributed the scholarship cheques and premiums awarded for papers read during the last session. Sir John Snell proposed, and Mr. C. H. Wordingham seconded, a vote of thanks to the retiring president, which was passed with acclamation. Mr. J. S. Highfield then read his presidential address, after which he was accorded a hearty vote of thanks that was proposed by Col. R. E. B. Crompton and seconded by Mr. L. B. Atkinson.

It was announced that the Council proposes to keep the Institution Library open on two week-day evenings until 9.30 p.m., or alternatively on one evening during the week and Saturday afternoon till 5 p.m. In order to ascertain which two days are most convenient to members, the library will remain open every evening and also on Saturday afternoons until the end of the year, and a record of the attendance will be kept.

LONDON STUDENTS' SECTION.—The following are the arrangements for the first part of the session:—November 18th, paper on "Modern Hydro-electric Practice," by Mr. E. E. Butten; December 2nd, "Automatic and Semi-automatic Railway Signalling," by Mr. H. S. Petch; January 20th, 1922, "Some Applications of the Thermionic Valve to Telephony," by Mr. L. T. Hinton. Visits arranged for members include the Western Electric Co.'s Works, North Woolwich, the L. and S.W.R. power house, Wimbledon, and the Cosmos Lamp Works, Brimsdown.

NORTH-WESTERN CENTRE.—Mr. W. Walker is to deliver his address as chairman on November 15th at the Engineers' Club, Manchester. The meeting will be followed by a smoking concert. In response to numerous requests, several informal meetings are to be held during the present session. About £64 has been raised towards the £250 which the Centre wishes to contribute to the Benevolent Fund.

LIVERPOOL SUB-CENTRE.—The opening meeting was held on November 7th, when Mr. Nisbett delivered his inaugural address. Mr. Nisbett dealt with electric lighting, and the many possibilities of improvement in order to obtain greater efficiency and simplicity in installation and operation. He made a plea for greater consideration of the small consumer by electricity supply engineers. A discussion on the address was opened by Dr. Marchant (who presided in the absence of Mr. Dickinson), followed by Messrs. Welbourn, Clothier, Lang, Malpas, Astley, Blades, Wilson, and Dennis. An abstract of the paper will be given in our next issue.

WESTERN CENTRE.—The first meeting of the present session was held in Cardiff on November 7th. The retiring chairman (Mr. A. J. Newman) presided over a large attendance. Mr. A. C. MacWhirter was inducted to the chair and delivered his inaugural address. In his address Mr. MacWhirter alluded to the increased activities of the Centre, and submitted figures showing the membership in the South Wales and Bristol and West of England districts, and suggested that the time was now ripe to consider the desirability of separating the Centre, with the Bristol Channel and the river Severn as the dividing line. He admitted that the question of finance presented difficulties, but he considered that any increased expenditure would be adjusted by the revenue from increased membership. Mr. MacWhirter reviewed such topics as industrial relations, commercial development, registration of electrical contractors, apprenticeship training, standardisation, and industrial research. He indicated that employers must be content with reasonable profits, and by wisdom and moderation seek to recapture the loyalty of their workers. The worker, on his part, must get rid of that suspicion of his employer which had recently driven him into short-sighted and perilous courses.

At the close of the address a discussion ensued, to which Messrs. Chamen, Alzer, Plevin, Rogers, Newman, Nairn, Burr, Hughes, Morley-New, Stretton, Teasdale, David, S. MacWhirter, Cronin, Evans, and Allen, and Professors Bacon and Knox, contributed.

INFORMAL MEETING.—On Monday last, the first "Informal Meeting" of the session was held, in the tea-room of the Institution, and there was a very good attendance. Mr. J. S. Highfield presided, and opened the discussion on the question: "How best to speed-up Electrical Progress." Numerous speakers followed, and the discussion was both informative and suggestive, affording abundant material for thought. Smoking was permitted, and after the opening speech a break was made for refreshments—in fact, the procedure which had proved so successful during previous sessions at another rendezvous was closely adhered to: the usual informalities were observed, with some new ones thrown in, and our misgivings lest the proceedings might become more formal at headquarters happily proved to be unfounded.

Chelmsford Engineering Society.—At a meeting of the Society, Mr. T. Clarkson, M.I.C.E., gave an interesting lecture on "Coke as a Fuel for Commercial Vehicles." After pointing out the desirability of obtaining power from whatever sources occurred naturally in the country in which it was required, Mr. Clarkson gave examples of the use of water, wind, and wood in the various countries where these sources of energy were most easily and cheaply obtainable. He also

spoke about coal and its distillation, alcohol, and petrol. In advocating the use of condensers on steam lorries, the difficulty experienced in extracting the last trace of oil, which became emulsified with the water, and the method of overcoming this by an electrolytic process was dealt with.

Royal Society of Arts.—The following is a synopsis of an address on "Wireless Telegraphy" that was given by Mr. Alan A. Campbell Swinton, F.R.S., Chairman of the Council, at the inaugural meeting of the 108th session of the Royal Society of Arts on November 2nd. Various methods of permanently recording wireless signals were discussed and illustrated, and an account given of how messages sent out from Annapolis and other American stations were photographically recorded in Paris. Experiments were made to demonstrate how wireless messages, both in Morse alphabet and in telephonic speech, could be recorded on a phonograph. For this purpose wireless signals, speech, and music, specially transmitted from distant stations while being made audible to the audience, were photographically recorded in the lecture hall, being afterwards reproduced for the audience to hear a second time. Wireless messages recorded in this way from Moscow, Berlin, Rome, Madrid, Paris, and other distant places, were also made audible. The phonographic method of recording enables messages that have been transmitted and received at too rapid a rate to be read by ear, to be reproduced at much slower speeds so that they can be readily deciphered. The amplifying and other apparatus used in the experiments was described, and experiments were also made with the new Johnson-Rahbek electrostatic frictional receiving telephone, with which very loud speaking can be obtained.

Receiving from distant wireless stations, such as Nantes and Paris, on a small directional frame aerial situated in the lecture hall was demonstrated and explained, together with a method whereby the absolute direction of the sending station can be located. Means were also indicated whereby the correct time can daily be obtained from Paris by wireless with an accuracy amounting to one two-hundredth of a second, a degree of accuracy that should suffice for most purposes.

Institution of Production Engineers.—At a general meeting of the Institution, to be held at the Institution of Mechanical Engineers on November 25th, Mr. A. F. Guyler will read a paper on "Drawings and Production," illustrated by lantern slides.

Society of Chemical Industry.—The engineering group of the Society held a meeting at Manchester on November 4th, when a paper on "Electrical Precipitation" was read by Dr. H. J. Bush. The paper gave a brief historical account of the origin and progress of the Cottrell electrical precipitation process, and described the fundamental electrical phenomena involved. The bulk of the paper was devoted to examples taken from actual practice, showing the modifications of the original apparatus necessitated by particular conditions. Some important working data were also given. The Group is to hold a meeting on November 2nd at the Institution of Electrical Engineers, when Mr. J. H. West will read a paper on "The Claude Synthetic Ammonia Process and Plant."

The Physical Society.—At the Society's meeting on October 26th, Mr. S. Butterworth, M.Sc., read two papers. The first was entitled "On the Use of Anderson's Bridge for the Measurement of the Variations of the Capacity and Effective Resistance of a Condenser with Frequency." The other, entitled "Notes on Earth Capacity Effects in Alternating-current Bridges," showed that an earth capacity acting at any point in the arm of a bridge might be replaced by two earth-impedances acting at the ends of the arm together with an impedance in series with the arm. By integration the result was extended to small distributed capacities. Two methods were given for the elimination of the error due to the end impedances. Complete elimination could only be obtained by the use of shields connected to the ends of the bridge arm.

A paper entitled "An Automatic Voltage Regulator," by Mr. F. G. H. Lewis, was read by Mr. J. W. T. Walsh, who gave an experimental demonstration. This paper described a method by which automatic voltage regulation to 0.15 per cent. might be obtained for such purposes as the operation of photometric standard lamps on an ordinary outside supply varying by as much as 10 per cent. The lamp was placed across an unbalanced Wheatstone bridge of which two opposite arms were composed of tungsten filament lamps. The increase of resistance of these lamps, due to the extra current passing through them when the outside voltage rose, caused a shift in the balance of the bridge such that the voltage across the photometer lamp remained unaltered if the values of the resistances were suitably or properly proportioned. The power taken was about 100 watts, the lamp being in series with the regulated circuit.

The next scheduled address is to be delivered by Prof. Sir W. H. Bragg, F.R.S., to-day (Friday) at the Imperial College of Science and Technology.

Birkbeck College. The first of two free lectures by Prof. Solly, of Oxford, on "The Reviving of Physical Science on Economics" was given at Birkbeck College yesterday evening.

Cleveland Institution of Engineers.—Mr. R. H. Archer Carlson of the Steel Ingot Iron Co. Ltd., in his presidential address to the Institution at Middlesbrough on November 7th, in urging the need of reliability in works management, said the use of grabs and magnets went a long way

towards the reduction of iron and steelworks' costs, and there was no doubt that the future would see the extended use of electric locomotives, the more so as accumulators were becoming more efficient. The possibility of running locomotives for a complete shift on one battery charge was within reasonable distance of attainment, and they could then hope to see the huge delay that now existed in obtaining coal and water, and the loss of heat units due to locomotives standing under steam, done away with.

If all electrical gear was of the simplest and most robust pattern, many stoppages would be avoided, as there was no other class of work where the demand upon it was so great as in an iron and steel works, and nowhere could a single failure dislocate such a large train of work.

Underground cables were a doubtful advantage, and should be avoided as far as possible. There was always the danger of heavy traffic over lines or subsidence due to water and other causes which allowed the cables to sag, and might pull out the joints, but the most serious point was the length of time taken to locate and repair a fault. Overhead cables certainly lent themselves to easy location of faults and repairs.

Using the power house as the centre of distribution had its disadvantages, mainly due to the danger of its becoming unwieldy as the plant grew, and in the event of a fault, it had to be looked for throughout the whole works, whereas with sub-stations a fault was limited to quite a small section, and much valuable time was saved.

For many years it had been the practice to operate auxiliaries electrically, but there were still a few movements which were operated by hydraulic power. Electrical operation gave a 50 per cent. better efficiency than hydraulic, and it was obvious that the latter should be used as little as possible. Delay through blown fuses could be avoided by the use of oil-immersed automatic circuit breakers. When a fuse "blew," a new one was put in, often heavier, without a look round to ascertain the cause of the extra load, and the new fuse would probably blow out before examination had shown the cause. Delay was thereby increased, and possibly a motor was burnt out.

Royal Institution.—This year's Christmas course of juvenile lectures will be delivered by Prof. J. A. Fleming, F.R.S., on "Electric Waves and Wireless Telephony," in the afternoons of December 29th and 31st and January 3rd, 5th, 7th, and 10th.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

On Tuesday evening next the North-Western Centre of the I.E.E. opens the 1921-22 session with an address from the chairman, Mr. W. WALKER. The proceedings will take place at the Engineers' Club in Albert Square, Manchester, and a smoking concert will follow the reading of the address. Mr.



MR. W. W. WALKER, OF MANCHESTER.
Chairman of the North-Western Centre of the I.E.E.

Walker is an alderman of Manchester. He is a Lancashire man, having been born at Worsley. He was educated at the Grammar School, Farnworth, Bolton-le-Moors, and afterwards at the technical schools there. He is engaged upon power installations for textile mills, chemical works, grain silos, flour mills, and pneumatic coal-handling plants. He is a director of Messrs. Henry Simon, Ltd. engineers, of Man-

chester, who have works at Stalybridge, near Manchester, at Bredbury, near Stockport, and at Sydney, Australia. His co-director in the business, Mr. E. D. Simon, is the new Lord Mayor of Manchester. Mr. Walker is chairman of the National Joint Industrial Council for the Electricity Supply Industry, and chairman of the National Board for the Electricity Supply Industry. He is, further, a vice-president of the Electrical Development Association. His recreation is mountaineering, which suggests the certainty that he will maintain the proceedings of the North-Western Centre at a very lofty standard of excellence during the session.

VISCOUNT PEEL has been appointed Minister of Transport (unpaid) in the place of Sir Eric Geddes (resigned).

Mr. H. K. BEALE has been re-elected chairman of the Birmingham Electric Supply Committee.

We are informed by the Federated Malay States Railway at Kuala Lumpur that our notice (ELEC. REV., August 26th, 1921) with reference to the appointment of Mr. WILFRED EVANS as head of the electrical department is not correct, as Mr. A. E. A. RIDGWAY, M.I.E.E., A.M.I.Mech.E., is the head of all the electrical works on the F.M.S. railways.

Mr. W. GREEN, on retiring from the position of works foreman at Wimbledon Corporation electricity works, after 21 years' service, was presented by the staff and employes with an English lever watch and a gold Albert, together with a pair of silver candlesticks for Mrs. Green. The presentation was made by Mr. W. J. Oswald, the chief assistant engineer.

At the annual dinner of the Kent Section of the Electrical Power Engineers' Association, at Maidstone, on Saturday last, Mr. H. WILSON, late mains superintendent at the Maidstone Corporation electricity works, was presented by Mr. F. E. Lewis, on behalf of the members of the Kent Section, with a slide rule and a gold pencil as a slight token of the members' appreciation of the good work Mr. Wilson had carried out during his chairmanship of the Section.

The claim of Mr. A. PEDER RUTHERFORD, formerly chief engineer and manager of the Leith Corporation Electricity Supply Department, against the City of Edinburgh, for compensation for loss of office due to the amalgamation of the Borough of Leith with the City of Edinburgh, has been decided by the arbiter, Mr. Percy Rintoul, C.A., Glasgow. Mr. Rintoul's final award confirms his proposed finding—namely, a payment to Mr. Rutherford of £4,000 with interest from the date of the amalgamation (November 2nd, 1920) and the expenses of, and incidental to, the arbitration.

Obituary.—MR. HERMAN SLOOG.—We regret to learn of the death of Mr. Herman Slog, at the age of 37 years. He underwent an operation in a nursing home, and passed away on Friday last. Mr. Slog was a member of the Institution of Electrical Engineers, also M.S.E., and M.Soc.C.E. (France). He was honorary secretary to the British Bureau, Engineering Department, of the Office National des Universités et Ecoles Françaises in connection with which the lectures on hydro-electric engineering were arranged at Grenoble for the last summer vacation. He was also hon. secretary of the Groupe Inter-Universitaire Franco-Britannique, and the Société des Ingénieurs Civils de France.

LIEUT.-COL. P. G. VON DONOP.—We regret to state that Lieut.-Col. Pelham George von Donop, late R.E., who was on the staff of the Board of Trade as an Inspecting Officer of Railways from 1899 to 1913 and Chief Inspecting Officer from 1913 to 1916, passed away on November 7th, in London, at the age of 70 years.

Will.—The late Mr. L. B. SCHLESINGER, banker, who was chairman of various electric lighting and tramway companies (Rhondda, Torquay, Mexborough, and Musselburgh), left £213,203 gross and £165,762 net.

NEW COMPANIES REGISTERED.

Beecroft & Partners, Ltd. (177,682).—Private company. Registered November 4th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers, importers and exporters of and dealers in ferrous and non-ferrous metals, ores, alloys, chemicals, paints, colours and varnishes, oils, greases, laboratory and electrical apparatus, electrical furnaces for the manufacture and treatment of metals, and electrical and mechanical equipment, analytical and metallurgical consultants and engineers, &c. The subscribers (each with one share) are: F. J. Beecroft, Cliffe Field Road, Moorsbrook, Sheffield, foundryman; V. Beecroft, 8, Thirlwell Bank, Sheffield, foundryman; F. J. Beecroft is the first director. Qualification: One share. Registered office: Norfolk House, 36, Cannon Street, Birmingham.

Davis, Hudson & Co., Ltd. (177,588).—Private company. Registered November 1st. Capital, £1,000 in £1 shares. To acquire the business of patentees, manufacturers, and electrical engineers carried on by A. Davis and F. R. Hudson at 178, Victoria Road, Aston, Birmingham. The first directors are: F. R. Hudson, 183, Slade Road, Erdington, Birmingham; Mrs. L. J. Davis, 36, Wenlock Road, Handsworth, Birmingham. The said F. R. Hudson is managing director and chairman, and may retain office so long as he holds 250 fully-paid shares. Qualification (except life directors): 100 shares. Registered office: F. R. Hudson. Registered office: 178, Victoria Road, Aston, Birmingham.

Sentillating Sign Co., Ltd. (177,642).—Private company. Registered November 3rd. Capital, £1,200 in 4,000 "A" shares of £1 each and 4,000 "B" shares of 1s. each. To carry on the business of exhibitors of electrical and other advertising signs, electrical and other indicators, and electrical contrivances of all kinds for use of advertisement, &c. The subscribers (each with one "A" share) are: E. C. Elmore, 1, Arden, Newdowry, N.W.11, director of companies; C. Russell, 221, Hampton Road, Hford, Essex, secretary. Permanent directors: E. C. Elmore (chairman), H. S. Coleman and W. H. Rawling. Secretaries: C. Russell. Solicitors: Hutchison and Cuff, 6, Stone Buildings, Lincoln's Inn, W.C.

on at Camp Hill, Birmingham, and to carry on the business of manufacturers of motor accessories, magnets for use with internal combustion engines, manufacturers of dynamos for lighting, power, and other purposes, and of fixtures of motor cars and other vehicles. The subscribers (each with one share) are: A. H. Treloar, 40, Victoria Road, Macclesfield, manufacturer; W. L. Sains, 20, Kingtons Road, Macclesfield, manufacturer; J. A. Smith, 1, High Street, Macclesfield, manufacturer; J. A. Treloar, 40, Victoria Road, Macclesfield, manufacturer; J. A. Treloar, 40, Victoria Road, Macclesfield, manufacturer; J. A. Treloar, 40, Victoria Road, Macclesfield, manufacturer. Registered office: 21, Orchard Road, Bessell House, Birmingham.

Strichen Electric Supply Co., Ltd. (11,921).—Registered in Edinburgh November 1st. Capital, £5,000 in £1 shares. To carry on the business indicated by the title. The first directors are: G. W. Sleight, Strichen Mains, Strichen, factor; G. Young, 16, High Street, Strichen, agent; J. Chalmers, Ugiebank, Strichen, retired farmer; J. A. Smith, 1, High Street, Strichen, accountant; G. Gill, 64, High Street, Strichen, merchant; G. Kinghorn, 38, High Street, Strichen, tailor; J. Ritchie, 65, High Street, Strichen, hotel keeper. Minimum cash subscription, 1,000 shares. Qualification: 50 shares. Registered office: 30, Bridge Street, Strichen.

Orlikon, Ltd., has been registered with a nominal capital of £40,000 in £1,000 shares. The objects are: To carry on the business of electrical, hydraulic, mechanical, and general engineering supplies, electricity, light, heat, and power, mechanics, iron and steel foundries and workers, copper smelters and workers, &c. The signatories to the memorandum of association (each signing for one share) are: Hans Max Huber, Oshingen, Switzerland, hon. professor, University of Zurich; Samuel Dietrich Schindler, Zurich, Switzerland, manufacturer; Hans Carl Bohn, Kusnacht, Switzerland, D.Ph., University of Zurich; Marie Paul Robert Jourdain, 30, Rue Courtaubert, Paris (XVI), engineer; Martin Werner Schindler, 15, Rue de Milan, Paris, manufacturer; Frederic Ernest Hirt, 3, Rue Charles Dulong, Paris (XVI), engineer; Gottlieb Wuetrich, 81, Bursors Cross Road, Fulham Road, S.W.6, engineer. The minimum cash subscription upon which the directors may proceed to allotment is seven shares. The first directors are: Samuel Dietrich Schindler and Martin Werner Schindler. Remuneration as fixed by the company. The registered office is at Oswaldre House, Norfolk Street, Strand, W.C.2. The file number is 177,580.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rhondda Tramway Co., Ltd.—Satisfaction to the extent of £5,900 on October 31th, 1921, of charges dated March 24th, 1911, November 13th, 1912, and March 11th, 1915, securing £230,000.

Wilson Hartnell & Co., Ltd.—Particulars of £4,082 debentures, authorised October 10th, 1921, present issue £3,000; charged on the company's undertaking and property, present and future, including uncalled capital, subject to first mortgage debentures.

Issue of October 18th, 1921, of £1,082 debentures, part of a series already registered.

CITY NOTES.

Amazon Telegraph Co., Ltd.—For the year ended June, 1921, the gross revenue was £63,143, and the working expenses were £35,015. Corporation Profits Tax to June, 1920, required £491, income tax £6,155, debenture interest £10,391, sinking fund £12,428, and the balance is £5,790. This is to be carried forward subject to Corporation Profits Tax. Owing to the continued trade depression in Brazil, and especially in the Amazon Valley, due to the fall in the price of rubber, the receipts have decreased by £21,987. The directors are, in consequence, unable to recommend the payment of a dividend. The s.s. *Viking* returned to Fara last December on the completion of her charters to the West India & Panama Telegraph Co. and the Cuba Submarine Telegraph Co. The balance of receipts from these sources has been credited to the expenses of cable steamers. The cost and amount of cable used for repairs were abnormally high, but it is hoped that the expenditure in this respect will be reduced during the current year. All instalments of subsidy from the Brazilian Government have been duly received.

Stock Exchange Notices.—The undermentioned securities have been ordered to be officially quoted:—

South Metropolitan Electric Light and Power Co.—45,000 ordinary shares of £1 each, fully paid, Nos. 120,001 to 150,000 and 400,001 to 415,000; 500 seven per cent. cumulative first preference shares of £1 each, fully paid, Nos. 292,069 to 293,468; 440 six per cent. cumulative second preference shares of £1 each, fully paid, Nos. 395,927 to 396,366; and 484,000 four and a-half per cent. first debenture stock (redeemable).

Calcutta Electric Supply Corporation.—250,000 ordinary shares of £1 each, fully paid, Nos. 550,001 to 800,000.

Metropolitan Electric Supply Co.—£500,000 7½ per cent. extension debenture stock, 1921, fully-paid (scrip certificates to bearer).

Application has been made to the Committee to allow the following to be quoted officially:—

North Metropolitan Electric Power Supply Co.—£228,460 seven and a-half per cent. debenture stock.

Dealings in the following have been specially allowed by the Committee under Rule 148a:—

Hankow Light & Power.—1,000 seven and a-half per cent. cumulative preference shares of £5 each, fully paid, Nos. 4,001 to 8,000.

Lancashire Electric Light and Power.—65,025 new six per cent. (income-tax free up to 6s. in the £) cumulative convertible first preference shares of £1 each, fully paid, Nos. 400,001 to 465,025.

Siemens Brothers, Ltd.—The directors announce an interim dividend on the ordinary shares of 1s. per share (at the rate of 10 per cent. per annum), free of tax, in respect of the half-year ended June 30th.

British Mannesmann Tube Co., Ltd.—Interim dividend on the ordinary shares of 1 per cent., free of tax. The accounts for the year ended June, 1921, are not yet completed, but no further dividend is contemplated by the directors.

Montevideo Telephone Co., Ltd.—The directors report that the net profit for the year ended July 31st was £27,755, plus £13,752 brought forward. After putting £10,000 to reserve, it is proposed to pay a final dividend of 5 per cent., free of tax, making 8 per cent., free of tax, for the year, leaving to be carried forward £12,157. For the previous year the profit on exchange amounted to £11,014, whereas for the year now referred to there was a loss on exchange of £1,067.

STOCKS AND SHARES.

TUESDAY EVENING.

WHENCE all the money comes nowadays which is so eagerly taking up new issues of gilt-edged character is something of a problem in the City. One heavy loan follows another with remarkable rapidity; still more remarkable, however, is the way in which these issues are over-subscribed in the first place, or readily absorbed if they do not go to the public straight away. The reduction in the Bank Rate to 3 per cent. is, of course, a contributory reason in forcing our money from deposit accounts. In point of fact, however, it is not very unusual for the City man to hear it said that, with the world in such a generally unsettled condition, some people prefer to keep their money on deposit, rather than to use it even in the best stocks. Nevertheless, the latter continue to be readily taken, and industrial debentures, as well as trustee stocks, are in brisk demand. The County of London Electric 7 per cent. debenture, for instance, has gone up to $\frac{7}{8}$ premium, bringing the fully-paid stock to a little over 101. Lancashire Power debenture has risen to $\frac{7}{8}$ premium, and the Shropshire, Worcestershire and Staffordshire $\frac{7}{8}$ per cent. debentures, now fully paid, have advanced to 98, which is 1 per cent. premium. Mersey Power debenture is $\frac{3}{4}$ premium. General Electric 7 per cent. debenture keeps about 95.

Southland Electric Power 6 per cent., guaranteed by the New Zealand Government, stand at 96 $\frac{1}{2}$. Clyde Valley preference remain about their par price. Pearson & Knowles $\frac{7}{8}$ per cent. debentures, which came out at 97, were left with underwriters to the extent of 52 per cent. The market opened at $\frac{1}{4}$ discount, but support forthcame, and the price advanced to $\frac{1}{4}$ discount.

The railway market is following with close attention the progress of the electrification schemes of the various companies, and the prices of the leading stocks show a noticeable tendency to improve. It is not surprising that such an event as the amalgamation of the North-Western with the Lancashire & Yorkshire should arouse a good deal of interest. The preliminary scheme for bringing this about is to be considered at a meeting on Thursday, November 17th. Underground Electric shares are better. The withdrawal of the L.C.C. proposal for spending five millions on tube railways disposed of whatever nervousness had been felt with regard to this suggestion. But, as already noticed here, people are apprehensive lest the spending of large capital sums, even though the financing may be assisted by the Government, will involve the placing of prior-charge stocks in front of existing securities. The refusal of the Government to promote legislation for "protecting" the London traffic combine against competition for a few years, had no effect upon prices in the market.

Wireless telegraphy has received a powerful advertisement through the opening of the Radio Central New York exchange, which belongs to the Radio Corporation of America, formerly known as the American Marconi Company. The President of the United States dispatched a message of peace all over the world as a send-off to the new installation. This development is probably the reason for the recent buying of the ordinary and preference shares over here, and it has had a sympathetic effect in strengthening the price of the shares of the Marconi company itself. At 11.15 they are 1s. higher on the week. Radio Central had risen to 10s. 6d., and the preferred to 10s. 3d.

Electric shares have been down to 10s. 6d., but recovered to 10s. 11d. upon the completion of a fairly large selling order. The B. preference rose to 10s. 6d. Other manufacturers' stocks are a little irregular. Eldon dropped to 5s. 2d. and 2s. 6d. have recovered from a bound. Henlys at 14 and 14.50. Callenders, S.E. and Havant Trust 5 per cent. debenture stock at 89 is 1 point up. Amongst other debenture stocks, it may be noted that Newcastle-on-Tyne second debenture at 74 and South Metropolitan $\frac{1}{4}$ per cent. debenture at 72 are both a point or so to the good. River Plate Electric 5 per cent. debenture stock, for which the company invited tenders at 48 1/2 p.c., could be sold to-day, Tuesday at 84 in the market. If any of the stockholders offered their debenture to the company at 80 $\frac{1}{2}$, it may be presumed that they would be frank to the position of the price in the Stock Exchange.

Electricity supply shares are quiet. Bromptons have recovered their previous fall, and are up to 62. Metropolitan at 33 is $\frac{1}{2}$ lower. There is not, however, much doing.

Eastern Telegraph ordinary stock at 163 is again a point lower, while small falls have occurred in both classes of the Anglo-American Telegraph Co.'s issues. United River Plates are better at 59 1/16.

Brazilian Tractions show a rise of $\frac{1}{4}$ to 30, more hopeful views being taken of the outlook for the milreais; Brazilian Government bonds are better, and the recent severe slump in Brazilian Railway stocks is being partly recovered. Foreigners, however, as a whole are very quiet. Mexico Tramways bonds both lost a point. There are no changes in Mexican Light & Power issues. British Columbia preferred is $\frac{1}{2}$ down. The rubber share list is distinctly firmer, owing to a rise in the price of rubber itself, and to optimism engendered by the successful launching of the Rubber Shareholders' Association. Iron, coal and steel shares are also better, because of the indications which accumulate with regard to labour arriving at a frame of mind more amenable to reason in the matter of wages.

The secretary of a well-known company courteously draws attention to an error in the yield on certain shares as worked out in our table. The mistake has been duly rectified, and this gives an opportunity for pointing out that our yield-column is calculated upon the last-paid dividends, as, of course, is bound to be the case. At the same time, the recent experience of so many trading concerns has resulted in reduction of previously-paid dividends, that the conscientious commentator feels misgivings lest the practice may mislead, should the dividends in his table be altered. However, this having been said, the reader is placed *au courant* with the position, and will have the less ground for grievance if expectations, based on previous performance, should suffer disappointment.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.									
	Dividend		Price		Nov. 8.	Rise or fall.	Yield.	p.c.	
	1919.	1920.	1921.	1921.					
Brompton Ordinary	12	12	62	—	—	—	48 18	0	
Charing Cross Ordinary ..	7	8	43	—	—	—	9	2	4
do. do. do. $\frac{1}{4}$ Pref.	4	4	34	—	—	—	7	4	4
Chelsea	4	6	82	—	—	—	9	4	8
City of London	13	14	27 1/2	—	—	—	10	9	6
do. do. 6 per cent. Pref. ..	6	6	17 1/2	—	—	—	6	17	1/2
County of London	8	8	8	—	—	—	9	10	4
do. do. 8 per cent. Pref. ..	6	6	7 1/2	—	—	—	7	10	0
Kensington Ordinary	7	9	42	—	—	—	11	6	1
London Electric	2 1/2	2 1/2	1	—	—	—	7	10	0
do. do. 6 per cent. Pref. ..	6	6	8	—	—	—	10	0	0
Metropolitan	6	7	8	—	—	—	9	6	8
do. do. $\frac{1}{4}$ per cent. Pref. ..	4 1/2	4 1/2	21 1/2	—	—	—	7	13	1/2
St. James' and Pall Mall ..	12	12	62	—	—	—	9	1	4
South London	6	7	22	—	—	—	10	18	2
South Metropolitan Pref. ..	7	7	15 1/2	—	—	—	8	17	10
Westminster Ordinary	10	10	52	—	—	—	8	15	10
TELEGRAPHS AND TELEPHONS.									
Anglo-Am. Tel. Pref.	6	6	38	—	—	—	7	4	7
do. Do.	13	13	17 1/2	—	—	—	6	1	6
Chile Telephone	6	6	54	—	—	—	6	14	3
Cuba Sub. Ord.	7	7	7	—	—	—	10	0	0
Eastern Extension	10	10	16 1/2	—	—	—	6	1	0
Eastern Tel. Ord.	10	10	16 1/2	—	—	—	6	1	0
Globe Tel. and T. Ord.	10	10	16 1/2	—	—	—	6	1	0
do. do. Pref.	6	6	94	—	—	—	8	9	9
Great Northern Tel.	22	24	24 1/2	—	—	—	9	16	0
Indo-European	10	10	3 1/2	—	—	—	6	1	0
Marconi	25	15	1 1/2	—	—	—	8	1	0
Oriental Telephone Ord.	12	12	2	—	—	—	6	0	0
United R. Plate Tel.	8	8	5	—	—	—	7	8	10
West India and Panama ..	10	10	16 1/2	—	—	—	6	1	0
Western Telegraph	10	10	16 1/2	—	—	—	6	1	0
HOME RAILS.									
Central London Ord. Assented ..	4	4	49 1/2	—	—	—	8	1	3
Metropolitan	14	14	26 1/2	—	—	—	6	7	3
do. District	Nil	Nil	Nil	—	—	—	Nil	—	—
Underground Electric Ordinary ..	Nil	Nil	12	—	—	—	6	1	0
do. do. "A"	Nil	Nil	5 1/2	—	—	—	6	1	0
do. do. Income	4	2	68 1/2	—	—	—	4	7	4
FOREIGN TRAMS, &c.									
Anglo-Arg. Trams, First Pref.	5 1/2	12 1/2	28	—	—	—	10	9	6
do. do. 2nd Pref.	Nil	6 1/2	2 1/2	—	—	—	10	4	8
do. do. 6 $\frac{1}{2}$ Deb.	5	5	1	—	—	—	7	4	8
Brazil Tractions	Nil	Nil	30	—	—	—	Nil	—	—
British Columbia Elec. Ry. Ptes. ..	6	6	59	—	—	—	8	9	6
do. do. Preferred	6	9 3/8	61	—	—	—	9	5	0
do. do. Deb.	5	12 1/2	62	—	—	—	12	4	0
Mexico Trams 5 per cent. Bonds ..	Nil	Nil	60	—	—	—	7	1	—
do. do. 6 per cent. Bonds ..	Nil	Nil	56	—	—	—	Nil	—	—
Mexican Light Common	Nil	Nil	10	—	—	—	Nil	—	—
do. do. Pref.	Nil	Nil	20	—	—	—	Nil	—	—
do. do. 1st Bonds	Nil	5	62 1/2	—	—	—	9	10	6
MANUFACTURING COMPANIES.									
Babcock & Wilcox	15	16	2	—	—	—	6	18	8
British Aluminium Ord.	10	10	19 1/2	—	—	—	10	0	0
British Insulated Ord.	15	15	15	—	—	—	10	0	0
Callenders	15	15	16 1/2	—	—	—	10	8	6
do. do. $\frac{1}{4}$ Pref.	15	15	18 1/2	—	—	—	6	18	8
Crompton Ord.	10	10	14 1/2	—	—	—	13	15	10
Edison-Swan	10	10	6 1/2	—	—	—	7	1	1
do. do. 5 per cent. Deb.	5	5	2 1/2	—	—	—	7	1	1
Electric Construction	10	10	16 1/2	—	—	—	11	18	10
English Electric	8	8	7 1/2	—	—	—	21	6	8
do. do. Pref.	8	8	11 1/2	—	—	—	10	13	4
Gen. Elec. Pref.	10	10	16 1/2	—	—	—	7	8	6
do. Ord.	10	10	16 1/2	—	—	—	11	18	10
Honey	15	16	12	—	—	—	10	18	2
do. do. $\frac{1}{4}$ Pref.	10	10	4 1/2	—	—	—	8	16	8
India Rubber	10	10	12	—	—	—	8	16	8
Mess. Vickers Pref.	8	8	11 1/2	—	—	—	8	16	8
Siemens Ord.	10	10	21 1/2	—	—	—	9	10	10
Telegraph Con.	20	20	21 1/2	—	—	—	6	11	9

* Dividends paid free of Income Tax.

ELECTRICITY SUPPLY IN THE UNITED KINGDOM.

REPORT OF THE ELECTRICITY COMMISSIONERS.

(Concluded from page 620.)

Consents to Subscriptions to Associations.—The Commissioners during the period ending March 31st, 1921, issued consents in respect of the payment of subscriptions to the funds of the following Associations:—

- (a) British Electrical Development Association (9 Local Authorities).
- (b) British Engineering Standards Association (3 Local Authorities).
- (c) Incorporated Municipal Electrical Association (17 Local Authorities).

With regard to the applications respecting the Incorporated Municipal Electrical Association, the consents of the Commissioners also covered the payment of the reasonable expenses of attendance of not more than two representatives of the Local Authorities concerned (one representative to be the electrical engineer or his deputy) at certain meetings of the Association.

The Commissioners have also had under consideration the question of giving their consent to the payment of subscriptions by Local Authority undertakers to the funds of District Joint Industrial Councils formed in connection with the National Joint Industrial Council for the Electricity Supply Industry, which was established with the approval of the Ministry of Labour. Further inquiries into this question were proceeding at the date of the Report.*

Charges for Electricity.—The Minister of Transport is the sanctioning authority for all alterations or modifications in statutory provisions governing methods of charging and the prices to be charged for electricity by authorised undertakers, and a considerable amount of work devolved upon the Commissioners in advising the Minister upon applications made in this connection.

The period covered by the Report has been one of exceptional difficulty to all electricity supply undertakings, as is evidenced by the large number of applications which were made to the Minister of Transport for Orders authorising an increase in maximum prices.

In considering the applications referred to them by the Minister of Transport, the Commissioners at an early stage were confronted with certain questions of policy among the most important of which was the question whether they should advise the Minister to re-allow a minimum quarterly charge in Orders authorising an increase in maximum prices.

Mainly through a non-understanding of the position, many domestic lighting consumers fail to appreciate the intention of, and justification for, a minimum quarterly charge, and regard it as a hardship when required to pay a fixed charge, especially for the two summer quarters, when little or no electricity may have been consumed. The continuance of such a public utility service as electricity supply under the difficult conditions at present obtaining can, however, only be ensured by consumers paying a fair and reasonable price for services rendered, or at their disposal, and by undertakers securing a fair and reasonable return on capital expended under statutory obligation in rendering and making available such services. A statutory minimum quarterly charge provides a means to this end, although not the only means.

After a full review of the present economic position of electricity supply from the standpoint of authorised undertakers and domestic consumers, they recommended the Minister of Transport to re-allow the minimum quarterly charge in Orders authorising increases in maximum prices, such charge to be on the following basis, namely:—

- (a) In respect of each of the two winter quarters, for any amount up to 15 units, 15 times the authorised maximum price per unit.
- (b) In respect of each of the two summer quarters, for any amount up to 10 units, 10 times the authorised maximum price per unit.

It should be noted that undertakers are not compelled to require a minimum quarterly charge from their consumers, and it is open to them to refrain from making or to discontinue such charge.

The Commissioners dealt with 200 applications made to the Minister for authority to increase existing statutory maximum prices. In five cases the applications were withdrawn by the applicants. Each application was closely investigated, and all relevant circumstances were taken into consideration. In 182 cases an increase was recommended; eight applications were refused, and five were deferred.

The maxima recommended included one of 1s. 3d., 9 of 1s. 2d., 2 of 1s. 1d., 4 of 1s. 0½d., and 65 of 1s., the remainder ranging from 11d. to 8d.

*The Commissioners, on May 18th, issued their consent under Section 30 to the payment of contributions by Local Authority undertakers out of the revenue of their undertakings towards the expenses of the Electricity Supply Industry District Council (No. 10), Great London area.

Construction of Interim Works.—During the period under review four applications were made to the Minister and were referred by him to the Commissioners for investigation. One related to the Lower Severn Electricity District, in respect of the purchase by the Minister of the existing generating station at Beachley for the purposes of a future Joint Electricity Authority, and the construction by the Minister of main transmission lines from the station to the Forest of Dean, to Gloucester and to the Stroud Valley. This application was ultimately withdrawn.

In the case of the Mid-Lancashire Electricity District, the National Electric Supply Co., Ltd., made application in March, 1920, for the construction by the Minister of an e.h.p. transmission line between Preston and Blackburn, the application being supported by the Corporations. After the Commissioners had investigated the engineering and financial aspects of the application, they recommended the Minister to accede to the application and carry out the works. The parties, however, found themselves unable to give certain guarantees, and the matter was postponed.

The National Electric Supply Co., Ltd., made a second application in July, 1920, for the construction by the Minister of a generating station at a site on the river Ribble. This was refused.

The Conference of the Mersey and West Lancashire Electricity Authorities made application in December, 1920, for the construction by the Minister of a capital station at a site at Riverside on the Mersey (including the acquisition of a site for the station) and also of main transmission lines. The decision of the Commissioners on the schemes dealt with at the Inquiry had not been issued by March 31st.

Overhead Lines and Wayleaves.—Under the provisions of the General and Special Acts or Orders relating to the supply of electricity, the consent of the Minister of Transport is necessary before authorised undertakers may place any electric line above ground, except within premises in the sole occupation or control of the undertakers, and except so much of any service line as is necessarily so placed for the purpose of supply. In cases where the local authorities are not themselves the undertakers, the further consent of such an authority was formerly necessary under the provisions of Section 14 of the Electric Lighting Act, 1883, and Section 10 of the schedule to the Electric Lighting (Clauses) Act, 1899, or corresponding provision in any Special Act or Order. The position, however, has been modified by Section 21 of the Electricity (Supply) Act, 1919, and where the consent of the Minister is obtained the consent of the local authority is not required. The Commissioners have dealt with 34 applications made by authorised undertakers for consent to the erection of overhead lines, and recommended the Minister of Transport to give his consent in each case, subject to power being reserved to review the situation upon the expiration of a period of five years.

Extensions of Time and Revocation of Powers: Compulsory Works.—The Commissioners dealt with 19 applications from authorised undertakers; after a review of the circumstances in each case, they came to the conclusion that extensions of time or postponements of consideration of revocation were justifiable, and recommended the Minister accordingly.

Breaking-up of Streets, &c.—The Commissioners dealt with nine applications and recommended the Minister to give his consent in each case.

Capital Issues.—Under the Public Utility Companies (Capital Issues) Act, 1920, the Minister of Transport may consent to variations in the provisions regulating the raising of capital by companies carrying on statutory electricity undertakings where the powers of raising such capital are regulated by Special Acts. An application for the consent of the Minister under the above-mentioned Act was made by the North Metropolitan Electric Power Supply Co. and was granted.

Private Bills.—During the last session and the present session the Commissioners examined all Private Bills, and in 45 cases in which electricity provisions appeared, advised the Minister in connection with his reports made under Standing Orders.

Borough Extensions: Provisional Orders.—The drafts of 22 Provisional Orders were dealt with, and where necessary the Commissioners suggested to the Minister of Health the insertion of provisions for the protection of the interests of existing electricity undertakers.

Methods of Charging for Electricity.—The Commissioners received representations from the British Electrical Development Association on the subject of the existing statutory provisions governing the methods by which consumers may be charged for electricity. In November, 1920, the Commissioners met a deputation from a Tariff Committee appointed by the Association to discuss the matter in further detail, and proposals involving an amendment of existing legislation were placed before the Commissioners. After consideration of the matter from the points of view of undertakers and consumers, the Commissioners subsequently asked the Association to submit

a fuller statement of their case, with practical examples of the operation of various tariff systems, in accordance with the offer made during the discussion in November.

Electricity (Supply) Bills.—The Electricity (Supply) Bill, 1920, was introduced into the House of Commons by the Minister of Transport on April 14th, 1920. In December, 1920, he made the following statement in the House with regard to the Bill:—

"When I introduced this Bill in pursuance of the policy of the Government as stated 12 months ago when the House was invited to agree with the Lords' Amendments, I had hoped that it would not be considered by this House to be of an acutely controversial character. As, however, this hope has not been realised, it has not been found possible to give time to its consideration. In the meantime the Electricity Commissioners have been dealing with a mass of preliminary work, and they now advise me that they recognise a general disposition on the part of undertakers and authorities in various parts of the kingdom to co-operate in the promotion of voluntary schemes within the ambit of the Act passed last year. It is not, therefore, immediately necessary to invite Parliament to consider the larger powers which are the subject of the Bill at present upon the Order Paper, though I can give no undertaking that at some future date it may not be so."

A smaller Bill was introduced on the following day and subsequently reintroduced by the Minister on April 12th, 1921, as the Electricity (Supply) Bill, 1921.†

ELECTRICITY IN GASES.

THE opening meeting of the North-Eastern Centre of the Institution of Electrical Engineers for the session 1921-22 was held on October 24th, when Prof. W. M. THORNTON, O.B.E., D.Sc., delivered his inaugural address upon "Electricity in Gases as a Branch of Engineering." The following is an abstract of the address:—

Fifty years ago Maxwell predicted that research on electricity in gases would be the avenue by which the constitution of matter might be penetrated. This has been wonderfully justified, but we are far from the end. It is easy to utilise molecular energy, to make and unmake molecules; the whole science of chemistry and of organic life depends on the power to do this. There remains the stupendous step of unlocking atoms into their component electrons on an engineering scale, and the still greater feat of untwisting electrons into their mother ether. A loose charged molecule is a possible ion, or moving carrier of electricity. Since molecules of gases are separated more than those of liquids, the phenomena depending on ionisation in gases are, on the whole, simpler than those in liquids. Radiation from flame is by far the most important practical electrical property of gases. Energy is radiated in ether waves whenever an isolated charge, or an atom, a system of both kinds of electrical charges, is accelerated or retarded, as when it is thrown into vibration by high velocity collision. At least a fourth part of the energy of the coal burning in a boiler furnace which reaches the water is transmitted to the heating furnace by electrical radiation from the atoms in flame and incandescent coal. Taking the total boiler power in the world as 50 million horse-power, at least 12 million horse-power is transmitted to the furnace walls by short ether waves, making 300 or more billion oscillations a second from atoms in the furnace acting as electric radiators.

Next in engineering importance to radiation is electric ignition. The phenomena here are of great complexity. Ignition proper is not primarily a thermal process; the gases of the explosive mixture are activated or ionised both positively and negatively by the field across the gap, and are then ready to enter into combination when a molecule of combustible gas collides with one or more of oxygen. The gases must be freshly ionised at a certain critical intensity for combination to follow collision. How to produce this ionised state in the most efficient manner is the problem of the magneto industry. There are three ways in which electrical action on gases may cause ignition, through direct ionisation, by collision of electrons with molecules, as in a pump-spark; or by ionic emission from arcs or their poles when a circuit is broken, or by thermionic emission from hot wires. Of these, the first is the most effective in gases of high inflammability, such as petrol vapour, or coal gas; the second, in poor mixtures such as blast-furnace gas. The last is chiefly important as a means of danger of ignition of gases in coal mines.

In the Diesel type of engine there is no direct electrical ignition, but a certain temperature by compression is necessary. Considering all chemical combination as electrical in origin, there are here two possibilities; either that the velocities of high temperature collision are those at which ionisation by collision with electrons can occur; or that at the ignition temperature the energy of atomic collision and vibration is such that intense pulses of ether waves are sent out which ionise the adjacent gas molecules after the manner of X-rays, but more intensely, or that there is some form of thermionic

emission from the gas molecules themselves. The absence of influence of magnetic fields on the velocity of transmission of a gaseous explosion favours the second hypothesis.

Ironclad switchgear is an example of precautions taken to avoid flashing over following ionisation in gases. All air is excluded, and in the most modern forms of making contact there is no possibility of live metal coming permanently into contact with air.

When a hot-wire lamp is broken in an explosive gaseous mixture, ignition is possible but not certain. As the temperature of a hot wire placed in an inflammable mixture is raised, nothing happens below 200 deg. Centigrade. At this temperature, far below red heat, a discharge of electrons from the wire begins, for negative electrons are always moving about freely in metals. The gas around the wire is ionised by this high-velocity discharge, and slow chemical combination begins. The temperature of the surface then increases until the gas burns freely in contact with the wire at a white heat without flame. This is the phenomenon of surface combustion, in which the greater part of the energy is in the form of radiation.

The oscillations which can be made to occur in an arc circuit promise to be more far reaching and permanent in radio engineering, for example, than the use of the arc as a source of light except for searchlights. The importance of electrical discharge in high vacua is shown in the development of the X-ray tube and of the triode valve. The triode valve can be made to give continued oscillations at high frequencies, and can, therefore, be used instead of a machine as a generator of waves in radio-telegraphy. As much as five kilowatts has been given out by a single valve, and by coupling valves in parallel large antenna currents have been obtained.

When electrical discharge takes place in air at atmospheric pressure, not as streaming sparks but as a corona glow, intense ionisation by collision is produced. At low temperatures nitrogen compounds are very little formed, the effect is almost confined to activation of the oxygen, which under the intense electrification appears to break up and recombine to form ozone. This gas is manufactured on an engineering scale for bleaching or preserving foods and oils. It is the negative ionisation which is effective, and when electrical discharge just falls short of the spark stage, it is the oxygen that is ionised first with a negative charge. When streaming sparks pass with more positive ions, nitrogen compounds are formed. This point is of importance in the theory of ignition, and in the protection of high-pressure switchgear from the destructive action of ozone and nitric acid.

The importance of the production of solid nitrogen compounds is recognised in Germany where many thousands of tons are made per year. In Scandinavia the electric arc method has been worked to a high pitch of efficiency. Britain is the last country to place extensive manufacture of nitrates on a sound basis. A plentiful supply of nitrogen for manures, with intensive mechanical cultivation of the ground, more co-operation, in fact, between engineering and agriculture, must come if we are to hold our own under all circumstances of peace and war.

Clouds of smoke can be treated to cause an aggregation and deposit. The essential is a strong electric field sufficient to produce strong clouds of ions, electrons, or charged molecules, and to sweep them into contact with the smoke particles, charging them in turn, and carrying them, still colliding and gathering together, to the separator. The success of such an apparatus depends upon the success of one kind of ion, and in this discharge it is probable that the negative ionic discharge plays the leading part.

The electricity of the atmosphere is by no means negligible in its bearing on engineering operations. The upper layers, ionised by radiation from the sun, form a conducting sheath enveloping the sunny side of the earth. This sheath has great influence on the propagation of electric waves, and on the success of radio-telegraphy and telephony. Electrical phenomena on, or near, the earth's surface are rarely beneficial in an engineering sense. Electric storms are the bane of telegraphists, and in certain parts of the earth, South Africa, for example, they are of sufficient violence to shut down large overhead power systems. To counteract the interference with power supply there is no remedy apart from safety valves for excess pressure surges, and the avoidance, as far as possible, of running power lines through lands having a loose and dusty surface.

The address was illustrated by a series of experiments.

Electro-Harmonic Society.—Mr. J. S. Highfield, the president of the I.E.E., is to take the chair at the concert (ladies' night) to be held this evening at 8 o'clock in the Great Hall of Cannon Street Hotel. The artists will be:—Miss Winifred Lawson, soprano; Miss Violet Openshaw, contralto; Mr. David Ellis, tenor; Mr. Ivor Foster, baritone; Mr. Jack Salisbury, violinist; Mr. Rupert Hazell, entertainer; Mr. Will Bentley, entertainer; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist. Members should take particular note that owing to numerous complaints with regard to the reserving of seats, the following new regulation has been instituted and will be brought into force at this concert: "There shall be no admission to the hall before 7.30 p.m., and there shall be no reserving of seats except by occupation."

* The statement was submitted in April and the matter is still under investigation.

† The Bill was withdrawn on August 10th, 1921.

TRADE CONDITIONS IN NEW ZEALAND.

A Promising Market.

The report by H.M. Trade Commissioner in New Zealand (Mr. R. W. Dalton), which has recently been issued by the Department of Overseas Trade, reviews trade conditions in the Dominion up to July this year.

After revealing the circumstances leading to the financial and commercial crisis that the country has suffered—which do not differ substantially from those obtaining in other parts of the world—the report says that a better feeling has been apparent recently owing to slight narrowing of some markets for New Zealand produce. In the opinion of Mr. Dalton, New Zealand has been caught only by the tail of the storm which has been felt in its full force in other countries, and it is not unlikely that conditions will now gradually improve. Certain it is that with a country so productive and with conditions so favourable, recuperative powers must be good, and there can be no question that development must proceed. All that is needed is careful handling of a difficult financial situation and a winning effort on the part of the primary producers of the country to meet their own difficulties by better, and therefore more economic, methods of production.

The report deals at some length with the problems which arose through the delivery of goods from abroad, contracted for a long time previously, in excess of consumptive requirements at the time of their arrival. It also discusses the relative responsibility of the different parties for the difficulties which ensued. This it places largely on the shoulders of the New Zealand importers, suggesting at the same time that those who have more recently taken up importing rather than the old-established firms have appeared to overlook certain essential factors of business.

Power of Absorption.

In connection with the whole of the question of over-importing, the Trade Commissioner considers it wonderful how New Zealand has been able to bear the

strain and how, generally speaking, traders there, and particularly the old-established traders, have accepted the situation and have stood by their commitments. While there have been some cancellations which were hardly justified, and some refusals to take up goods which were shipped or even actually landed, the general body of old-established importers have honourably fulfilled their engagements.

New Zealand, with a population of little over a million, has accepted goods to the value of over £35,000,000 in seventeen months, while her exports amounted to only £68,000,000 in the same period, and many of these exports were paid for long before the period in which they were shipped. This seems to be sufficient proof of the preparedness of New Zealand merchants to stand up to their contracts, and it is doubtful whether there is any other country in the world which can show such a record.

Actual stocks, however, are not phenomenally great in quantity; it is the value represented, combined with the difficulty of getting financial accommodation, which is causing distress. Stocks are large, of course, but it is only in certain lines that they are really in excess of normal. Consistent efforts are, however, being made to clear them, and all possible reductions are being made.

It is difficult to forecast the future, but, continues the report, it seems certain that before very long there may actually be a shortage of goods in this market.

There has been very little new buying, particularly in the soft goods trade, since September, 1920. Most ships have been coming out in ballast for some months now, and it is only very occasionally that ships arrive with any quantity of cargo. In view of the distance of New Zealand from the source of supply it takes a considerable time for goods to be received in execution of orders, and if there is a revival in England in the near future, which seems likely, it is not improbable that New Zealand may fairly soon be again in the position of finding it difficult to obtain goods when a demand for them exists."

It may be added that the difficulty of forecast has been increased since Mr. Dalton's report was penned, by the threat to New Zealand wool held out by the Fordney tariff proposals in the United States.

More Publicity Needed.

Mr. Dalton still finds it necessary to allude to the failure of individual firms to keep their agents and prospective customers informed of the industrial situation as it affects them at home. Dissatisfaction

has been felt by importers generally in New Zealand concerning the treatment which they have received since the Armistice. Much of this feeling was due to misconception of the position in the United Kingdom consequent on the war. Few people overseas realised the extent of the resultant disorganisation.

A further complaint is in respect to goods which were not up to sample, but here again these instances have been due rather to laxity than to definite intent. In short, it may be said that abnormal conditions explain the whole matter.

Summarising this section of his report, the Trade Commissioner says:

"The one thing essential now in New Zealand above and beyond all others is the adoption of methods to re-establish confidence in British commercial practice which, in the writer's opinion unjustifiably, has been rudely shaken. General feeling here, both among the general public and on the part of trade, is still strongly in favour of the development of British trade with New Zealand, and all sections of the public are anxious to be convinced that their former faith in British systems of trade need not be revised."

Trading Methods.

The most serious complaint which has been heard in New Zealand, however, is that when the demand from other markets ceased, British firms immediately unloaded on the New Zealand market goods in completion of orders which had been given, in many cases, years before, and in total disregard of ordinary trade customs which had been well understood before the war by firms supplying the New Zealand market. It has even been said frequently that firms in the United Kingdom deliberately waited until prices had reached the peak to deliver these goods, and took care that advice of what they were doing should not reach New Zealand until the goods were actually on the water.

In November of last year, when these complaints began to be rife, the Trade Commissioner issued a long statement which appeared in practically every newspaper in the Dominion explaining his views on the situation with the idea of attempting to remove some of the misconceptions which undoubtedly existed. In this statement he pointed out some of the difficulties which had had to be faced in the United Kingdom since the end of the war, and said that, in view of all the circumstances, it was surprising that British firms had been able to deal with overseas trade at all while faced with such difficulties. He also gave it as his opinion that the fact that large quantities of goods were shipped to this market at peak prices was for the most part merely a coincidence. It would naturally follow that firms in the United Kingdom could not deal with bulk orders with any facility until demand from all markets had eased slightly; this could only be when prices had reached the top; thus it would follow that heavy deliveries of orders booked previously would take place at peak prices.

It seems that this must be the natural and economic conclusion of an abnormal period such as the world has passed through in the last few years. But in the main the Trade Commissioner's case for British firms was based on the assumption that all those firms which had been engaged in export business for years, which would comprise most of the firms trading with this market, would realise that it would be a very foolish policy to endanger their goodwill in overseas markets for the paltry advantage which they could hope to get by doing what it is alleged they have done; this apart entirely from the general principles of honest trading which have always stamped British trade.

Since issuing this statement Mr. Dalton has heard scores of detailed complaints, but has seen no reason materially to change the views which he then expressed.

Hydro-Electric Programme.

As has been anticipated, the Government has continued to attach great importance to an active public works programme, in so far as conditions will permit. Hydro-electric development has, of course, received the foremost place in the order of importance, and considerable strides are being made in order to get under way the Government schemes for both Islands. The three main sources selected for the North Island are at Mangahao in the Wellington district to produce 24,000 h.p., Arapuni in the Auckland district to produce 96,000 h.p., capable of extension to 162,000 h.p., and the intermediate station at Waikaremoana to produce 40,000 h.p., capable of extension to 136,000 h.p. In addition to these, supplementary supplies are to be obtained from smaller stations in certain parts of the Island and from the existing steam services at Auckland and Wellington.

Constructive work is now well in hand at Mangahao, and it is estimated by the Minister for Public Works that the installation should become available in 1923. Work has been started also at Waikaremoana, but owing to doubts having been expressed as to the efficiency of the foundations for the proposed Arapuni dam, the northern part of the scheme is, for the time, delayed.

With regard to the South Island, the system will include the existing power station at Lake Coleridge, the Dunedin City Council's plant at Waipori Falls and the proposed Southland Electric Power Board's scheme at Lake Monowai. With regard to the latter station, tenders were recently called for and received, but owing to the financial stringency existing it was deemed not desirable to proceed with the full scheme, and no tender was accepted. Surveys will also be made to decide on the most economical sources of power in the Central Otago, and the northern and western districts of the Island.

As regards the station at Lake Coleridge, owing to the heavy demand for electricity, this power house has in the past been running at a higher capacity than that provided for, and plant for an additional 4,000 h.p. is accordingly being provided. It is stated that in 1922 a further 4,000 h.p. will be provided, and that ultimately, by the construction of a new tunnel and pipe line, the capacity of the station will be brought up to about 36,000 h.p. Meanwhile anxiety as to the maintenance of the water level at the intake has been removed by the diversion of the waters of the river Harper into Lake Coleridge.

In January of the present year the Minister for Public Works stated that the money voted for hydro-electric development would be spent to the best advantage of the Dominion as a whole. Meanwhile, and again owing to financial stringency, expenditure on public works has had to be seriously curtailed.

In the Public Works Statement of 1920, the position of the Government with regard to hydro-electric development was definitely laid down. It was stated that the function of the Government would consist essentially in the construction of the main generating stations and the main transmission lines and sub-stations from which the power will be sold in bulk to local distributing authorities. These local Power Boards, as they have been termed, will be responsible for the final distribution of power in the districts.

In connection with the public works which have been undertaken since the war, it is very encouraging to note the success of British firms in contracts given. The Government of New Zealand is extremely sympathetic towards British interests in such contracts as are to be given, and British firms themselves have shown a strong inclination to do their best to take full advantage of this sympathy. Some very important contracts have been secured by them in the teeth of foreign competition, notably the electrification of the Oira Tunnel, a contract for 45 railway locomotives, a contract for 2,500 railway trucks, a large contract for rails and several smaller contracts of considerable importance.

Later the number of contracts let has been limited by the shortage of funds, but it seems not unlikely that when the big contracts for hydro-electric works come forward, British firms will, at least, secure a considerable share of the work.

It is also gratifying to note the sympathy toward British interests which is shown by the various City Corporations and local bodies. In contracts for these authorities, British firms have also been very successful, and it augurs well for the future that they have been able, so soon after the war, to prove their competitive ability.

THE BREWERS' EXHIBITION.

ALTHOUGH electricity enters into every department of modern life, it would not be expected that in a Brewers' Exhibition it would appear to a large extent. Nevertheless, a wide interpretation of the needs of this particular industry permitted a large number of electrical firms to display their products at the recent exhibition at the Agricultural Hall. Of course, the electric motor drive is nowadays taken for granted, but apart from this there were several exhibits of electrical interest.

THE FALKIRK IRON CO., LTD., had a large display of cooking and heating apparatus. The chief feature was a large electric range with two ovens, boiling rings, hot-plates, &c., arranged for very comprehensive heat control. A small cooker for use in restaurants was shown, as well as a somewhat similar appliance for domestic use. The last was of a very convenient size for the average family, of strong construction, and with remarkable heat-retaining characteristics. The cooker possessed a one-heat grill, oven, and two boiling plates. The oven was loaded to 2,000 W (3-heat), the grill 1,300 W, and each boiling plate was of the same loading as the grill, making a total of 5.9 kW. In addition to the cooking appliances, a number of electric fires and irons were exhibited. The fires were of sound construction and of plain but attractive appearance.

THE WASHING-UP MACHINE CO. demonstrated a new dish-washing machine (the "Dreadnought") upon its stand. This machine has a tank divided into three compartments into which a basket is placed which contains the plates and dishes to be washed. The centre of the tank has two rollers running through its length. On either side of the centre is a side tank, in which two fans revolve and force hot water through a narrow entry over the plates, at high pressure, while the rollers slowly rotate the plates, securing an even washing of every surface. The three divisions are respectively for washing, rinsing, and sterilising. The machine is driven by a .5-h.p. motor.

THE HOT-POINT ELECTRIC APPLIANCE CO., LTD., displayed examples of most of its manufactures—kettles, irons, grills, &c., all of very high finish. A convenient appliance shown

was the "Handyvac," a small portable suction cleaner and blower which, although very light, gives a high vacuum.

MESSRS. RANSOMES, SIMS & JEFFRIES, LTD., had on view a 4-ton "Orwell" electric lorry and a "C" type electric truck capable of dealing with a load of 4,000 lb. and fitted with a 20-cell "Ironclad-Exide" battery.

MESSRS. RICHARD GARRETT & SONS, LTD., and the GENERAL VEHICLE CO., LTD., also showed electric vehicles. The former had a 34-ton vehicle with a platform 11.3 ft. long and 6 ft. wide. The other firm exhibited a lorry, of similar capacity, made for Messrs. Whitbread & Co., to operate within a ten-mile radius.

THE HOBART MANUFACTURING CO., LTD., displayed and demonstrated a number of machines for use in bakeries and restaurants, in which the drive was provided by a motor incorporated in the design. Among these were dough mixers, coffee mills, potato peelers, meat choppers, loaf moulders, and a silver burnishing machine. These appliances were all of reasonable size and very efficient in working.

READS BAKERS' MACHINERY, LTD., had two or three examples of mixing machines. These were fitted with electric motors and operated through a 3-speed drive. The beater or mixing blade has a planetary motion; the speed is controlled by an accessible lever.

MR. H. C. SLINGSBY had a stand bearing a number of trucks of various kinds, including small battery trolleys and trucks fitted with electrical elevating gear.

THE TURBINE FURNACE CO., LTD., displayed the "Turbine" furnace described in the ELECTRICAL REVIEW a short time ago.

MESSRS. JOHN THOMPSON (WOLVERHAMPTON), LTD., exhibited samples and models of steam boilers superheaters, and water-softening plant. The "Thompson" sectional superheater consists of a pair of mild steel cylindrical headers and a group of "U" tubes arranged for easy replacement without total dismantling; they are tested to 350 lb. per sq. in. The "Kennicott" water-softener is fitted with a revolving sludge gear which prevents the accumulation of sludge in the bottom of the softener. The apparatus can be fitted with a feed-water heater to utilise waste heat.

MESSRS. J. W. FLOWER & CO., in addition to an electrically-driven rotary pump and a bottling machine driven by an electric motor, showed an "Eclipse" electro-hydraulic stacking crane similar to that described in our issue of May 27th (p. 676).

MESSRS. BARRETT & ELLIERS, LTD., showed a number of samples of moulded insulating material. These included "Belleroid," a non-hygroscopic material suitable for use in temperatures up to 300 deg. F. and practically acid-proof; a low-voltage material with similar heat and acid-proof characteristics known as "Bellerite"; and "Bellerock," a material which is opaque to X-rays, with a specific gravity only one-fifth of that lead. A shield for a Coolidge tube was shown; this was about 1/4 in. in thickness, and, it was claimed, formed a complete protection and localised the rays through the aperture.

The exhibition, which closes to-day (Friday) after a week's run, is yet another proof of the ubiquity of electricity.

German Commercial Propaganda in Sweden.—*Nya Dagligt Allehande* learns that the German Aussenhandelsverband plans the establishment of a great propaganda and selling organisation in Sweden, including the formation of a permanent giant exhibition of German goods. No less than 30 different industrial branches representing practically all kinds of production are included in the plan. An attempt is to be made, says the journal, to give the organisation the character of a purely Swedish enterprise.—*Reuter's Trade Service* (Stockholm).

Abnormal Pressure-rise in Transformers.—In a paper published in the I.E.E. *Journal* on "Abnormal pressure rise in transformers and its remedy," Mr. R. Lorik, A.M.I.E.E., explains that in a high-pressure transformer, abnormal potential gradients likely to cause a breakdown appear usually at the foot of the bushing and at the end coils. The author describes briefly a theory which is applicable to both these cases and from which he concludes that these dangers may be due to the incorrect arrangement of electrostatic capacities. Following this theory, he shows that, by properly grading the capacities, it is possible to avoid to a great extent the dangers in both the bushing and the end coils. The correct gradation of the capacities is shown to be as follows:—

1. The shunt capacity (C_s) must be graded so as to increase with the distance from the earthed end of the coil, or from the top of the bushing.

2. The capacity (C_g) to earth, or to the high-pressure conductor, should be graded so as to decrease with the distance.

3. The ratio C_s/C_g should be as great as possible.

4. It is preferable to use a resistance in series with the capacity C_s .

Experiments show that where a transformer is exposed to excessive stress a potential gradient of about 20 times the normal value may occur at the end coil, and this can be reduced to one-third this value by the device proposed. The author's method also prevents breakdowns due to other causes, such as the decrease in the natural frequency of the coil.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Brooklite" 1-kW Set.

There are numerous small electric lighting sets upon the market, but many of them are made abroad. MESSRS. J. W. BROOK & CO., LTD., Adrian Works, Lowestoft, have sent us particulars of a set which they are now manufacturing, and which is an addition to the list of British makes. This is the "Brooklite" 1-kW set, illustrated in fig. 1. The engine is a two-stroke, 2-h.p. petrol engine, running at a speed of 900 r.p.m. The engine is direct coupled to a 1-kW shunt wound

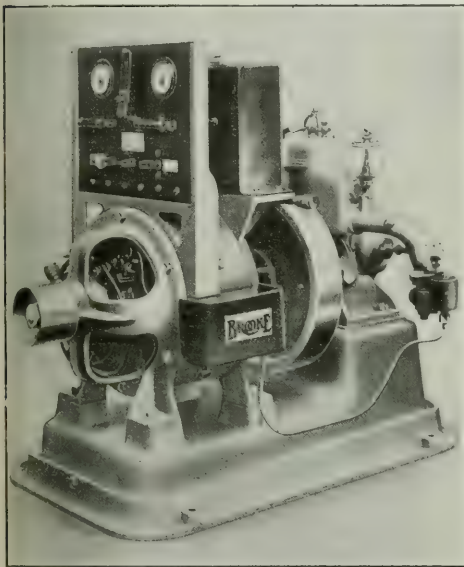


FIG. 1.—THE "BROOKLITE" 1-KW SET.

dynamo through a flexible coupling. The shaft is extended and a pulley mounted on it to enable other plant to be driven direct. The switchboard is of enamelled slate plainly marked with ivory labels to prevent mistakes in connecting and operating. The battery recommended for this plant, and usually supplied, consists of thirteen cells with a capacity of 180 Ah.

Translucent Plaster Bowls.

A new departure in electric lighting has been made by the Z ELECTRIC LAMP & SUPPLIES CO., LTD., 73, Newman Street, W. 1, the aim being to provide a bowl fitting with the appearance of carved alabaster without the weight and expense that are usually concomitants of this material. The material used is plaster, which can be moulded to any desired shape or design, rendered translucent by a special process. The casts are reinforced with fabric, and this enables any colour or marble "effect" to be obtained in the process of moulding. The appearance of the bowl when not illuminated is similar to that of pure white marble or alabaster. The bowl retains a sufficient degree of opacity to prevent coloured rays being shed into the room; the result is a white diffused light.

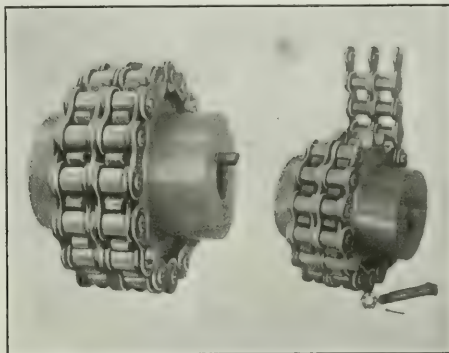
"The Coventry" Chain Coupling.

The Coventry" chain coupling (fig. 2) has been introduced by THE COVENTRY CHAIN CO., LTD., Spun End Works, Coventry, to meet the demands of automobile and general engineers for a positive and flexible coupling constructed for high duty and long life. The unit comprises a standard duplex roller chain, provided with suitable coupling bolts at intervals, and two sprocket wheels, each having a boss on one side only bored to suit the respective shaft diameters. Its design is such that a high factor of safety on the duplex chain is automatically obtained, owing to the stresses being divided equally over the teeth in the coupling flanges or chain sprockets. The coupling is perfectly balanced, being machined all over, is practically indestructible, transmits a large power for its size, and needs no lubrication. It is in no way affected by atmospheric conditions, and the cost of maintenance is

practically negligible. The 2-in. maximum bore coupling will transmit .8 h.p. at 100 r.p.m., and the 5-in. size 180 h.p.

Fig. 3 illustrates the facility with which the two halves of the coupling can be disconnected. The removal of a cotter pin, nut and bolt permits the chain to be wrapped off the coupling easily and quickly. In cases where the coupling is used to operate magnetos and other devices where "setting" is called for, the removal of the chain as indicated above permits of the relative positions of the teeth being modified to give the angular adjustment usually necessary in practice.

The coupling is not designed to replace universal joints where considerable angular motion has to be taken care of.



FIGS. 2 AND 3.—"THE COVENTRY" CHAIN COUPLING.

out can be fitted where the angular motion does not exceed 2 degrees. The coupling also permits of relative end movement between the two shafts, but this end movement should be limited to an amount equivalent to one-sixteenth of the shaft diameter.

The couplings are stocked in standard sizes from 1 in. to 3 in. bore, and can be re-bored to suit special requirements up to the maximum bore permissible.

Chain couplings can be manufactured in other sizes to meet special circumstances, and the company is making a speciality of small couplings for operating magnetos.

A "Carron" Grate Suite.

CARRON COMPANY, Falkirk, N.B., has put on the market some well-designed electric fires and accessories to conform to the ordinary type of fireplace. Fig. 4 shows one of these suites, which are carried out in any design to harmonise with their surroundings. The one illustrated includes a dog grate

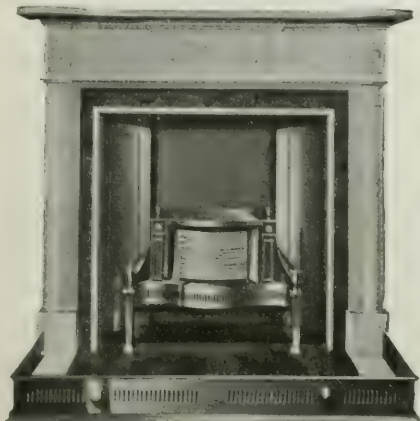


FIG. 4.—A "CARRON" GRATE SUITE.

with an "armour bright" finish, having panels and kerb in the same style and a marble surround, hearth, and appropriate mantel. A number of designs are on view at the company's showrooms, 60, Berners Street, Oxford Street, W.1.

THE INTERNATIONAL MOTOR EXHIBITION.

The "Motor Show," as it is familiarly called, that is being held in London this week is the fiftieth of the series organised by the Society of Motor Manufacturers and Traders, Ltd., in conjunction with the Royal Automobile Club, an annual event which offers an unrivalled opportunity to a large and constantly growing national industry to display its newest products, and supplies the means of calling public attention to the never-ceasing success of research and improvements in craftsmanship.

The holding of the exhibition concurrently at the White City and Olympia was again found to be a necessity. The whole show is international in character (excepting only the products of late enemy countries), and each part is representative of all sections, except that the Motor Boat and Marine Engine Section, which is re-introduced this year as a feature of the annual show, is wholly located at the White City. In this section Messrs. J. W. Brooke & Co., Ltd., exhibit a new 1 kW self-contained electric lighting set, which is described on the previous page, complete with a switch-board and self-starting gear actuated by energy derived from a battery. The outfit is suitable for either yacht or house lighting.

The total number of exhibitors is 571, an increase of 52 over the record entry in 1920, and approximately 1,000 motor cars comprising 151 different makes are available for inspection. Nevertheless, only the cars on two of the stands, both at the White City, can claim to arouse any electrical interest, and that on account of their adoption of the Entz magnetic system of transmission which has been fully dealt with in our pages. The "Magnetic" car (MAGNETIC CAR CO., LTD.) is driven by a 15.9-h.p., 4-cylinder engine with B.T.H. magneto ignition, while on the 30/50-h.p., 8-cylinder chassis a B.L.I.C. magneto is fitted. The "Crown Magnetic" car (J. L. CROWN MOTOR CO., LTD.), which was shown last year also, is driven by a 30/50-h.p. 6-cylinder "Silent Knight" engine, with S.E.V. magneto ignition; two magnetic and two internally-expanding mechanically-operated brakes are fitted to the rear wheels, and the car's petrol consumption is stated to be 18 m.p.g.

The accessories section of the exhibition is a large one, and it is here that the electrical gadgets are to be seen. They consist mostly of lighting equipments; engine-starting devices; ignition systems, including many types of magnetos and sparking plugs; accumulators; cable and wire; electric horns, &c.

MESSRS. C. A. VANDERVELL & CO., LTD., announce that after a long period spent in testing all kinds of anti-dazzle devices submitted to them for motor lamps, they have decided that

flowing through a pipe, or for delivering separate quantities. The instrument, which is illustrated in fig. 1, has been passed by the Board of Trade as a legal measuring device, and is, therefore, the only liquid measuring instrument to be approved by the British Government. It is claimed that the electric petrometer complies with the requirements of the Explosives Department of the Home Office; that the viscosity of the liquid to be measured does not affect its accuracy of working, and that its measurement cannot vary through component parts wearing out—in fact, it has been carried for "thousands of miles" clamped to the handlebar of a motor bicycle.

The instruments can be made for any desired feed, i.e., vacuum, gravity, or pressure; the consumption of electricity is very small; any voltage may be used; and its action is as follows:—The liquid flows into the instrument through a valve at the bottom. When the chamber is full it is permitted to slowly enter the tube at the top where it raises the float and this, in turn, makes the electric connection in the body of the vessel which immediately cuts off the flow of liquid and at the same time opens the outlet valve. The liquid then flows to the desired place, and when the vessel is empty the discharge valve is closed by the float in the bottom tube, making another electric connection which automatically reopens the inlet valve. These instruments can be made to deliver the smallest quantity up to any desired volume; are not controllable by hand, and it is not possible by any derangement to give short measure. On the registering device for motor vehicles there are two sets of hands, one gives the gross quantity that has passed through and this hand cannot be interfered with. The other hand gives the amount used for either a test or trip and can be reset at will.

Another interesting device is the Rolph combined tail lamp and traffic warning (MESSRS. ALLEN LAYLERSIDE, LTD.), which illuminates the number plate, exhibits the regulation rear light, and enables the driver of the car to signal to traffic

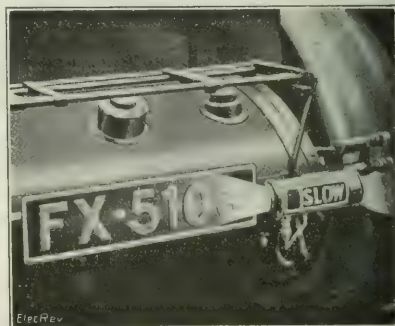


FIG. 2.—THE ROLPH TRAFFIC WARNER.

behind him, as shown in fig. 2. The device is operated mechanically, the signal "slow" being made automatically directly the clutch lever is depressed or the foot brake is applied; the signal "stop" is operated by the hand brake. The direction signals "right" and "left" are shown by arrows, and are operated by a simple lever attached to the steering column. They are not automatic, as the driver's intention to turn has, of course, to be made known some time before the corner is reached.

Another contrivance intended for the same purpose is the "ARROW" signal (ARROW ELECTRICAL & MOTOR ACCESSORIES CO., LTD.), which also attracted attention at the show last year. It consists of three main component parts—arrow at the front and rear of the car and the control mechanism inside it. The driver moves the control handle in the direction in which he wants to go; the arrows are locked in an of their positions, and each time they are moved the electric horn is sounded. The switch that controls the lamps inside the arrows for night work is also carried on the control bar.

In conclusion, it might be noted that the Isotta Fraschini car, which comes from Italy, is fitted with a complete electrical equipment from Stuttgart.

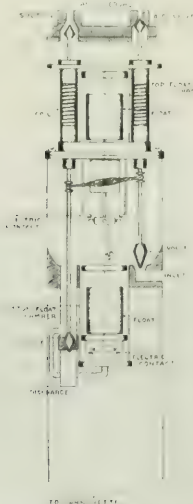


FIG. 1.—THE ELECTRIC PETROMETER.

the one which will meet the requirements, and is nearest to the ideals of the Transport Ministry, is that made under the Grubb patents, which was recently described in our columns. Messrs. Vandervell have therefore arranged to take over the world rights for the manufacture of this lamp, which in future will be known as the "C.A.V. Non-Dazzle Lamp."

MESSRS. POTTERHEAD & SONS, LTD., demonstrate the working principles of the electric petrometer and "super-vac" (Bowden's patent)—an instrument designed for the purpose of measuring and recording with accuracy the volume of liquid

"Rocking-horse Power."—Under this title the *Evening News* publishes a *Reuter* message from Quebec announcing the invention of a generator driven by a rocking-horse, which is capable of providing power to a washing machine, sewing machine, or other domestic appliance. The old claim that "A child can work it" would seem very applicable to the idea. On the other hand, if the child discovers that it is doing something useful, it will probably go on strike.

For the benefit of the lay reader, we may add that the idea must not be treated seriously.

WEST RIDING (AIRE AND CALDER) ELECTRICITY DISTRICT.

THE COMMISSIONERS' CONCLUSIONS.

THE Electricity Commissioners have considered the evidence that was given at the Inquiry at Leeds* into (a) the schemes submitted respectively by the Conference of West Riding Local Authorities† and the Corporation of Leeds‡; (b) the representations made to them by the Yorkshire Electric Power Co.§ and others; and (c) the application made by the Power Company for consent to the establishment of a new generating station at Ferrybridge; and have arrived at the following conclusions:—

1. The area provisionally determined‖ is confirmed subject to the inclusion of the urban districts of Hoyland Nether, Wath-upon-Deane, Bolton-upon-Deane and Thurnscoe, and the rural district of Riscall.

2. The existing generating stations at Bradford, Halifax, Huddersfield, Keighley, Leeds, Thornhill and Wakefield should be interconnected.

3. The existing generating plant at those stations together with the extensions thereto already authorised by the Commissioners and the addition of another generating set to be accommodated in the Whitehall station of the Corporation of Leeds will, when those stations are interconnected, meet the estimated requirements of the district for several years.

4. The first stage of a new station at Ferrybridge should be constructed forthwith by the Power Company and linked up with the interconnected system above referred to.

5. A second new station is not required at present; matters relating to it should be left to the consideration of the Joint Electricity Authority that is to be established.

6. The negotiations between the Conference of Local Authorities and the Power Company for the sale and purchase of the Company's undertaking having failed, the scheme submitted by the Conference is not feasible. Moreover, the much-needed improvement in the organisation for the supply of electricity in the district should be effected by the co-operation of all the authorised undertakers and authorities in the district under the general control of an authority on which all interests will be represented.

7. A Joint Electricity Authority should, therefore, be formed for the whole district.

8. To ensure the most efficient use of existing generating plant and to avoid unnecessary expenditure on transmission lines, the district should be dealt with in two agreed areas, one being that which can be dealt with by the interconnected existing municipal stations (area "A"), and the remainder should be supplied by the Power Company, provided that all the interconnected stations are worked under one control and for mutual assistance. With regard to area "A," the local authorities concerned and the Power Company should prepare for the approval of the Commissioners a scheme to simplify the position as to rights of supply and transmission or distribution within that area, either by the acquisition on agreed terms of the Power Company's rights of supply in the said area (together with such parts of its transmission system, if any, as have been laid therein at the date of the agreement) or otherwise; and with regard to the remainder of the district the powers of supply of the Joint Authority should be transferred to the Power Company, the latter obtaining such further powers as may be necessary for the foregoing purposes.

9. The Power Company or the Electrical Distribution of Yorkshire, Ltd., as may be determined, should (if they so desire) have conferred upon them, by transfer from the Joint Authority, the distribution rights in all areas within the district which are not at present within the areas of supply of authorised distributors subject (a) to the purchase provisions contained in the Electric Lighting Act, 1888; (b) to the existing right of local authorities or companies to apply for Special Orders to establish local distribution undertakings, the Power Company giving to such undertakings (if established) any bulk supply required; and (c) to a provision enabling a local authority (being an authorised distributor) to purchase such part of the Company's distribution system as may be included in any subsequent extension of that authority's local government boundaries.

The financial arrangements contemplated by the Commissioners are: (a) that the moneys for the construction of the Ferrybridge station and of the interconnecting transmission lines therefrom, as well as for the development of the districts outside area "A," will be provided by the Power Company; the Commissioners understand that the Company is prepared to raise these moneys, subject to the necessary powers being obtained, as to which the Commissioners will require to be satisfied in due course; (b) that the moneys for the construction of the lines interconnecting the other stations (where not previously raised by the local authorities concerned) and for the construction in due course of a second capital station, will

be raised by the Joint Authority. A modified technical scheme for inclusion in the draft Order should be drawn up jointly by the respective engineers for the Leeds and Corporation schemes and of the Power Company on the lines hereinafter stated.

The Electricity Commissioners have accordingly decided to prepare a draft Order establishing a Joint Electricity Authority for the whole district as amended, and providing:—

(a) For representation on the Joint Authority (1) of the Corporations of Bradford, Halifax, Huddersfield, and Leeds respectively; (2) jointly of the Corporations of Barnsley, Batley, Brighouse, Dewsbury, Keighley, Morley, Pudsey, Todmorden, and Wakefield, (3) jointly of the Urban District Councils owning undertakings; (4) jointly of local authorities possessing rights of purchase of the undertakings of authorised distributors supplying in their areas, such rights being transferred to the Joint Authority; (5) of the West Riding County Council acting on its own behalf and on behalf of the urban and rural district councils not owning undertakings and in whose districts there are no authorised distributors; (6) of the Power Company; (7) jointly of companies, other than the Power Company, owning authorised undertakings; (8) of the railway companies.

(b) For the administrative expenses of the Joint Authority not properly chargeable as part of the cost of electricity supplied, or to capital, or not met out of contributions from local authorities or other bodies represented on the Joint Authority, to be met by all the authorised undertakers in the district; and for any excess of expenses of the Joint Authority over its receipts, which may arise from the supply of electricity from the interconnected system, to be met by the authorised distributors connected with the system.

(c) For the control by the Joint Authority of the working of the centralised system of interconnected generating stations, such control to be exercised in consultation with an Advisory Committee composed of the engineers of the stations in question; for the pooling of the operating results of the interconnected municipal stations for the common benefit of the local authorities supplied; and for supplies to or from the Power Company's system on agreed terms.

(d) For giving effect to the agreed scheme referred to in paragraph (8).

(e) For the inclusion of the outlines of the technical scheme to be undertaken by the Joint Authority and the Power Company, with provision that modifications thereof may be made with the approval of the Commissioners.

(f) For the Joint Authority acting with the Power Company to submit within two years from the date of the establishment of the Authority, proposals, as laid down in paragraph (9), for a system of distribution in areas within the district which are not at present within the areas of supply of authorised distributors, where there is a reasonable prospect of such supply being remunerative.

(g) For the necessary financial powers being conferred on the Joint Authority, subject to the enactment of a further Electricity (Supply) Bill.

Pending the establishment of the Joint Authority, the Commissioners will ask the principal local authority undertakers and the Power Company to form a small Provisional Committee with which the Commissioners may consult from time to time with regard to any development of supply in the district.

WATER-POWER IN THE BRITISH EMPIRE.

THE COMMITTEE'S FINAL REPORT.

THE Water Power Committee of the Conjoint Board of Scientific Societies that was appointed in November, 1917, "to report on what is at present being done to ascertain the amount and distribution of water power in the British Empire" issued a preliminary report in July, 1918,† which was followed by a second in March, 1919.‡ Since then additional information has been obtained, and it is summarised in the present final report; it is hoped to publish shortly a combined edition of the three reports. It will be remembered that the Committee that was appointed by the Board of Trade to investigate the water power resources of the United Kingdom issued its first interim report in 1919,§ and suggested in its second report, issued in June, 1920,¶ machinery for the control of the water resources of Great Britain, including the formation of a Board of Water Commissioners.

The present final report gives additional information relative to various parts of the Empire, and indicates the present state of the investigation work, showing that in Great Britain, India, Canada, New Zealand, Tasmania, and some portions of Australia, more or less adequate steps are being taken by the various Governments, and that definite preliminary steps have been taken in the Union of South Africa, in British East Africa, in Ceylon, in British Guiana and in Egypt. In the remaining countries of the Empire nothing definite is being

* ELEC. REV., May 27th, 1921; p. 697.

† ELEC. REV., March 11th, 1921; p. 324.

‡ ELEC. REV., January 21st, 1921; p. 95.

§ ELEC. REV., March 18th, 1921; p. 361.

¶ ELEC. REV., June 25th, 1920; p. 815.

* ELEC. REV., August 16th, 1918; p. 151.

† ELEC. REV., August 29th, 1919; p. 264.

‡ ELEC. REV., March 28th, 1919; p. 345.

§ ELEC. REV., July 9th, 1920; p. 58.

done, or appears to be projected, although the potential water-power in New Guinea, Burma, and West Africa, for example, is known to be very large indeed; while where investigation work has been initiated, with the exception of Great Britain, Canada, New Zealand, and possibly India, the scope of the work does not appear to be in any way commensurate with the importance of the subject.

Taking the Empire as a whole, no attempt is being made to ascertain the total resources, to secure any uniformity in methods of investigation and recording of data, to encourage such investigations as are being made, or to collect the information as it becomes available at a central bureau. At present not even an approximately complete inventory exists, much less the practical and commercial information that would assist development of this important national resource.

In calling attention to the active development of water-power resources which has taken place in European countries during the war, as shown in the Committee's second report, a few additional particulars are added, which show that the Empire's position in water-power development at the present time compares unfavourably with that of its commercial competitors. The latest available figures show the following:—

	Hydraulic horse-power.		Per cent. of available now developed.
	Available.	Developed.	
<i>Europe:</i> Germany, Italy, Switzerland, Spain, Sweden, Austria-Hungary, France and Norway ...	47,300,000	8,450,000	18.0
<i>United States</i> ...	32,000,000	6,500,000	20.3
<i>British Empire</i> ...	60,000,000	3,000,000	5.0

Of the total developed water-power in the British Empire, about 72 per cent. is in Canada.

In its first report, the Committee recommended the formation of an Imperial Water-Power Board, to include a representative of each of the Dominions and Dependencies, and briefly outlined its functions. It now adds suggestions as to the principal objects that the proposed Board should endeavour to carry out:—

It should (in every Dominion and Dependency) ensure comprehensive investigation on a uniform method and system, and secure the initiation of investigations where these are not already in hand. The Board should endeavour to make co-operative arrangements for carrying out investigations in such Dependencies as are not in a position to undertake them unaided.

Arrangements should be made with all oversea authorities for complete copies of all data secured, and reports issued to be on file at an Imperial headquarters in London. From these the Board should compile and publish an annual report and detailed annual records of investigations throughout the Empire in a uniform form. The Board should, in fact, be a central clearing house of information on this subject for the whole Empire. It is not suggested that the Board should investigate natural resources other than water-power, but that it should collate brief particulars of such resources locally available, with references as to where fuller information can be obtained.

It should be possible for any capitalist or company needing cheap power in large quantities to ascertain at the offices of the Board, from information immediately available, all the water-powers in certain districts, with the state of investigation for each, in such form that it could be decided which locality and which power appeared sufficiently promising to justify further detailed investigation. For such purposes, whenever possible, investigations of rivers should be carried out with sufficient thoroughness to allow of reasonably close estimates of costs being obtained. These estimates should be made by the engineers of the Government concerned.

The Committee submits that the Joint Board of Scientific Societies should urge upon the Government that the creation of an Imperial Water-Power Board, as suggested above, is needed, and that a great impetus would be given to the investigation of water resources in the Dominions and Dependencies by the creation of such a Central Board to assist and to record information for the assistance of commercial investors. An Imperial Water-Power Conference should be convened in London, if feasible, at an early date. The Committee understands that a proposal has been made to hold such a Conference, and that this has been cordially received by the representatives of those of the outlying portions of the Empire, which are most directly concerned. Such a Conference would offer the opportunity of discussing matters of policy, administration, uniformity of investigation and records in connection with water-power development, and could not fail to have a useful effect on such development.

Railway Fusion Scheme.—Proprietors and debenture stock holders of the Lancashire & Yorkshire Railway Co. are to meet on November 17th to consider the scheme that was announced in our columns last March for the amalgamation of the company with the London & North-Western Railway Co.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Inaugural Address,

By J. S. HIGHFIELD, *President.*

(Abstract.)

UNDER the Council come our Territorial Centres and Sub-Centres, each in a measure autonomous, each depending on, and at the same time strengthening, by direct representation, the central Council. Again, there are the Students' Sections, mainly managing their own affairs. We also have allied to us the Wireless Section and the Society of Radiographers, independent bodies but connected by the closest ties; there are also the important Associations, the Electrical Development Association and the Electrical Research Association, in the formation of which this Institution took a leading part.

These various Centres and Associations, jointly with the Council, form a constitution of proved worth. It is designed, on the one hand, to preserve that continuity of growth based on tradition without which no structure, be it material or spiritual, can hope to attain strength and influence, and, on the other, to bring to bear new energy and new ideas so that yearly its youth may be renewed. The granting of a Royal Charter, together with the very greatest possible honour conferred on us by the King in becoming our Patron, marks, I am sure we all feel, a great step forward. It is the highest public recognition of the work and importance of our Institution. It is also a change which throws on us all an added responsibility to maintain, to strengthen our position, to enlarge the usefulness of the Institution not only to its members but to the public whom they serve. The circumstances of these latter days have forced on the attention of all the fact that the body politic is not working smoothly. Mr. Atkinson says that discontent exists mainly because the people do not like their work. I agree, but what is the remedy?

Many, perhaps most of us in one sense hate work, but without work we cannot live, and to live it is necessary to do many very dirty and unpleasant jobs. It may be said that a man will do a job if he is well paid for it. That may be, but the pay will not make him enjoy it, and that is the point. One of the first steps necessary to the enjoyment of any work is, I think, a personal knowledge of the possession of skill; the greater the knowledge of this skill the greater the pleasure. It has its source probably in a feeling of rivalry, and this sense in its best form is greatly promoted by the national love of playing games, and in sport of every description. There is a splendid sense of pleasure in team work. At least 80 per cent. of the working population must be engaged in manual work, and from the point of view of works production it is clear that the efficiency is highest when the directing and designing staff is as small as possible in proportion to the number of direct producers.

Since the majority of workers must work with their hands, can it be said that our methods of general education are correct? The most proficient hand skill, and the most useful knowledge of some of the difficult industries such as farming, and shipping, and engineering, can only be acquired in boyhood. We have made it imperative that every boy and girl should suffer the generally unpopular operation of having book knowledge forced into them, and we have neglected manual training. Many schools are moving in the opposite direction and are teaching art and hand skill at an early age, but the process should be carried further; but this cannot be done unless the teachers themselves possess the necessary skill.

Every skilled trade is in its nature an art, just as music, painting, and sculpture are arts, and all arts must be practised at an early age. Education, besides assisting in the perfecting of art, must be directed mainly to the formation of character, and continuity of education should be insisted on, so that no student leaves school or college with any other idea except that he leaves with a mental equipment designed for the acquisition of further knowledge. The best of education never can be proved by written examination. In life, knowledge and skill form the spear point; determination, wisdom and character are the shaft which gives the driving power.

My object in enlarging on a subject raised by former presidents is to try and rouse a keener interest in this most important subject among our members. I want, as we all do, to see a greater England, a greater Empire, where every man may have a fair chance not only to benefit himself, but to benefit others, and I hold that to this end the sound and sensible education of youth is of the first importance.

I use the term education to include all up-bringing, the formation of character, the means of health both of body and of mind, the Christian virtues, the love of work, the need of service, and the sacrifice, called duty, that alone should win us rights. These qualities can be won to the full only when there is ordered society, where there is that thing which the framers of the Electricity Act call a margin, and which ordinary men call a profit. Life mainly consists in a hard pull up-stream, but, fortunately, there are softly washed shallows and quiet pools where for a time the struggle ceases. It is in the sunlit shallows and quiet pools that the fish breed, just as in life in the quiet pools of profit, strength, vigour and

new ideas are born that enable the next push forward to be made. Through the war and since, we have all suffered from a spate which washed out the quiet pools and flooded the banks and reduced our river to a cataract. The spate has been followed by a horrid drought with which an engineer finds it still more difficult to deal.

Progress has been rudely interrupted, and it is certain that no rapid remedy is possible; only steady skilled application can produce any result. We know that hard constant work is required to resolve the simplest problem in engineering and science, we know that only sustained effort will produce any lasting result, and that time is requisite. We know that many have not that experience and still believe, about engineering and other matters, in the Fairy Wand by which results are achieved without effort and without time.

I am glad to note the important work recently done by electrical firms to better the training of their apprentices and technical assistants, and I think that every engineer in a managing position should do everything he can to assist in the education of his own men and of their sons. Scientific methods should be used. Scientific methods consist mainly in taking precautions against fooling yourself or being fooled, by applying, where possible, steady observation, and deducing by skilled thought true results from the observed phenomena. It will be a great day for our educational systems when the advocates of classical education see eye to eye with the modern side, so that the scientific method may be applied in the widest sense, and on the foundations of past experience be erected a sure knowledge.

I repeat that education should be directed to enabling every boy to acquire skill in a trade, and although the theoretical side of education acquired from books and bookish men is useful, the practical hand-skill, to be acquired only from hand-skilled men, is vital, and the sooner more attention is directed to this side of education the better. One of the nation's most valuable assets is a great body of men skilled in their trades, and taking delight and finding pride in their skill.

There should be due reward for skill and industry. The Trade Unions have done much good for their members, but they have done at least equal harm, not only to their own members, but to the whole nation, by forcing the principle of standard wages and by reducing output. How can any proper man take pleasure in his work under such conditions, and since his life must be passed in work, how can he be happy unless he enjoys it? I hold it right, in a well-conducted State, that everyone should have the opportunity to earn a living, provided he will work, though it must be recognised that this happy state of affairs is one most difficult of attainment. It is only by fortunate environment, steady industry, and thrift among the general population, and good government, beginning in each home, continued by clever management in the factory, and extended by efficient and honest local and national government, that this state of affairs is possible. To complete my happy State, it is also necessary that each man should be willing to help the next, and to rejoice in his good fortune. To attain such success, the spirit of honourable rivalry should have full play, and this cannot be, unless each man is free to work as skilfully and as hard as he desires, and to attain a due reward for his labour.

I have used the term "profit," and I believe the common misuse of the term is responsible for more than half our industrial difficulties. To the individual it is not what he spends on rent, rates and maintenance of himself and his family; it is not the sum he saves for old age or a rainy day, but it is what he can use to serve his desires whether in the form of sport or art, a present to his wife or children, or any other addition to the amenities of life, including the delight of charity. The amounts that may be so spent out of annual income are profit. But there is another sum which I include under the term, and from the industrial point of view a more important one, and that is the sum that each of us can devote to new ventures, including investment in the common stock of companies. All progress in science and engineering depends on the ability of the individual to venture his profit or part of his profit in this way, in applying part of his savings to new ventures.

It is, or should be, clear that national wealth (that is, the wealth belonging to the nation as a whole) is created by individuals and belongs to individuals. We, as electrical engineers, are particularly interested in public companies. It is due to the thrift and enterprise of the shareholders in these companies that there is any electrical business. There is no more democratic institution than a limited company. There is continually at work a compelling influence tending to maintain efficiency of direction and management, and the rough measure is profit. Any sum left over after a dividend is paid on the ordinary shares may be called profit, and in my view it should be employed equally to benefit those who direct and work the business, the shareholders who bear the risk, the consumer by way of a reduction in price, and lastly, some share for the business itself. It is this last portion which can be applied safely for research in new methods and in new ventures, from which arise the means of reducing prices.

Unfortunately, little attention, so far as I have observed, has been given to the importance of profit by electrical engineers. Great attention has been given for years to the reduction of cost, and with excellent results. Almost equal attention has been given to low average prices, but very little to

profit, which is really the important matter. Where profit is earned, prices can be reduced and, if this is wisely done, the result will be increased profits. The effect is cumulative and leads to expansion of business, with continually decreased prices, because money is easy to raise and, consequently, is cheaply raised. Profit, in short, is the grease which lubricates the wheels of progress; it is the certain sign of successful business. Without profit, if an industry does not die it can live only in a state of suspended animation.

Losses must be faced in any business, and anyone claiming a share of the profit in good times must equally be prepared to share the losses in bad times. The profits, in fact, belong to those who are able and willing to shoulder the losses.

I have spoken mainly of the great business of electricity supply, because I am familiar with its technical and financial aspects, and because it is the foundation on which the whole electrical industry is supported. If electricity supply flourishes, manufacturers of plant, cables, lamps, motors and all necessary apparatus flourish. Electricity helps every manufacturer and trade, and active trade causes a greater use and demand for all means of communication, telegraphs, telephones, railways, and shipping.

The really important matter at the present time is to get on with the work, and since a great part of electricity supply is carried on, and carried on very well, by municipal Corporations and Councils, I want also to say a word about their constitution and methods. The theory of municipal trading is that the citizens should, through their properly elected representatives, provide their own urgent wants. Electricity has been regarded, and rightly so, as a necessity, for although the number of inhabitants directly paying for it may be a moderate proportion only of the population, indirectly, through its use for railways, tramways, driving, factories, and street lighting, the bulk of the population have great interest in securing a cheap and abundant supply. It is claimed for municipal trading that the supply must be more cheaply provided than by companies, for two main reasons: one is that the payment of directors' fees is avoided, the other that money can be more cheaply raised on the credit of the general rate-paying capacity of the whole community than by a company on its own credit, or the credit created by the belief that it can pay and continue to pay dividends.

Doubtless, both contentions are in a measure true; there are no directors' fees, and the rate of interest paid on borrowed money is usually less on municipal loans than on a company's debentures. This, however, is only part of the story; the municipality can borrow money only if it undertakes to repay it by a sinking fund which is an annual sum coming from the pockets of the consumer. It must also provide a reserve, the greater part of which should be used to provide new plant. The sinking fund and reserve are equally direct charges against the revenue, but whereas one continually weakens the cash position, the other strengthens it.

The annual contribution to the sinking fund is money which is paid away to the man who lent the money; the annual contribution to reserve is hard cash with which plant may be bought.

A municipality should create a reserve, and many wisely do so, but the advantage of the low rate of interest on loans is largely wiped out by the annual sums that must be set aside out of revenue for sinking fund and reserve. In fact, for every hundred pounds employed for electricity supply the municipal undertakings have made a charge of nearly 2 per cent. in excess of that made by companies.

In the public services, both company and municipal methods have been employed on a large scale; both have in the main produced excellent results, and both will continue. The company method is, I think, the better because it throws a more severe and direct burden on the shoulders of the management and, consequently, tends to greater efficiency.

I have recited these elementary facts about the finance of enterprise, because failure to realise their importance so often brings the work of the engineer to nought. It is no use devising new machines for saving working costs if the expense of putting them into use results in capital charges that exceed the saving in working expenses. It is no use effecting savings if the results are all given to the public; part should go to the industry, part to those who work, and part to those who venture their savings on its behalf. The fault of mispending the profits is a capital one. In company working, it generally takes the form of paying too high dividends at the expense of reserve, and so the business is starved. In municipal working, it is common to appropriate too large a proportion of the profit to the relief of the rates; it is much better to buy new plant and avoid raising fresh loans, especially at the present time. The Electricity Bill of 1919 originally provided that all savings should come to the consumers, clear evidence that its framers neither paid attention to business principles nor showed any knowledge of human nature.

(To be concluded.)

Arithmetical Calculating Slips. Messrs. Bowman and Murdoch, 29, Shoe Lane, E.C.4, have sent us a box of their calculating slips (price 1s.) for carrying out multiplication and division. The slips are, we think, of educational rather than practical value.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

- 27,700. "Means for rendering inoperative simultaneously prime movers and brakes," S. G. Gifford, and electrically-propelled vehicles, &c." E. W. Foss and H. Rose, October 18th, 1920. (147,718.)
- 27,692. "Interrupter rheostats," J. P. Argall, October 18th, 1920. (147,715.)
- 27,703. "Dynamo-electric machines," British Thomson-Houston Co., Ltd. (General Electric Co.), October 19th, 1920. (147,716.)
- 27,706. "Means for operating electrical signals," Ges. fur Drahtlose Telegraphie, October 19th, (Germany, October 22nd, 1920.)
- 27,788. "Telephone systems," J. E. Pollak (Siemens & Halske Akt.-Ges.), October 19th, 1920. (147,722.)
- 27,808. "Electric switch plugs," R. Rust, October 20th, 1920. (147,723.)
- 27,822. "Electric sound producing horns," T. S. Rogers, October 20th, 1920. (147,724.)
- 27,835. "Steam electric plant for production of power," H. H. Bridges, October 20th, 1920. (147,725.)
- 27,845. "Dynamo-electric machines," A. S. Murdoch, October 20th, 1920. (147,726.)
- 27,849. "Electrical transmitter microphones," E. D. Young, October 20th, 1920. (147,727.)
- 27,868. "Carrier telegraph circuits," Western Electric Co., Ltd. October 20th, (United States, October 21st, 1920.)
- 27,874. "Electric heating of water, &c." British Generator Co., Ltd., and H. Constable, October 20th, 1920. (147,728.)
- 27,883. "Radio-signalling systems," British Thomson-Houston Co., Ltd. (General Electric Co.), October 20th, 1920. (147,729.)
- 27,884. "Electric discharge apparatus," British Thomson-Houston Co., Ltd. (General Electric Co.), October 20th, 1920. (147,730.)
- 27,885. "Automatic electric ship's lead," I. Ben-Ayad, October 20th, 1920. (147,731.)
- 27,889. "Circuits for electric sound-signalling batteries," W. R. Bullimore, October 20th, 1920. (147,732.)
- 27,893. "Telephone systems, &c." W. J. D. Godsell, October 20th, 1920. (147,733.)
- 27,901. "Systems of operation for electric locomotives, trams, &c." W. P. Durnall, October 20th, 1920. (147,734.)
- 27,902. "Switches for train lighting systems," J. Etchells and Vickers, Ltd., October 20th, 1920. (147,735.)
- 27,917. "Condensers," W. J. Alder and Balfour Baring, Ltd., October 20th, 1920. (147,736.)
- 27,934. "Overload trip retarding device for electric circuit breakers, &c." F. W. Close and Electric Construction Co., Ltd. October 21st, 1920. (147,737.)
- 27,937. "Incandescent electric lamps," J. Knight, October 21st, 1920. (147,738.)
- 28,016. "Electric railway motor control systems," Metropolitan-Vickers Electrical Co., Ltd. October 21st, (United States, November 5th, 1920.)
- 28,017. "Electric discharge apparatus," British Thomson-Houston Co., Ltd. (General Electric Co.), October 21st, 1920. (147,739.)
- 28,063. "Electric fly and insect killer," H. A. Thomas, October 22nd, 1920. (147,740.)
- 28,074. "Portable electric lamp holders," Cable Accessories Co., Ltd., I. W. Davis, and E. H. Reeves, October 22nd, 1920. (147,741.)
- 28,079. "Apparatus for reproduction by electro-deposition," S. O. Cowper-Coles, October 22nd, 1920. (147,742.)
- 28,087. "Starter, transmission gear, and dynamo drive combined," J. B. Bignamy, October 22nd, 1920. (147,743.)
- 28,089. "Method of electrically welding high-speed steel to tool shanks, &c." E. Schoder, October 22nd, 1920. (147,744.)
- 28,123. "Spark plug for explosion motors," A. O. M. Loifgren, October 22nd, (Sweden, October 23rd, 1920.)
- 28,142. "Electric arc welding," B. Turner, October 24th, 1920. (147,745.)
- 28,144. "Electric fuses," W. J. Line and J. H. Tucker & Co., Ltd. October 24th, 1920. (147,746.)
- 28,146. "Electric chronoscope," G. E. Moore, October 24th, 1920. (147,747.)
- 28,160. "Electric wall, &c., plugs," F. D. Denner and L. J. Lepine, October 24th, 1920. (147,748.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1919.

- 27,561. "Electrically heated soldering irons," A. H. Browning, July 16, 1920. (170,010.)

1920.

- 27,764. "Electric measuring instrument," E. C. R. Marks, W. G. Nae, Electric Co., April 7th, 1920. (170,021.)
- 27,780. "Spark plug for internal combustion engines," H. B. Ransom and F. J. S. Thompson, May 6th, 1920. (170,030.)
- 12,831. "Apparatus for rectifying high and low-frequency alternating currents," J. Nienhold, May 15th, 1917. (142,870.)
- 15,188. "Electric arc welding," B. Turner, October 24th, 1920. (170,031.)
- 15,189. "Electric arc welding," B. Turner, October 24th, 1920. (170,032.)
- 15,190. "Electric arc welding," B. Turner, October 24th, 1920. (170,033.)
- 15,191. "Electric arc welding," B. Turner, October 24th, 1920. (170,034.)
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- 15,193. "Electric arc welding," B. Turner, October 24th, 1920. (170,036.)
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No. 2,295.

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THE HACKNEY CASE.

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THE case of Dore v. Hackney Borough Council, which came before Mr. Forbes Lankester, K.C., some months ago, and has now been adjudicated upon by the Court of Appeal, involves the decision of a question of very considerable importance, not only to electrical undertakers, but to all who are under a statutory duty to supply any commodity to the public. The facts are very simple. The Hackney Borough Council was summoned for making default in supplying electric power to the house of a consumer as required by the Hackney Electric Lighting Order, 1893. The borough electrical engineer was satisfied that the wiring had been properly done, and the committee was anxious to give the supply, but acting on the orders of the Electrical Trades Union, the Council's employes refused to connect because the work was not done by trade union labour, but by a man who was his own master. The learned magistrate found* that the Council was in default, and ordered it to pay a fine and costs. He pointed out that his only duty was to consider whether the failure to connect was due to *force majeure* or not, and said that in the absence of any decision to the effect that mere threats amounted to *force majeure* he held that they did not. "It is to be observed," he said, "that the threat, if acted upon generally (and I was told that this trade union controlled the action of electrical workers throughout the kingdom) would deprive all men in the position of Mr. Cant of an honourable and legitimate livelihood, whilst it avowedly amounts to a claim on the part of the union to dictate to all their fellow subjects the class of persons they shall employ to do private electrical work on private premises. Some may regard such a threat as high-handed and insufferable tyranny on the part of the union. It is not for me to say." The Court of Appeal unanimously confirmed the finding of the magistrate, and dismissed the appeal. It should be noted that the decision of a magistrate is final on a question of fact.

We confess to a feeling of surprise at the attitude adopted by the Hackney Borough Council in this matter. The statute which entitles a consumer to receive a supply is plain as plain can be. The consequences of refusal are made equally clear: "Whenever the undertakers make default in supplying energy to any owner or occupier of premises to whom they may have and are required to supply energy they shall be liable in respect of each default to a penalty not exceeding forty shillings for each day on which the default occurs." The circumstances in which penalties *cannot* be imposed are stated with equal clearness. No penalty can be inflicted in respect of any default if the Court is of opinion that the default was caused by inevitable accident or *force majeure* or was of so slight or unimportant a character as not materially to affect the value of supply. It was not, and could not be, suggested that the failure was due to inevitable accident; the sole question was: Is this *force majeure*?

* His judgment was reported in the ELECTRICAL REVIEW, May 6th, 1921, p. 604.

People unaccustomed to the forms of law may desire to know the meaning and significance of this phrase. Its English equivalent is "the act of God." Suppose, for example, a generating station were knocked down by an earthquake, or the mains were carried away in a flood of almost unprecedented violence, the resulting cessation of supply would be held to be due to the act of God or *force majeure*.

In the course of his judgment Mr. Lankester pointed out that no exhaustive definition of the phrase could be found. But references may usefully be made to another branch of the law. A common carrier is, generally speaking, an insurer of the goods which he carries. But he is not liable for the Act of God or the King's Enemies. His duty was thus defined in an old case: "A common carrier is not liable for any accident as to which he can show that it is due to natural causes directly and exclusively, without human intervention, and that it would not have been prevented by any amount of foresight and pains and care reasonably to be expected from him."

It would indeed be a serious outlook for the public if any Court were to hold that the dictates of a trade-union official were equivalent to *force majeure*. The whole supply of electricity in these islands could then be held up unless the system of supply and the wages paid to the undertakers' workmen were approved by union officials. The supply of gas and water might be equally affected; and the public would have no redress! To a summons for penalties the answer would always be—*force majeure*!

It may be asked: Has the consumer—or would-be consumer—no remedy other than a summons? Can he not bring an action? That it is reasonable to ask this question is manifest when it is explained that a summons, even if successful, brings no pecuniary reward to the prosecutor. The fine is swept into the coffers of the State; the costs awarded (if any) are barely sufficient to cover the prosecutor's out-of-pocket expenses. Why may he not sue for damages?

This remedy does not avail him. It is an old principle of law that where a statute prescribes a remedy for a particular injury, any other remedy which there might be is taken away by implication. So in one case it was held that no action lay against a gas company for damages sustained by a consumer by reason of its failure to give him a supply of gas sufficient in amount and in purity to satisfy the requirements of the Act. His only remedy was to proceed for penalties. In the present case if the gentleman who had reason to complain of the Hackney Borough Council had commenced proceedings in the County Court he would have done so in vain.

It is now many years since the Legislature conferred upon trade unions immunity from actions for wrongs. It was hoped that they would not exceed their privileges; but it must be confessed that the case under review has brought a singular abuse into public notice. It will tend, moreover, to create an uneasy feeling that the exercise of similar powers is a matter of common occurrence, and that it is only by reason of a curious combination of circumstances that the facts of one case were duly brought to light.

SOME months ago we remarked, with regard to the electrical wages dispute, that the collapse of the strike was largely due to the flat refusal of many members of the E.T.U. to engage in it; that they were affected by the incessant attempts of their leaders to involve them in strikes, and that there was a "good feeling" for the Executive of the London Branch. This feeling has attained maturity, as we

be gathered from the abstract elsewhere in this issue of a circular recently issued by the National Executive Council of the Electrical Trades Union.

The Council, in fact, exasperated by the insubordination, indiscretion, mismanagement, and recklessness of the London District Committee, has at last suspended the latter. We have often had occasion to criticise the actions of the London committee, and have expressed the conviction that the rank and file of the members in the London district were not in sympathy with, or responsible for, the policy adopted by their hot-headed leaders; our impression is fully confirmed by the terms of the circular, which leaves no loophole for doubt as to the intensity of the indignation with which the Executive Council regards, and for years has regarded, the conduct of the Committee.

Needless to say, we welcome this drastic action; we bear no ill-will either towards the Union, which is capable of doing excellent work in promoting the welfare of the industry, or towards the members of the Committee, against whom we have no personal complaint to make—but we do utterly detest the "policy," if such it can be called, for which the Committee has been responsible—a policy which is almost wholly comprised within the twelve reasons for suspension cited by the Council!

For its attitude towards the Whitley Council system, and its adhesion to the decisions to which it has been a party on the Councils, we commend the Committee. But we regard the *unity* of the trade union as the first essential to its usefulness, and we believe that the action taken by the Executive Council is in the best interests of the Electrical Trades Union, the electrical industry, and the nation as a whole.

Promoting Electricity Supply.

THE importance of the work which the Electrical Development Association is peculiarly qualified to carry out has recently been emphasised in various quarters, notably in the presidential address of Mr. J. S. Highfield, the inaugural addresses of chairmen of Territorial Centres of the Institution, and by the Conference of Industrial Councils. Mr. Highfield touched upon it in connection with the necessity of adopting a system of charging for electricity which will enable the price of lighting to be raised to a reasonable figure, and will avoid the necessity of overcharging for power and heating, whilst allowing electricity to be supplied for all purposes through one meter. This can be effected by means of the two-part or multi-part tariff, provided that the obligation to offer an alternative flat rate is removed. As he remarked on a previous occasion, and indicated again in his address, the immediate development of the public supply of electricity is of *vital* importance not merely to the supply authorities themselves, but also to contractors and manufacturers, and to the workpeople whose interests are at stake, affecting as it does the employment of many thousands of men, and immensely improving our position with respect to the development of export trade.

Mr. G. H. Nisbett, in his outspoken address to the Liverpool Sub-Centre of the North-Western Centre, laid great stress on the same point—the dependence of the electrical industry in great part upon the development of new business. Whilst we cannot agree in all respects with his comments upon the relative national importance of power and lighting supplies, we are entirely at one with him regarding the urgent need for developing the domestic side of the business. We regret that we are unable to devote more space to his stimulating address, but plenty of food for thought will be found in the abstract which appears elsewhere in this issue. Before leaving the question of power supply, we may point out that the main objects of the committees which recommended the extension of a "cheap and abundant supply" of electricity to all parts of the country were: to economise fuel, and to enable a greater proportion of mechanical power to be employed in manufacturing operations, thereby increasing output *per capita* and

diminishing the cost of production. Surely these are vitally important "national objects"; the cost of power in percentage of the cost of the finished product may with great advantage be increased, if thereby the output of a factory can be doubled and the cost of production reduced.

So far as Mr. Nisbett advocates the extension of electric lighting pure and simple, we fear he will not convince the supply engineer, who knows that the cost of services is from three to four times the pre-war cost, and that in very many cases the profit on the energy used for lighting alone does not even cover the annual charges on the cost of connection. This is particularly true in the case of the small consumer, whose case Mr. Nisbett obviously has in mind, and when he suggests that the supply authority shall bear the cost of the wiring also, he aggravates the difficulty—*unless the authority is empowered to charge a remunerative price*. Thus we come back again to the question of tariffs and the maximum price permitted, which Mr. Highfield dealt with so forcefully. That question has now been before the Electricity Commissioners for about twelve months, and has not lost any of its urgency by the delay. We know the Commissioners are faced with great difficulties in securing a reform of the law on this subject; but no one else is in a position to deal with it, and we look to them to exert every effort to expedite the removal of the statutory restrictions. As things are at present, the only way to secure a return on the cost of wiring is to charge a separate rent for it.

We are pleased to note that the Local Authorities (Financial Provisions) Bill (No. 230, H.M. Stationery Office) has received the Royal Assent, as it contains a clause of great importance to electricity supply undertakings, which have to lay out capital that will not produce a revenue for some years. This clause gives power to suspend payments to the sinking fund for a period not exceeding five years, while the capital expended remains unremunerative. This was one of the concessions that were pressed upon the Cabinet Committee upon Unemployment by the deputation from the Conference of Joint Industrial Councils on November 2nd, and will in great measure facilitate the development of electricity supply.

THE Berlin Chamber of Commerce recently distributed copies of a pamphlet written by Herr Felix Deutsch, chairman of the directorate of the A.E.G., in respect of the relation borne by wages and salaries to the return on capital invested in industrial undertakings. The pamphlet forms a continuation of one of a similar character which was issued in 1919 in regard to 66 joint stock companies, although in the present case the inquiry has been extended to 152 companies which are also not specifically mentioned, and therefore incapable of being checked. The author endeavours to show that while wages and salaries have increased in the past two years, the share capital as represented by the average rate of dividends paid has considerably declined. It is, however, not to this side of the question that we wish to refer, although the *Frankfort Gazette*, in criticising the pamphlet under the title of "A False Account," states that it has been written for a pronounced purpose, and it rejects the author's conclusions, although we observe that the *Financial Times* swallows them in its issue of November 5th. On the other hand, and in a subsequent issue, the German newspaper directs attention to another part of the pamphlet, and warmly commends the policy set forth therein, to the consideration both of industrial undertakings and of the banks associated with the latter in the emission of new capital. As this particular part is also of interest in this country, which likewise has a depreciated exchange in relation to the United States and two or three other countries, and is also confronted with a considerably greater capital expenditure for replacements of machinery and

plant as compared with pre-war times, no apology is needed for reproducing what the chairman of the directorate of the A.E.G. says on the question.

Herr Deutsch first points out that the former method of writing down in gold the machinery and plant to the value of one gold mark—which, as is known, many companies practised in Germany in pre-war times—is no longer sufficient to-day, when machinery and appliances cost from 16 to 18 times the pre-war rates, for the purpose of protecting an undertaking against the consumption of its capital. As a consequence, and in order to render possible the acquisition of new plant (replacements) and maintain the efficiency and competitive capacity of industry, such large renewal reserve funds must be provided that the necessary capital stands available for the purchase of a new machine on an old one being scrapped. As an example, the author says:—

"At the A.E.G. we formerly used certain generally introduced machine tools, one man being required to attend to each machine. One day new machines were offered us from America, every three of which could be served by one workman. That implied a considerable economy, and we therefore did not dare delay making the large expenditure for the provision of the new machines. This progress did not satisfy technicians. Only a short time elapsed before the Americans placed new machines on the market, of which nine could be attended to by one man. For this purpose, of course, a workman of higher intelligence was requisite, while only purely mechanical work had to be performed with the machines originally used. It is now obvious that the considerable expenditure for the new plant could only be borne by an undertaking which, having a large turnover, was able fully to utilise the new machines. This was the case with the works of the A.E.G.; they had for their products a customer with a market comprising the whole of the inhabited globe; the entire organisation of the A.E.G. comprised approximately 400 branches, and they could therefore venture to replace the machines acquired a few years ago with the more efficient but very costly new machines. The result showed that we were right, for we soon increased our sales by more than fivefold, and the large sums were intelligibly and well invested. But—and this is the essential part—we were only able to venture upon this step because we had completely written off the first machines. Otherwise we should not have been able to provide for the redemption also of the new machines, and should have had to leave the business to more intelligent and more far-sighted firms, with whom we should then no longer have been able to compete. This example could be applied to German industry as a whole to-day. Certainly many companies, besides making the customary depreciation, have formed considerable internal reserves by the careful valuation of securities and stocks. But the question whether these are adequate and guarantee that security which is urgently necessary under present conditions arises to-day more threatening and oppressive than ever before."

The warning given in the final sentences of the statement by the chairman of the A.E.G. is certainly not unnecessary. While large sums have been written off by the coal, iron and steel, and engineering companies for depreciation for the past financial year, and considerable sums have been placed to reserve funds, these amounts are totally insufficient to effect replacements of plant and machinery on the present basis of the cost of purchase as contrasted with pre-war sale prices. As a general rule, and in order to make a show of great prosperity, depreciation and renewals reserves are being provided for just as if the companies were working with the mark at par value, whereas the total amount set aside for these two purposes by all the colliery companies in Westphalia in 1919-20—and 1920-21 will probably indicate no difference—would not have sufficed to pay for the sinking of a new shaft to replace one where the coal had been worked out. Similar conditions prevail in the iron and steel and engineering industries, all for the purpose of paying high and, in reality, fictitious dividends. Even where there is a prospect of at once forming a very considerable reserve fund by the issue of new capital for extensions and developments—not for replacements—at a very high premium, and thus permit of the premium being placed to reserves, shares are mostly issued at a low premium in order to please the shareholders in the exercise of their preferential rights of subscription, unless waived, and also to please the directors and their friends. Everything seems to point to a future day of reckoning, when the present sham state of prosperity will be revealed in its true colours.

THE LOW TEMPERATURE CARBONISATION OF COAL.

WHAT IS COAL?—A substance found in certain geological formations. It is a black solid, and contains pitch, tar, creosote, carbolic acid, tar oils, benzol, ammoniacal liquor. Yes, quite so, and in the same sense a baa lamb contains men and children. For coal contains none of these things, and nobody really can do more than guess what coal is in the sense of being able to formulate the molecular arrangement of the elements into which it may be ultimately resolved. True, when heated in a closed vessel the substances above named and a host of gases in addition are produced, and may be separated and placed in bottles and labelled "Products of distillation of coal." Of late years the tendency has become evident to add to such labelling the words "at 500 deg. C. of temperature," or such other temperature as was given to the retort in which the distillation took place. In all cases of destructive distillation and of combustion, temperature is a crucial factor. The distillation of coal is classed as destructive because, it may be assumed, the coal is changed so greatly in appearance and texture that it ceases to be coal. But constructive distillation would be a better term to employ, for by heating coal its molecules are rearranged, some as gas, others as liquids, and yet others as solids.

The so-called constituents of coal have not been taken from the coal, but entirely novel bodies have been generated. And these new bodies from the same piece of coal will differ according as they are the result of heating the coal gently or bringing it up to a high temperature. Substances brought into being by a temperature of from 550 to 600 deg. C. are represented as

pioneers of more rational methods of using coal and of economising the products of distillation. Thwaite, Allen, and Booth worked along these lines nearly 30 years ago. But the motor car and the flying machine, with their greedy petrol-absorbing maw, have done this work of late years, and the need for petrol substitutes has really been the spur which has urged chemists to bring about a more rational employment of coal by using moderate temperatures of distillation in order to secure a more valuable series of molecularly reconstituted substances. The following table of the effects of high and low temperatures is due to Mr. Brownlie. It gives the high- and low-temperature products of 1 ton of coal of an average type:—

	Low temperature carbonisation.	High-temperature Gas works.	carbonisation. Coke ovens.
In retorts...	11 cwt. of smokeless fuel	13½ cwt. soft coke	14 to 14½ cwt. hard coke
Gas ...	6,000 cb. ft. of gas of 700 to 750 B.th.u. per cb. ft.	12,000 cb. ft. of gas of 550 B.th.u. per cb. ft.	11,500 cb. ft. of gas, 450 B.th.u. per cb. ft.
Liquid products	20 gal., including 3 gal. motor spirit & Diesel, lubricating & fuel oils	10 gallons	8 gallons
Sulphate of ammonia	15 lb.	25 lb.	28 lb.

Much more oil results from the low-temperature process than from high-temperature carbonisation. It con-

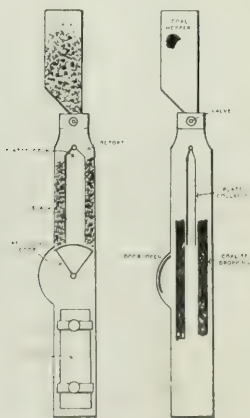


FIG. 1.—SECTIONS OF RETORT AND COOLING CHAMBER.



FIG. 2.—CARBONISING PLANT AND COALITE DUMP.

low temperature products. At from 900 to 1,000 deg. C. the distillation temperature is considered as high, and the products of a lower temperature will be "cracked" to use the trade term, with the evolution of fresh molecular structures.

Ordinary illuminating gas is a high-temperature resultant, and the particular aim of this procedure is gas for lighting purposes. High temperature is also employed in producing metallurgical coke, and in this case the gas which is evolved may be, and is, used in driving gas engines or heating boilers. But much of the value of the distillation products is destroyed by high temperature.

Coal for steam production is usually passed directly from the mine to the boiler furnace. The columns of the ELECTRICAL REVIEW have for long been open to the

tains also less of naphthalene and other more complex products, but more of the simpler products, such as benzol, toluol, creosols, or creosote oil than does the tar of high-temperature retorts. Its value is very much higher, and the final solid residue or coke is very different from gas-retort coke or the product of the coke oven. The coke or coalite from low-temperature distillation has been more or less known for some years, but there have been many difficulties attending its production. It is softer than gas coke, somewhat resembles charcoal, more readily soils the hands, and apparently has its carbon contents in a sort of annealed state, in which condition it is easy to ignite, and it burns with a cheerful glow and with a short flame.

But the object of low-temperature carbonisation is general rather than specific. It is, perhaps, first, de-

sired to produce motor fuel of various orders of density; next, to produce a smokeless house fuel with a capacity for easy ignition, clear burning, and of high radiating power. An ordinary coal fire absorbs much of its heat in distilling filthy gas to pass up the chimney and foul the atmosphere. The blocks of coal burn at their rearward faces and shield off the room from radiant heat. The net result is a pitiable inefficiency. The economies due to a clean atmosphere are enormous; few realise the destructive action of smoke both directly on textiles, and indirectly through frequent and more intensive laundry punishment. And all this waste is



PASSING SLACK COAL FROM HOPPERS INTO THE RETORTS.

waste of our main national asset, an asset already far depleted and more recently reburied in small areas, too small to be again opened up and worked.

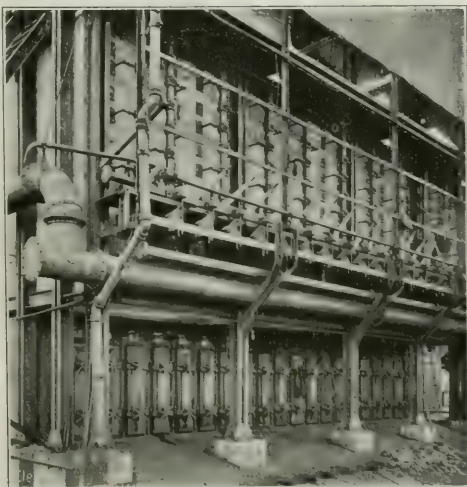
The chemistry of low-temperature distillation is not, perhaps difficult. But there have been technical difficulties of a physical and mechanical order which are now stated to have been overcome by the system of Low-temperature Carbonisation, Ltd., which for several weeks has had plant in continuous operation at Barnsley, Yorkshire, and a special demonstration was held on Wednesday, October 19th, for representatives of the technical Press. The company is using up slack coal and converting it into a smokeless fuel of high value. Experiments and trials have been in progress for 21 years, over 40 different types of retort have been used, and over 200,000 tons of coal more or less satisfactorily treated, and the cost has been very great.

Coal when carbonised at low temperature swells up and becomes viscous, and sticks fast in most retorts. When extracted with great trouble it flames on contact with air, and when quenched it disintegrates badly. The gas passes through the porous retorts, but this difficulty is overcome in the usual manner by maintaining an isostatic condition between the interior of the retort and the exterior. Ordinary gas retorts or coke ovens appear to be useless for producing coalite. If too cool, the result is coke on the surface of the mass and coal inside but little changed. The broken up mixture in no way resembles coalite which, when properly made, is homogeneous, and carries a fixed proportion of volatile matter of such a nature that the gas burns with the short flame with which users of best Welsh are familiar. It appears that a mixture of 70 per cent. non-coking coal with 30 per cent. of coking coal can be employed. This seems to confirm the recent researches of Mr. Lewis, which show that coal which refuses to coke does not do so because of the nature of its constituents so much as because of their laminar structure.

The apparatus used at Barnsley is nearly all of the ordinary commercial type—coal washers, conveyors, gas exhausters, tar separators, and so on. The core of the

matter is the retort, and in this most essential feature the company has shown that the old difficulties of low-temperature carbonisation have been overcome in a very ingenious, practical, and simple manner. A unit of ovens is made up of 20 cells. On the top of each cell is a hopper holding 10 cwt. and filled by a conveyor line above. The base of the hopper is closed by a rotary valve or shutter with an external lever to turn it when discharging. The valve passage lets the coal down to the oven or retort, a narrow flat cell 9 ft. deep by 6 ft. 6 in. long by 11 in. to 13 in. wide. In the existing plant the width is 11 in. The small mixed coal remains in this cell for seven to eight hours subject to heating from gas flames outside the cell walls, which are of firebrick. The rotary shutter forming the base of the cell serves to allow the carbonised mass to fall into the cooler below. This cooler is a narrow water-jacketed cell in which the finished product remains several hours to cool. As it is sealed up, no air can enter and there is no flashing into flame. Just before a charge is to be dropped from the retort the cooling cell door is opened. The contents are raked out upon a slope, down which the coalite—now not hotter than 100 deg. F.—slides to the base of the slope, whence in a complete plant a conveyor will carry it away to the storage dump or direct to rail wagons.

Coal subject to low-temperature carbonisation intumesces, and as Weller would say, "swells visibly," and has always given trouble in the past by sticking fast in the retort. Just here comes in the vital point of the new oven (fig. 1). The cell is fitted over its length and height with a pair of $\frac{1}{2}$ -in. perforated steel plates, hanging about 4 in. apart. At the top they are fitted with inclined suspension links, and at the base they are kept apart by lugs. The cell is thus made up of two coking chambers separated by an internal empty space. Into this space, which is drawn upon by the exhausters, passes the gas from every part of the charge through the perforations, and the exhausters maintain atmospheric pressure throughout the cell, and this prevents any diffusion of gas through the porosity of the cell walls. Were this not done the generated gas would pass through the walls and burn outside; it would be impossible



FIRE-BRICK RETORTS, WITH COOLING CHAMBERS BELOW.

to control the oven temperatures, and there would be great loss of valuable gas.

By a simple movement of the suspension gear the plates fall inwards towards each other, and their lower lugs slide past each other so that the central space of the retort is reduced by one-half and the converted charges are set free, and will drop out by gravity on opening the lower rotary shutter.

The various operations were shown in action, and the charges examined. The coked mass has a peculiar mottled surface, and shows evidence of its structure from small coal. It is firm and dense, and obviously fit for carriage. It burns with a steady glow, has great heat radiating effect, and is clean to the extent of containing only 5 or 6 per cent. of ash. It is unmistakably a successful and excellent fuel made from coal that is of little value in its small condition—being, of course, the inevitable waste product of mining operations.

The gas drawn from the cells is cooled in the usual way, and the liquids are sent away for conversion to benzol, toluol, and other compounds. Carbonisation is carried on at about 600 deg. C., and the yield of coalite is about 1,612 lb. per ton of coal. The cells are heated by the admission of gas through a number of pipes which pass through the front and back walls of the oven spaces between the cells. Where the finally produced gas can be sold to gas companies for mixture this should be done, producer gas being used for the retort heating. At the demonstration plant the gas, purged of its valuable by-products, is employed for this purpose. The efficiency is good. Coal containing 30 million B.th.u. will yield coalite containing 22 million and oil containing 3 million B.th.u. Apparently 5 million heat units disappear by radiation or in the oven exhaust, or are locked up in latent form in the liquid and gaseous by-products, or in generating steam.

As a fuel, coalite has about the same calorific value as the coal it is made from, but it is superior in its heat radiation effects, and has the advantage of small ash contents. It is free from smoke—a property really worth many millions sterling to the householder. Yet it has sufficient clean burning volatile matter to make a cheerful fire—supposed to be necessary for every home-respecting Englishman.

The tar has a sp. gr. of 1.06, and contains much of the valuable creosols and less phenols than high-temperature tar and no naphthalene—the bane of the gas-works. Distilled at up to 300 deg. C. the tar oils may be used in engines, and will produce 2 b.h.p.-hour per pound of oil. Lighter fractions may be taken off at

170 deg. and upwards. The gas of 750 B.th.u. per cu. ft. has 27.5 per cent. of hydrogen, 48 per cent. of methane, 10.1 per cent. of other hydrocarbons, 7.3 per cent. of CO, and 3 per cent. of unsaturated hydrocarbons, and only 2.5 of CO₂ and 1.6 of nitrogen. It is thus over 95 per cent. combustible.

The salient points of the new apparatus are the collapsing plates in the cells and the cold chamber to hold the hot discharged coalite until cooled beyond any risk of flashing, but the whole combination is extremely neat and effective, and we are of opinion that the mechanical difficulties of making coalite have been well solved.

Since writing the foregoing article, we have received from Messrs. Close Brothers & Co., Ltd., who control the process, a copy of a report by Sir Percy Girouard, K.C.M.G., based on his independent observations and investigations. Sir Percy speaks very highly of the process, which he regards as "a great step in advance in low-temperature carbonisation," and he lays stress on the national importance of the process in the industrial field.

Our attention has recently been called to two systems of low-temperature carbonisation besides that of coalite.

In the Lamplough system the product, which we understand should not be called coalite, is not brought out of the retorts in the form in which it is supplied to consumers, but is subsequently briquetted. The Lamplough Co. are not, we believe, to be manufacturers of fuel so much as suppliers of the plant to collieries and manufacturers on a royalty basis. We have no technical description of the process, so we cannot say how the extra process of briquetting is justified by economies in the earlier processes of washing and heating.

In the Freeman system the process is continuous and somewhat progressive in its heating of the coal which is discharged for further treatment by briquetting, or a further coking process, or pulverising.

There is evidently considerable thought being given to the question of coal treatment generally, and it is certain that coal ought not to be burned as such with destruction of its valuable by-products and the production of filthy, tarry, and oleaginous smoke.

THE BANDY MOTOR.

By "ANODE."

THE writer recently had an opportunity of visiting the works of Messrs. Berkeley & Young, Ltd., the makers of the well-known "Emcol" motor, and was extremely interested in a further development in connection with the "Emcol" system of enclosure, this now being fitted to the single-phase repulsion induction motor of their manufacture, better known as the "Bandy."

The Bandy motor is largely used for lift work, and in connection with cranes, hoists, &c., also for printing presses, and similar work where speed variation and control are essentially required.

This type of motor has many advantages over the ordinary induction motor, the principal one being that the starting current is limited to one-and-a-half times the running current, but the special feature of the Bandy motor consists in the fact that the speed can be varied over a wide range, at the same time ensuring that this shall remain constant, or practically so, at the figure to which it is set at any point between full and no load, and the following results obtained in actual use show the extremely small variation under a wide range of speed:

	R.P.M.	R.P.M.	R.P.M.
Full Speed	1,350	900	800
Half "	1,350	900	820
No "	1,350	1,000	840

Two of the earliest difficulties met with in fitting a governor to a motor were in overcoming the brush friction, and also considerable speed variation would occur before the governor operated.

In the Bandy motor the former difficulty is overcome by floating the brush rocker on ball bearings on the shaft, the rocker being held in place by a chain attached to the governor arm; this method of mounting the rocker is clearly shown in fig. 2, from which the mode of

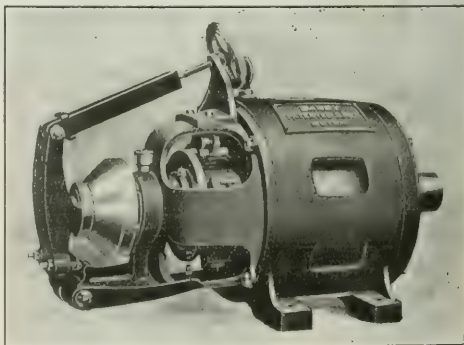


FIG. 1.—THE BANDY MOTOR WITH GOVERNOR.

operation of the governor can also be easily gathered.

By altering the tension of the spring by means of the hand wheel shown in the illustration of the complete machine, the effect of the inward or outward movement

of the governor balls is modified accordingly, and the ultimate speed of the motor is thereby controlled. This can, of course, be done while the motor is in operation if desired.

This method of control enables a small governor to control the speed of the motor within very narrow limits, practically the only friction which has to be overcome being that of the governor itself.

A most interesting installation of these motors is to be found at the sewage pumping station of the Bedford Corporation, where there are four of the 70-h.p. vertical type Bandy motors, the stator voltage being 2,000; the

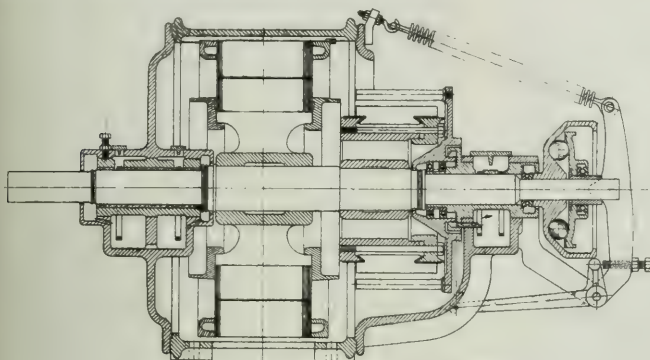


FIG. 2.—SECTION OF BANDY MOTOR AND GOVERNOR.

control is entirely automatic and electrically operated by float gear.

As these motors work under unfavourable conditions as regards moisture, it is essential that the windings be kept dry, and this is ensured by the stator current being kept on continuously; as the speed of these motors can be varied from zero upwards, it is only necessary for the brushes to be brought to the zero position to stop the motor. No damage can therefore be done to the windings, and the fact that these motors have been in use for several years proves this statement.

These motors are used largely in districts where the supply authorities restrict the starting current within limits. Portsmouth is an example, where it is stipulated that this shall not be more than 1.3 times the running current, and an instance of this is to be found in a Temperley travelling bridge transporter, where the installation consists of two sets of motors, each comprising:—

- 1 65 h.p. 600 r.p.m. for hoisting full grab at 240 ft. per min.
- 1 30 h.p. 600 r.p.m. for transporting at 800 ft. per min.
- 1 15 h.p. 600 r.p.m. long traverse at 40/50 ft. per min.
- 1 10 h.p. 700 r.p.m. for beam lifting.

These motors run on a 200-volt, 50-period supply, and are operated by drum type controllers, as in a d.c. installation, and easily comply with the stringent restrictions laid down as to starting current.

In addition, these motors are also made in the short-circuited type, and, as already stated, with the Emcol system of enclosure; the illustration, fig. 3, shows a 5-h.p., 1,430 r.p.m. motor for a 220-volt, 50-period, single-phase supply, and this machine, after a six hours' full load run, had a temperature rise of only 45 deg. F., a highly satisfactory result.

In conclusion, I have to tender my thanks to Mr. H. C. E. Jacoby, the patentee, for kindly giving me some of the facts and figures mentioned.

C.A.V. Dynamos.—MESSRS. C. A. VANDERVELL & CO., LTD., of Acton, have supplied no fewer than 2,000 dynamos since January 1st, to the London General Omnibus Co. This statement will indicate the part played by C.A.V. in the lighting of the new type of 'buses running on the London streets. In addition they have supplied 1,500 dynamos to the various oil companies alone in the Metropolis this year.

ELECTRIC TRUCKS IN NEW YORK CITY.

By E. KILBURN SCOTT.

THE use of electricity for driving trucks, delivery wagons, and vehicles is growing rapidly in the larger American cities, and this is especially the case in New York and Chicago, through the active campaign of the New York Edison Co. and the Commonwealth Edison Co., of Chicago.

Electric vehicles have been used in New York City for 20 years, and there are on the road 70 of that age. On

January 18th, 1920, there were in use in the Metropolitan district 3,851 trucks, of which 2,448 had been in use six years. Six firms have each over 100 trucks, three firms have between 50 and 74 trucks, ten firms between 25 and 49 trucks, whilst there are 30 firms which have each 10 to 24 trucks in regular use.

The total investment in electric trucks now running in the Metropolitan district (not including Brooklyn) is 23 million dollars, and the sale of electric trucks during 1920 amounted to about three million dollars, which is 450 per cent. greater than the sales of 1919.

The automobile bureau of the New York Edison Co. has made a careful estimate of the saving to the public by use of electricity instead

of petrol for vehicles, and finds it is annually about 6½ millions, or at the rate of \$8 per car per day. There are at present 42,000 petrol trucks in New York City, and at least half of these can be converted into electrics. Assuming 21,000, then a saving of only \$4 per car per day for 300 working days gives a total annual saving of \$25,200,000.

There are 54 charging and boosting stations in Manhattan and the Bronx, and 19 in Brooklyn, which is almost three times the number in use in Chicago. The Electric Storage Co. spent over half a million dollars in

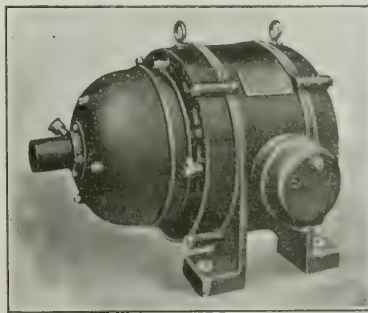


FIG. 3.—BANDY INDUCTION MOTOR WITH EMCOL ENCLOSURE.

1920 in building electric garages and charging stations.

The average daily route for a horse is under 25 miles, whereas an electric vehicle can do up to 45 miles, and with a short boost can increase this by one-half. Horses consume food every day, whether they are working or not, whereas electric vehicles only consume energy when in use, and one electric can do the work of two to four horses, depending on the nature of the work. The speed of an electric is about double that of a horse-drawn truck. Ten years is a conservative estimate of the length of service of an electric truck, whereas horses average only about four years for heavy trucking.

Weather conditions have a serious effect on horse

transportation. In 1921, in one week, 776 horses died from heat, and, in winter, horses are constantly being injured by slipping and falling on icy pavements.

An electric battery never freezes, and although at temperatures of 20 deg. F. below freezing point chemical action is a little sluggish at first starting up, this disappears directly current warms up the electrolyte.

With gasoline engines there is trouble, when the temperature gets below zero, because the water in the radiator may freeze unless care is taken to add sufficient alcohol or to drain off the water whilst the vehicle is standing. Should the water in the jacket of the engine freeze, there is great liability of the casting being cracked by the expanding pressure of ice formed inside.

The life of a gasoline truck is only about five years, because the engine is reciprocating and explosive, and therefore causes a great deal of vibration, which is liable to crystallise the steel. On the other hand, the life of an electric truck may be from 10 to 20 years.

Electric trucks were first used by the old American Express Co. in 1907; as a war measure several Express companies consolidated under the name of the American Railway Express Co., and the combined concern has now 1,200 electric trucks operating in the country, of which 360 are in the New York area.

The company uses gasoline cars for long-distance haulage, and wherever the greater cost is warranted by the increased mileage, but in congested districts, where many stops and starts are necessary, the electric truck has shown itself to be superior to all other types.

At loading platforms an electric truck occupies less space than either horses and wagons or gasoline motor cars of similar carrying capacity, and it can be manoeuvred in less space.

For trucks of the two, three, and three-and-a-half ton sizes, the average cost is about seventeen cents per mile, exclusive of driver's wage and insurance.

Electric service is capable of carrying 60 to 80 per cent. overload without undue strain or damage, as shown by the fact that out of a total of 212 electric trucks at the main garage, 206 are on the streets every day.

The Bush Terminal Co., of Brooklyn, has 33 trucks, 25 being five-ton vehicles, which were installed during 1916 and 1917. They lose on the average less than twelve days' service during a working year. As a fleet, they average 887 miles each day, while there is hardly a day that two or three of the cars do not run from forty to forty-five miles.

The trucks handle a great part of the local deliveries from the terminal, serve manufacturers whose factories are in the big loft buildings, and connect with customers who are scattered throughout the city.

The big loft buildings of the Bush Terminal Co., along the South Brooklyn water front, are occupied largely by manufacturers whose raw materials are imported or come in by freight train and lighter. Railroad connections carry finished product to points away from New York, but the electric trucks handle all deliveries within the city itself.

In order to make an early morning start, the electric trucks are loaded up after finishing their afternoon journeys, and then go to the garage to have the batteries charged during the night. They get away at seven in the morning, and this early start makes possible a second trip in the afternoon.

In addition to the trucks for general deliveries, the Bush Terminal Co. has a fleet of storage-battery tractors and trailers. Each trailer carries loads of merchandise from the pier to the warehouse, where it is left while the tractor goes off for another. These tractors are very powerful, and it is a regular thing to use them to shunt loaded railway cars if no locomotive is available. Some tractors, equipped with cranes, have been in use about nine years. When the trucks come to the garage at night they are lined up, facing the middle of the floor. Charging plugs hang from the ceiling in a line down the centre of the building, and as the vehicles are face to face it is possible to charge several batteries in turn from the same plug.

The first Electric Automobile Show in New York was held in February last in the palatial showrooms of the New York Edison Co. at Irving Place. Street trucks and pleasure cars were shown during the first week; industrial trucks, tractors, and trailers the second week; and batteries and accessories for the entire period.

The Walker Vehicle Co. showed a $3\frac{1}{2}$ -ton chassis 22 ft. long, which was manoeuvred by the chauffeur into position between two showcases with a clearance of only about a foot, thus showing the ease of control.

A particularly interesting exhibit was the first industrial truck used by the New York Central Railroad, and the week spent at the Irving Place showroom was its first vacation from continuous day and night duty for 11 years, during which it had travelled 17,000 miles.

There are now sufficient charging stations along the main roads leading out of New York to enable electric automobiles to travel to Boston, Buffalo, Philadelphia, Richmond, and Washington D.C., and call at many smaller cities between these centres. It will soon be possible to travel by electric automobile from New York to Chicago, a distance of over 1,000 miles.

There are about three times as many electric trucks in use in New York as in Chicago, but electric passenger cars are more numerous in the latter city. It is likely, however, that New York will have more passenger cars in the near future, because a scheme is on foot to place a large fleet of electric taxicabs in service. About 150 additional electric trucks will be put into operation this year.

In New York City there are 15 garages where electric vehicles can be stored and the batteries charged, &c., also 75 stations where batteries can be boosted. The usual charges are:—

Carrying capacity of car in lb.	Cost per month for storage, inspecting, charging, garaging, washing & flushing batteries.
750 lb.	\$48 to 55
1,000 lb.	\$53 to 70
2,000 lb.	\$58 to 80
4,000 lb.	\$63 to 90
7,000 lb.	\$70 to 105
10,000 lb.	\$75 to 115

HAIGH'S ALTERNATING-STRESS TESTING MACHINE.

A METALLIC structure is permanently safe when, and only when, the stresses remain within the fatigue limit. It is the object of fatigue testing machines to determine this limit, but if operated at a low frequency of reversal, the time required for a single test becomes considerable and, moreover, if irregular vibration is produced, it is impossible to measure the range of load with accuracy.

In the course of research work at the Royal Naval College at Greenwich, Prof. Haigh overcame these drawbacks, and produced a machine that is capable of making rapid tests with high frequencies of reversal, and by means of a simple device the range of stress may be varied at will and measured with accuracy. Messrs. Bruntons, of Musselburgh, Scotland, manufacture the new machines, which have been supplied to the National Physical Laboratory at Teddington; the R.A.E. Farnborough; the Universities of Edinburgh, Birmingham, Sheffield, and others. An important advantage of this type of machine lies in the uniform distribution of the alternating stress across the full section and along a considerable length of the test piece. When testing by means of bending stresses it has not been possible to determine the fatigue limit with accuracy because the test piece cracked at a fillet when the intensity of the stress was indefinite. The new machine of viates that difficulty, and may be applied in wider fields of research to test models of machine parts as well as simple test pieces.

The machine occupies comparatively little floor space, stands about 5 ft. in height, will admit test pieces up to a length of 15 in., and its frame is arranged to allow for special tests, e.g., to allow of an electric furnace being placed around the test piece for tests at high temperatures. The range of stress which is indicated on the special stress-meter shown mounted on the wall behind the machine (fig. 1), can be varied up to a maximum of 1.5 tons. The action of the machine depends on the pair of electromagnets M_1 and M_2 (fig. 2), which are energised by two-phase current. The forces generated by these magnets, pulling on the opposite sides of the single armature A, are transmitted to the lower end of the test piece, the lower end of which is gripped by the adjustable head

piece H. No considerable vibration is transmitted to the foundation, and the device is almost silent in operation. The frequency of reversal of the stress is governed by the speed of the alternator that energises the magnets, and is usually 2,000 stress cycles per minute, corresponding to a speed of 1,000 r.p.m.; each cycle of stress includes one pull and one push. Although the majority of tests are performed with stresses ranging between equal intensities of pull and push, the ratio between the extremes may be varied at will, which adjustment is effected by giving the flat springs S a suitable degree of initial load as indicated on the scale I. The springs serve

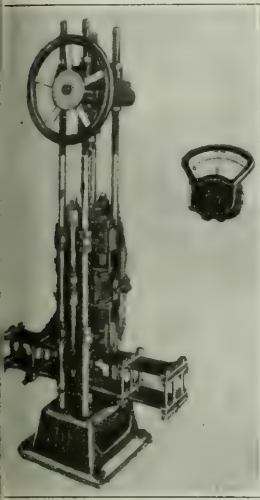


FIG. 1.—HAIGH'S STRESS TESTING MACHINE AND STRESSMETER.

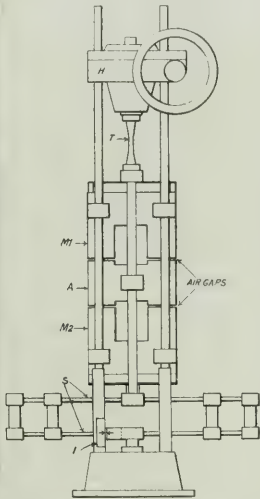


FIG. 2.—ELEVATION OF THE MACHINE.

the further purpose of compensating the force required to accelerate the armature and its fittings in their small but very rapid vertical movement; by means of the clamps the spring stiffness may be adjusted to suit widely different frequencies of operation.

The standard equipment, in addition to the testing machine itself, includes the following items: a switchboard on which are mounted the combined stress meter and differential ammeter; a main switch with an automatic cut-out to operate on completion of the test; and two regulators (coarse and fine) for adjusting the range of stress; a two-phase alternator for 2,000 stress cycles per minute, fitted with a counter for re-

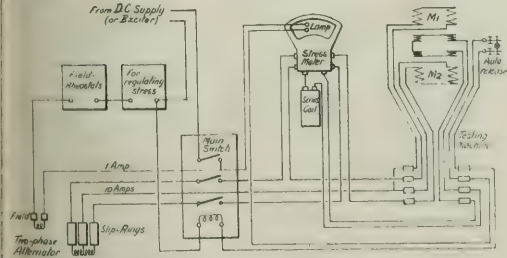


FIG. 3.—STANDARD WIRING DIAGRAM.

ording the number of cycles required to break the test piece, and driven by a 1 h.p. motor; when a d.c. supply is available, the machine needs no exciter. Fig. 3 is a wiring diagram for a standard set.

The regulators vary the range of stress on the test piece by controlling the alternator voltage that is supplied to the testing machine. The readings of the stress meter do not directly indicate the stress, but must be interpreted by the aid of a calibration chart that is supplied with each outfit. This electrical instrument combines two movements with separate pointers in a single case—viz., the differential ammeter which is used to balance the currents in the two phases, and the stress indicator which resembles a voltmeter in its action, but does not read the voltage. If required, apparatus consisting of a mirror camera is supplied for the purpose of checking the calibration of the outfit.

LEGAL.

BRITISH THOMSON-HOUSTON CO., LTD., v. CORONA LAMP WORKS, LTD.

As briefly mentioned last week, the hearing commenced in the House of Lords on 7th inst., of the appeal by the British Thomson-Houston Co., Ltd.

The appellants alleged that the respondents had infringed their letters patent No. 101,918 of 1913, granted for an invention entitled "Improvements in Incandescent Electric Lamps." The respondents replied in their defence (*inter alia*), want of subject matter, insufficiency and non-infringement. Mr. Justice Sargant held that the respondents had infringed, and that the specification of the appellants' letters patent disclosed an invention of a high order of merit and of great utility, but he held the letters patent to be invalid on the ground that claim 1 did not sufficiently define the ambit of the monopoly claimed, inasmuch, as the word "large" used in the claim did not sufficiently define the dimensions of a filament coming within the combination claimed, and the lamp maker could not ascertain without experiment and trial, whether or not he was infringing the appellants' patent. He therefore dismissed the action. In the Court of Appeal the Master of the Rolls and Lords Justices Warrington and Younger expressed agreement with the judgment of Mr. Justice Sargant, and in particular that the word "large" as used, in claim 1, was too vague to limit the ambit of the claim.

The appellants now contended that the judgments below were erroneous in so far as they held that claim 1 of their specification was too vague and indefinite.

Sir Arthur Colefax, K.C., Mr. Hunter Gray, and Mr. James Whitehead appeared in support of the appeal (instructed by Messrs. Bristow, Cooke and Carmael), while Sir Duncan Kerly, K.C., Mr. Robert Frost, and Mr. J. E. Walker (instructed by Messrs. H. C. Morris, Woolsey, Morris & Kennedy) were for the respondents.

Sir ARTHUR COLEFAX, opening, said that the question now before their Lordships had considerably narrowed down since the action was launched, and the judgments below were challenged as erroneous only so far as they held the appellants' patent to be invalid. The appellants' invention consisted in the use of a filament of tungsten or other refractory metal. This filament was placed not in a vacuum as was the universal custom at the date of the letters patent, but in an inert gas or vapour of low heat conductivity, and was caused to incandescence at a very high temperature by passing through it an electric current. An incandescent electric lamp of this type was an entirely novel article of manufacture and opened up a new field in electric incandescent lamp lighting, with the result that the arc lamp had been largely displaced and the vacuum lamp was being gradually superseded. The appellants' invention was a lamp that fulfilled their requirements, and was the result of many years' experiment and research. Expert evidence given at the trial proved that a lamp could be made from the specification without requiring experiments to be made by the workman. There was no ambiguity in the word "large" as alleged in the particulars of objection, nor was the state of common knowledge such at the date of the patent as to render the invention one an unfit subject for a patent.

The hearing of the case was continued into this week. On Tuesday Sir Duncan Kerly was speaking for the respondents, and the case was expected to last the rest of the week. We shall continue our report next week.

ARMATURE REPAIR CLAIM.

At the Peterborough County Court, last week, the Armature Repair Co., Ltd., was sued by Geo. Andrews & Co., electricians, for the sum of £12 6s. 6d. The prosecution alleged that the defendants were given a dynamo to repair. Upon its return it was not used for five or six months, and when it was required it was impossible to excite it. The defendants sent a man to inspect it, and he reported that the field coils required rewinding. This was done, but still there was no excitation. A second man attempted to remedy this, but without success, and finally the plaintiffs repaired the machine themselves. The defendants stated that after the repairs were carried out the armature was given a voltage test with satisfactory results. They were only asked to repair the armature.

After further evidence the judge said that there had been no negligence, but he thought that reasonable care had not been exercised. He awarded the plaintiffs £3 8s.

PLATELAYER'S CLAIM.

IN the Mayor's and City of London Court, on Monday, before his Honour Judge Atherley Jones, K.C., Richard Goldsmith, platelayer, claimed against the Consolidated Construction Co., Ltd., electrical and mechanical engineers, compensation for personal injuries which were caused to him on August 23rd while working for them. Mr. Martin O'Connor appeared for the plaintiff, and Mr. Edgar Dale for the defendants. Mr. O'Connor said that the plaintiff was helping to carry a tram-rail weighing 15 cwt., when it slipped and fell, hurting his

foot and ankle. He attended hospital as an in-patient for some weeks, and in the meantime the defendants offered him work as a watchman of the mill, which involved standing for 12 hours a day. He refused that, which was absolutely impossible, and he declined it, particularly considering that he would have had to work seven days a week. Defendants had discontinued the payments of 35s. a week, and now the plaintiff demanded a continuance of the compensation, as he said he could not work. Goldsmith denied that he preferred 35s. a week to doing light work. Defendants called medical evidence to show that the plaintiff could do light work if he liked. He would not have had to stand 12 hours a day. No man could possibly do that. He would be better working at a light job than doing nothing. Defendants offered to make up his wages to the former amount before the accident if he could not earn as much doing light work. Judge Atherley-Jones, K.C., found for the plaintiff for £1 a week until further order, with costs.

SMOKE NUISANCE PROSECUTION WITHDRAWN.

HEARING was resumed on November 10th, at Bradford City Police Court, in a case in which the Health Committee prosecuted Edward Lynch, a stoker in the employ of Thwaites Bros., Ltd., electrical and general engineers, for smoke nuisance as a result of using certain furnaces. The case was adjourned three weeks previously. The defence was that the firm were exempt from the smoke abatement clauses of the Bradford Corporation Act, 1910, being a foundry. They contended that the process of annealing, which was that under review, was part of the whole process of steel manufacture in which they were engaged. The prosecution had contended that annealing was a finishing process, and that a place where finishing was carried on was a factory, within the meaning of the Act. Last week, however, Mr. W. H. Pollitt, for the Health Department, said the prosecution had taken expert advice as to whether annealing was finishing or not, and as a result of the advice he asked for withdrawal of the case. Mr. W. Bird, defending, gave an undertaking that the firm would take every possible care to minimise smoke emission. The Stipendiary Magistrate, in allowing withdrawal, said if the case had gone on he would have wanted to hear a good deal of expert evidence.

DORE v. HACKNEY BOROUGH COUNCIL.

MR. JUSTICE DARLING, Mr. Justice Sankey, and Mr. Justice Branson, sitting as a Divisional Court of Kings Bench on November 11th, heard an appeal by the Mayor and Corporation of Hackney against a conviction by a magistrate under Sec. 26 of the Hackney Electric Lighting Order, 1893, for failure to supply electricity to the respondent, Mr. Dore.

Mr. Schofield appeared for the appellants, and Mr. S. C. Hardy for the respondent.

Mr. SCHOFIELD said that the appellants were convicted by the magistrate upon an information that they had made default in their obligation in regard to the supply of electric power or energy, and the question for the Court was whether the default of the appellants in giving supply of electric energy was caused by the action of a trade union, and if so, whether was such default was due to *force majeure*. The Act provided that the electrical undertaking at the request of the owner or occupier of premises should give and continue to give a supply of energy to such premises, and clause 26 said that whenever the undertakers made default in supplying such energy they should be liable to a penalty not exceeding 40s. a day during the continuance of such default. There was, however, a proviso that no penalty should be inflicted if the Court were of opinion that the default was unavoidable or the result of a *force majeure*, or of a slight character. All the employees of the appellants were members of the Electrical Trades Union, and on the 25th March last the appellant's engineer received notice that respondent's premises had been fitted by non-union men, and that the employees would not proceed with the work of connecting. Several interviews took place between the parties, and the appellants used every endeavour to induce their employees to obey orders and carry out the work. If, under the circumstances, they had used other labour, a large body of men would have been withdrawn from the Hackney works. The respondent contended that he was entitled to the energy under the Act, but, on the other hand, the appellants contended that the failure to supply was not consequent upon any default of theirs, and they were entitled to the protecting proviso of *force majeure*. The magistrate was of opinion that the proviso applied, and he gave judgment in favour of the appellants.

Counsel proceeded to cite a number of decisions, amongst them those of Justice Wilton, Justice Baillache, and Justice MacArthur, the effect of which was that *force majeure* meant something that was beyond the control of the contracting party having regard to the general terms of the contract, something that was unavoidable. Supposing, said counsel, the liability was under contract, and not under an Act of Parliament, the authorities showed that something which

was unavoidable excused the parties under the obligation. There was a case of the Industrial Dwellings Co. against the East London Water Co., where a supply of water had been refused. The Court there held that as the neglect was caused by drought it was an unavoidable cause, as the water company had done its best to afford the supply. In that case the Court of Appeal upheld the decision of the magistrate.

MR. JUSTICE SANKEY: Is there any difference between being prevented by a strike and being prevented because there is going to be a strike, or might be a strike?

Mr. SCHOFIELD said his submission was that there was not. The Corporation had done its best under exceptional circumstances, and it could not have avoided this. It made no difference because there was not an actual strike, because there could have been a strike if any compulsion had been used.

MR. JUSTICE DARLING suggested that a man who undertook to do a thing because a pistol was presented at his head, and told that if he did not he would be shot, would have unavoidable cause, but supposing, he asked, he was only threatened, would that be an unavoidable thing, or should he wait until he saw whether the man would shoot or not?

Mr. SCHOFIELD submitted that in this case, if there had been a strike, it would have resulted in the stoppage of the electric light and consequent inconvenience throughout an enormous district. Where an obligation was imposed by Act of Parliament they were not in the same position as if the obligation were imposed by contract. It had been suggested that the work might have been done by the unemployed. If the Corporation had allowed a strike to take place it would have been disastrous to a very large community. His submission was that the Hackney Borough Council had done its best, and that there had been unavoidable cause. It was impossible for the Council to avoid doing what it had done.

Mr. HARDY, for the respondent, submitted that the magistrate's judgment was correct. On March 11th Mr. Dore paid £9 for laying on the light, and on the 15th he signed the contract for the supply, and after the whole of the conditions had been fulfilled the default took place. The appellants relied on the fact that there was *force majeure*. His contention was that the meaning of *force majeure* was something not dependent upon the will of man. As applied to English contracts he said that it only applied to physical force outside the control of the contractor, and did not apply to threats merely. In this case all the work had been done except making the connection between the outside and the inside wires. What the Electrical Trades Union meant was that all should join the union, but there was no such *force majeure* as the appellants contended. Supposing a man had been dismissed for refusing to obey orders, there were plenty of skilled electricians out of work to take his place; moreover, there was no evidence that the man would have been dismissed. His contention was that a reasonable anticipation of a peril was not a *force majeure*. There was no evidence that any force was used or intended to be used.

MR. JUSTICE DARLING said the Court had come to the conclusion that the application could not be allowed. In his judgment the magistrate was right in law. He had found that work up to a certain point had been done by men who were not members of the trade union. Everything had been put into Mr. Dore's house, making it ready for the connection, and when that came to be done the Council would not connect because persons had been employed who were not members of the trade union. If the work of connecting the main had been proceeded with, the result would probably have been that the union would have given notice to the men to terminate their engagement. The Hackney undertaking was responsible for the supply of electricity to a wide district, and the result of a strike would have been disastrous. The case was very near being a case of *force majeure*, but not quite, and the appeal must be dismissed.

The other judges concurred, and the appeal was dismissed accordingly.

HAMILTON v. MARCONI'S WIRELESS TELEGRAPH CO., LTD.

IN this action, which was in Mr. Justice Bray's list on Tuesday, to be heard by his Lordship and a special jury, Mr. Douglas Hogg, K.C., appearing for the defendants, applied for an adjournment. He said the application was not opposed by the plaintiff. The action was brought for the rescission of an agreement on the ground of fraud, and that was the only issue when the pleadings were closed. The case started about a year ago. On November 4th an order was made by Mr. Justice Lush in Chambers allowing the plaintiff to amend his statement of claim by adding a claim for a declaration that the agreement was illegal and void, as being in restraint of trade. That, said Mr. Hogg, was an entirely different issue. Defendants had put in a reply traversing that allegation, and Mr. Justice Lush, as a condition of leave to amend, informed plaintiff that he must not oppose any reasonable application for an adjournment. Counsel explained the reason for his application, and suggested that the adjournment should be for four weeks, to give time for mutual discovery.

Mr. Wilfred Lewis, for the plaintiff, agreed, and the hearing was accordingly adjourned for a month.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Telephony—or Telepathy?

Regarding the telephonic episode so interestingly narrated in the ELECTRICAL REVIEW by your correspondent T. W. Best, and already the object of amusingly apt editorial banter, may I be permitted to suggest an explanatory theory?

First of all, however, it is a pity that nobody seems to have thought of verifying and corroborating the alleged occurrence by some kind of systematic reconstruction of an affair seemingly so puzzling as far as audition at the country house telephone and speech in the park glades are concerned.

The explanation, I think, is this:—

1. The telephone line through the park is faulty. If earth is used in the country house, there is, somewhere in the park, leakage from the single line to earth. If a metallic circuit has been adopted, there is, somewhere in the park, leakage between the two wires.

2. The electrically variable fault, whatever it may have been—whether caused by a stag fight or by a clumsily driven nail—is acting as a microphone. The fault, varying under the vibratory impact of any loud and emphatic speech in its immediate vicinity, causes similar variations in the current induced by the telephone magnet in the country house telephone.

Here, apparently, is the unique instance in which Dr. Bell's beautiful and simple telephone has been acting simultaneously as a transmitter and as a receiver.

Here, too, may be not only a basis for a new system of fault localisation, but we are here confronted by a chain of happenings affording golden grist for elaboration by any up-to-date novelist.

E. Raymond-Barker.

London.

November 14th, 1921.

Cheaper Postage.

I have read your leader with much interest.

You will be aware that considerable pressure is being brought to bear on the Postmaster-General, and that he has entrenched himself behind a statement to the effect that, while he is anxious to meet the present demand for cheaper postage, he is unable to do so without asking for a State subsidy to cover the consequent loss.

A deadlock is thus reached, and the time is opportune for a complete investigation of the proposal that the token value of the penny should be increased by 20 per cent., thus making it represent one-tenth instead of one-twelfth of the shilling.

Given a penny of this higher value, the following postal concessions would be available without calling upon the State for any subsidy:—

1. The postcard rate could be restored to one "penny" by a reduction of 20 per cent. from the present charge as compared with 33½ per cent. if made in terms of the present value of the penny.

2. A revised inland letter rate of 1½d. would represent an actual reduction of only 10 per cent. from the existing 2d. rate, although the public would attach considerably more value to the concession due to the continued use of the existing copper coins. From the G.P.O. point of view this reduced rate would be augmented by the increased value of the half-penny, which could still be charged "for every additional oz. or fraction thereof."

3. The restoration of the ½d. rate for printed matter could be secured at a much earlier date if the ½d. represented a value 20 per cent. higher than its present value.

4. The restoration of the 2½d. foreign postage would involve no reduction from the existing charge of 3d., since 2½ high-value pence would be exactly equal to 3 existing pence.

5. Increased revenue might be earned by the telegraph department without any alteration of the existing rate of 1d. per word.

6. A smaller number of coins would be required for telephone call-boxes.

The position in the matter of postage rates is an object lesson of the difficulties confronting all other penny basis interests.

The public, being poorer, will no longer pay 1½d., and the producers cannot afford to restore the original penny price. The high-value penny would provide a price stage payable in one coin about midway between these two extremes.

Harry Alcock.

Manchester.

November 14th, 1921.

Electricity in Isolated Buildings.

With reference to the letter appearing in the ELECTRICAL REVIEW of November 11th, written by Mr. R. F. Long under the heading of "Electricity in Isolated Buildings," the reading of this leads one to the impression that he is strongly opposed to the entirely hand-operated sets (what he terms older and obsolete plants); also he gives the impression (to

the man who is not in touch with the trade) that the automatic plant is much cheaper both in first and running cost. Here we would state that we are manufacturing a plant which is hand-operated, is equipped with a slate switchboard containing the standard switchgear, which is necessary for the efficient control of a battery charging and lighting system, a low-speed paraffin engine, low-speed dynamo (all mounted, including switchboard, on a strong cast-iron bed), and an open-top glass cell battery at a price which is approximately £25 cheaper than the cheapest semi-automatic set at present on the market; also the running costs for fuel are 25 per cent. lower than other plants we have had experience with.

It is evident that there are other gentlemen who are tempted to write when they have "insufficient knowledge of the trend of present-day products." He also states "the fact that the semi-automatic sets are still being bought is proof that they are still wanted," but this is not proof that they have won the day over the hand-operated set, as the former have not been on the market sufficiently long to prove their absolute reliability. Further, it only needs a little thought to realise that the battery is subjected to the most severe stress when it is least capable of withstanding it; this happens, of course, when one wishes to start the set up and the battery is already in a discharged condition. Also, even with the semi-automatic set, the human element has to intervene when it is necessary to give the battery the periodical topping charge which is essential to its long life.

There is also a further saving with the hand-operated set, i.e., in the life of the lamps; here one can regulate accurately the voltage on the line, but with the semi-automatic set the voltage attains a value 30 per cent. above that for which the lamps are designed; therefore the result is quite obvious.

F. Smith.

Phoenix Ironworks Co.

Littleborough.

November 14th, 1921.

A Dynamo Problem.

I should esteem it a favour, if you would kindly offer a suggestion, through the medium of your journal, that would overcome the following trouble.

Two identical dynamos, 220 V., 90 amp., compound shunt, d.c., direct driven, are run singly or in parallel, according to loads. These machines give a fairly constant voltage from no load to full, with a small rheostat adjustment of from 2 to 6 notch (there being 24 stops in all).

One of them, however, has recently developed the contrary, viz.—As load increases, voltage decreases, and vice versa, to such an extent that from 50 to 80 amp. regulator has to be put over from 6 to 20 stop, with the adverse effect of lessened amperage, and apparent over-load on engine, and to attempt to move the shunt regulator any further aggravates the trouble. There is no undue heating of windings, armature, or field, or heavy sparking, and the speed remains the same. Thanking you in anticipation of a favourable suggestion.

Electron.

November 5th, 1921.

[Our correspondent has since advised us that:—

- Neither series nor shunt windings have been reversed.
- Brush position has not been changed.
- Insulation to earth of whole machine is 2 megohms.
- System is 2-wire with both poles insulated.
- The machine gives the same results when running on a water load.

Can any reader make a suggestion as to the cause of the trouble?—Eds. ELEC. REV.]

The Design of Switches.

In view of the disparity in the size of switches supplied by manufacturers for an equal carrying capacity, I should be pleased if any of your readers who have had experience in the manufacture of electrical accessories would be kind enough to state the generally accepted standard of contact area for unit current.

Seager.

November 14th, 1921.

The E.P.E.A. and the E.T.U.

The attention of my Committee has been drawn to the statements in the technical Press as to what happened at the meeting of the National Joint Board with respect to an agreement between the Electrical Power Engineers' Association and the Electrical Trades Union. The facts of the case are these: An agreement was entered into between my organisation and the Electrical Power Engineers' Association, provided that agreement could be arrived at on lines of demarcation of membership. Agreement has not been reached on the said point, and, therefore, there is no agreement between the two bodies.

I have asked our General Secretary, Mr. Rowan, to confirm this statement.

W. J. Webb.

London District Secretary, Electrical Trades Union.

November 11th, 1921.

The Durability of Lead-covered Wiring.

I have noted with considerable interest the several letters which have appeared in your columns on the above subject. May I say that, with reasonably extensive experience of the well-known lead-covered wiring systems, I cannot think of any trouble having occurred, except from direct mechanical damage.

I agree with Mr. Alldread that efficient bonding and earthing are essential, and on one or two systems, notably that designed by Johnson & Phillips, it might be said that inefficient bonding is almost out of the question.

I would certainly say with "Contractor's Foreman" that solid-drawn conduit and high grade v.i.r. provide the most reliable job, but here comes in the strong point of the lead-covered system, that is, reasonably high efficiency at a very moderate cost.

In your advertisement columns recently an advertisement appeared which illustrated a booklet descriptive of a wiring system, and suggested: "Apply for this booklet and get busy." At the present time one can often persuade a potential consumer to go ahead after the economy of the lead-covered system has been demonstrated, whereas the higher-priced, but more desirable, conduit job would have had to wait for better times.

Contractor.

November 8th, 1921.

The recent correspondence on the subject of the durability of lead-covered cable has been very interesting and instructive to one who is engaged in the testing and inspection of all classes of installations.

There is no doubt whatever that only the best quality of C.M.A. lead-sheathed cable and fittings should be used. The bonding at fittings and to earth should be very carefully carried out, with a view to the efficient maintenance of a low resistance path to earth for any leakage current. Many installations at the outset give a good bonding test, but what result would be obtained, say, three years after the installation was completed? In this connection, the advantage of having a regular inspection made of the installation by an approved company will be apparent to all users of electricity, whether for lighting or power purposes.

The writer recently came across an installation wired with a new type of lead-sheathed cable, consisting of a sheathing of very thin sheet lead, merely wrapped round the cable with a longitudinal lap joint, and covered with a spiral armouring of aluminium strip. As this cable has no solid-drawn sheathing, it cannot be claimed that it is suitable for any but very dry stations, and, moreover, this type of cable will stand very little bending without cracking the sheet lead covering. The difficulty of satisfactorily bonding this cable to fittings is very real, and unless the aluminium strip is very carefully finished off there will be a danger of earthing switch and ceiling rose terminals. Another point in connection with this type of cable is the possibility of electro-chemical action taking place between the lead sheathing and the aluminium armouring. As aluminium is electro-positive to lead, under certain conditions electro-chemical action would be inevitable. Altogether this type of cable appears to the writer to be a very unsuitable one for house wiring purposes.

A lead-sheathed cable should certainly have a solid-drawn sheathing, and the durability of such a cable manufactured by a reputable firm cannot be denied.

The sheathing of the cable of the various wiring systems is not of pure lead, but of a lead alloy, in order to obtain a stiffer cable, and one less liable to sag from ceilings and walls, but the durability of this alloy will probably not be equal to that of lead in any but very dry situations.

It should be obvious to engineers that unless lead-sheathed cable is enclosed in tubing when fixed in plaster, in the event of a fault developing in that particular circuit, it would be impossible to re-wire the circuit without damaging the plaster, hence the necessity for such a rule which is found in many wiring regulations.

Inspector.

Manchester.

November 14th, 1921.

Being a constant reader of your paper, and being interested in the discussion appearing therein regarding lead-covered wiring, I wish to give my personal experience with it.

Having for some time used continually Henley's lead-covered wire, and having found this wire faultless in whatever situation installed, I cannot see why this system of wiring should be doubted for general use with reliability.

One great point I have found is that wire bought on reels is much more satisfactory than that bought loose, or rather, wrapped round with canvas. Only a few weeks ago I wanted to try another maker's wire, and when I received it I found it so badly kinked and knocked about in transit that I at once altered my mind. A contractor also knows from experience that lead-covered wire requires more careful handling than any other wiring system, and finding it hard to get hold of a man to be trusted with it, one is at his wit's end to know what to do.

I have found many bad cases relating to bad workmanship, one of which I give, for instance:

(a) Joint boxes omitted under floors, etc., in which cases ordinary ceiling roses or cut-outs are substituted, or simply taped connections made without even soldering or using porcelain connectors.

(b) Insufficient saddles or fixing clips used, especially on ceilings or places where the wire has to hang, this kind of thing resulting in loose loops, which undoubtedly tends to strain the lead sheathing.

(c) Places where the wire or wires have to follow some ornamental picture railing or the like, and are bent so acutely that the lead sheathing has kinked or even cracked, which afterwards generally results in the sheathing making contact with the internal wires.

(d) Lead case not sufficiently bared off at ceiling roses or switches, and having been pierced with the fixing screws of the block itself.

(e) In damp and exposed situations iron nails have been used, these rusting and setting up electrolysis, and very soon causing failure altogether.

(f) Contact with iron gas or water pipes, these pipes being rusty or corroded.

(g) Wiring let into walls, etc., without some metallic protection against damage, such as nails being driven into the walls for pictures.

(h) And finally, no earth connection made to lead sheathing, nor even continuity of the sheathing itself ensured.

These faults, when found and witnessed by the consumer, soon convince him that the system is in no way perfect, and this kind of thing soon spreads to the would-be consumer, not encouraging him to install lead-covered wire.

I consider that there is no excuse for this neglect or bad workmanship, because if one takes advantage of the Henley system for instance (which provides the suitable metallic sheathing and all requisite fittings), he will see that it is as good, if not better, than any conduit system, provided it is installed by a competent electrician.

For neatness, in my opinion, there is nothing to come up to lead-covered wire, and it is by no means expensive. I should like finally to say that I could personally show people installations wired by myself with Henley's system, that have been in use for some considerable time, and have never given me or the consumer any trouble.

W. A. Allwright,

Electrical Engineer.

Lewes, Sussex.

November 14th, 1921.

A Change-over from d.c. to a.c.

It will be interesting to have the experience of engineers who have changed-over single conductors, lead-covered, from d.c. to a.c. One would expect that the induced currents in such wiring would cause trouble, and even the possibility of the heating of the covering. Possibly where the current in the wiring is small, say, an ampere or under, the effect may be negligible, but one would expect that in circuits run for fires, &c., where the currents are heavy, the chances of trouble would be greatly increased.

The opinions of those who have gone into the matter would oblige.

Lead Covered.

November 10th, 1921.

A New Dynamo.

We are rather surprised at the contents of one of your leading articles in your issue of November 4th, headed "A New Dynamo." On the report you gave the writer made a special journey to see this dynamo, and considers your report misleading; in fact, we do not think it a practical proposition. Even if it could be constructed on commercial lines, it does not require much time to prove that it would increase the cost of building rather than decrease it. The weight of the machine must be greater, not less; the motor cannot be run faster, at present, than the standard design permits; and the efficiency must be considerably lower.

All the above remarks are compared with modern practice on interpole motors and dynamos.

W. F. Higgs,

Higgs Brothers

Birmingham.

November 11th, 1921.

[We regret that Mr. Higgs considers his journey wasted; we, however, are not responsible for that. Our article was written in the conditional mood throughout, and clearly indicated that the invention was in the experimental stage. In passing, we would point out that the machine can be seen only by invitation of Mr. Sayers, and is not open to public inspection; it is regrettable that Mr. Higgs should have publicly subjected it to adverse criticism after a private inspection, seeing that the inventor is debarred from divulging details and refuting his criticism at the present stage.]

With regard to the merits of the invention, apart from the fact that Mr. Sayers is a dynamo designer of over 30 years' experience, we have ourselves thoroughly inspected the models, and the designs for larger machines, and while we have foreseen difficulties, which had not escaped the inventor's

notice, we believe the device is well worth trying on a larger scale. We understand that some of the manufacturing experts who have had a private view of the invention have paid two and even three visits, showing that they, at any rate, did not consider their first journey wasted. So many devices which were condemned in their early stages have proved "practical propositions" that it is risky to dismiss new ideas off-hand.—**EDS. ELEC. REV.]**

The I.E.E. Informal Meetings.

I am sorry to notice in your current issue several inaccuracies in the leaderette on the subject of the Informal Meetings Section of the Institution. This leaderette contains certain misstatements which I should be glad if you would correct in your next issue, as otherwise the article in question is likely to do harm to the movement, and this I feel sure you would not wish.

In the first place, you indicate that the meetings will be held in the "dignified surroundings of the theatre of the Institution." The meetings will actually be held in the tea room, where smoking, as hitherto, can be allowed.

The Committee has not relaxed the rule (made by the Council) that there shall be no publication of the speeches made at these informal meetings, and the appointment of a member to supply an official summary to the Press was decided upon in order that the Press might be relieved of the responsibility for publishing anything which the Institution might prefer should be withheld from publication.

The conduct of the meetings will be exactly as hitherto, including the break for refreshments during the discussion. This, I think, was amply proved by the meeting held last night, and will be confirmed on reference to any member of your staff who may have been present.

There is no desire or intention on the part of the Committee or the management of the Informal Meetings Section to make the meetings of this Section more formal and consequently less likely to serve the purpose for which they were instituted than when the meetings were, of necessity, held away from our own building.

I will add that I am, at all times, ready to give any representative of the Technical Press correct information regarding the proceedings of the Informal Meetings Section of the Institution.

F. Pooley.

Westminster.
November 8th, 1921.

Chairman, Informal Meetings
Section, I.E.E.

[Mr. Pooley has evidently misunderstood the purport of our leaderette; it was obviously written to prevent harm to the movement, which has nowhere received more wholehearted support than in our columns. In vindication of our comments, we may point out that the "Informal Meeting" of January 24th last was held in the theatre of the Institution of Civil Engineers, with Mr. Pooley in the chair; if, as is not unlikely, the meetings at headquarters become too large for the tea-room, they will no doubt be held in the theatre. The receipt of an official report of the last meeting, comprising some 900 words, and summarising the remarks of seven of the speakers besides the President's, confirms our reference to the relaxation of the rule of "No Publication of Speeches." The Press was well aware of the rule, and so far as we know, had no desire to be relieved of the responsibility for publishing reports which it did not intend to publish. For the rest, we expressed the hope that the Committee would jealously safeguard the amenities of these informal meetings; that hope we continue to cherish.—**EDS. ELEC. REV.]**

BUSINESS NOTES.

Bankruptcy Proceedings.—**FREDERICK ALFRED STANLEY WORMMULL**, 273, High Street, Lewisham, trading as the Lewisham Electric Wiring Co., electrical engineer.—The first meeting of creditors was held on November 8th at 29, Russell Square, W.C.1. The causes of failure, as stated by debtor, were heavy administrative expenses, lack of proper supervision of outdoor staff, losses incurred through inaccurate tendering for contracts carried out, together with the general trade depression. In January, 1919, with a capital of £200, he started business in the name of the Lewisham Electric Wiring Co., at 273, High Street, Lewisham (rental £50 a year), but from accounts prepared by an accountant the business was carried on at a loss of £707 to December 31st, 1920. The estimated trading loss since that date was £1,049. The first legal process issued against him was in February, 1921, and at the date of the receiving order five creditors for £103 had obtained judgment. The unsecured liabilities included £2,584 to the debtor's wife for cash advanced, apparently for the purpose of the business; £93 18s. 5d. to other cash creditors, and £144 12s. 1d. to trade creditors. The statement of affairs showed gross liabilities £2,584, of which £2,762 was expected to rank. The net assets were estimated to produce £260, thus showing a deficiency of £2,502. The case was left in the hands of the Official Receiver.

J. OWEN (J. Owen & Sons), electrical engineer, 186, Westcombe Hill, and 3, The Grove, Greenwich, S.E., electrical engineer.—Receiving order made November 7th on debtor's own petition. First meeting November 18th at Russell Square, W.C.1. Public examination December 9th at the Court House, Greenwich, S.E.

JOHN EDWARD ADOLPH BRADBURY, 11, Dean Park Road, Bournemouth, Hampshire, director of companies.—The adjourned public examination of this debtor was held recently at Bournemouth. The statement of affairs showed liabilities amounting to £9,367, and assets amounting to £682, leaving a deficiency of £8,685. The debtor attributed his failure to depreciation in the value of shares, and losses in connection with an electrical supply business with which he was concerned, &c. The debtor started a venture called the Electrical Goods Supply Co., and he was joined by another debtor finding £960. The debtor alleged that while he was away in April of last year he lost quite £1,205. After questions had been asked the examination was adjourned.

GEORGE WILLIAMS ENDALL, trading as Endall & Co., Canal Motor Works, Canal Bridge, Church Street, St. Helens, Lancs., electrical, mechanical, and automobile engineer.—The public examination of this debtor was held on November 7th at Liverpool. Debtor was ordered to amend his deficiency account, and the examination was adjourned.

Dissolutions of Partnership.—**SHEFFIELD ACCUMULATOR CO.**, Broom Street, Sheffield.—Mr. W. T. Baldwin and Mr. J. S. White have dissolved partnership. Mr. W. T. Baldwin will attend to debts and continue the business.

SLATER BROS., Electrical Engineers, 25, Dickinson Street, Manchester.—Messrs. T. G. Slater and G. Slater have dissolved partnership. Mr. T. G. Slater will attend to debts, and continue the business under the same style.

Receiver Appointed.—**S. GILLITT & CO., LTD.**, electrical engineers and contractors, 33, Groat Market, Newcastle-upon-Tyne.—Mr. A. E. Dees has been appointed receiver on behalf of the debenture holders, and is at present carrying on the business in that capacity.

Trade Announcements.—The Belfast depot of the Edison Swan Electric Co., Ltd., has now been removed to more commodious premises at 41, Chichester Street, and all communications for the branch should be sent there.

Mr. A. R. Fox has commenced business as an electrical and mechanical engineer at 19, Lowden Avenue, Chippenham, Wilts. He wishes to receive catalogues and price lists.

Mr. E. FUGGLE has been appointed manager of the electrical business of Wellman Brothers, 57, St. Leonard's Road, Windsor.

Catalogues and Lists.—**MESSRS. BELLING & CO.**, Derby Road Works, Edmonton, N.18.—A large coloured poster depicting a lady warning herself at a "Belling" fire.

Mr. J. B. RUDKIN (representing Sprecher & Schuh Co., Switzerland), 212a, Shaftesbury Avenue, W.C. 2.—List No. 1, giving illustrations and dimensions of quick-and-slow-break knife switches. Priced in Swiss francs.

THE MIRRLEES WATSON CO., LTD., Scotland Street, Glasgow.—B Sheets 1,751 and 1,752, illustrating and describing, respectively, a multi-injector air pump and a surface condenser.

MESSRS. SIEMENS BROS. & CO., LTD., Caxton House, Westminster, S.W.1.—Pamphlet 730a, illustrating and describing luminous signalling apparatus for power stations, &c.

MESSRS. FERRANTI, LTD., 180, Fleet Street, E.C.4.—Leaflet MTG/508, giving examples of castings in "No-Mag" non-magnetic iron.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Three leaflets, No. 2,659, giving particulars, with illustrations, of the G.E.C. showroom service; and Nos. F 2,656 and 2,660, lists of revised prices of fixtures and accessories.

THE GLOBE ENGINEERING CO., LTD., Freeoverhouse Works, Brighouse.—List No. 3, giving illustrations, dimensions, and prices of protected type a.c. motors and dynamos.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa., U.S.A.—Contact, a magazine dealing with salesmanship in connection with electrical appliances.

SWEDISH GENERAL ELECTRIC LTD., 3, Chancery Lane, W.C.2.—Stock list (No. 110) of d.c. and single-phase a.c. motors, and Stock list (No. 110a) of two and three-phase a.c. motors. Both lists are fully priced. Also a descriptive list of electrical equipments for the printing and allied trades.

MESSRS. REAVELL & CO., Ranelagh Works, Ipswich.—Pamphlet No. 100, illustrating and describing rolling drum type rotary air compressors and vacuum pumps.

BELL'S UNITED ASBESTOS CO., LTD., Southwark Street, S.E.1.—An illustrated folder giving examples and descriptions of several kinds of asbestos insulating compounds.

Electric Cooking at Glasgow.—As we recently announced, the Corporation of Glasgow has, in order to encourage the use of electricity in the home, decided to hire out certain domestic apparatus, including electric cookers. A batch of them has just been completed and dispatched to Glasgow; they are of the No. 20 type manufactured by the Jackson Electric Stove Co., Ltd. Details are as follows:—

The whole outfit is heavily constructed of cast iron and steel. The oven has an actual cooking space (not total size of the oven, which is often given and is misleading), of 14½ in. high, 12½ in. wide and 15 in. deep. It is loaded to 1,600 watts with three-heat regulation. The oven is double-cased and lagged on all sides, including the door. The switch is fitted in a convenient position and is arranged for three-heat regulation.

The hob, which is mounted above the oven, contains two open-type boiling plates, each with three-heat regulation, and a grill loaded to 1,500 watts, with a single heat.

There is no mica of any description employed in this cooker. There are no loose leads, beaded wires, or asbestos-covered wires; all connections are of the solid rod type mounted on porcelain insulators—in fact the connections resemble the back of an ordinary switchboard. The leads, therefore, need no further attention once they are built in position, the only adjustments that may be occasionally necessary are the elements, these being extremely simple to replace. The hob lifts without the necessity of undoing screws or bolts, and an element can be replaced by an unskilled person. The boiling plates consist of three elements which are connected as follows:—On full heat each element is in parallel. On medium heat the two outside elements are in parallel. On low heat the centre element is in series with the two others. This ingenious method causes an out of balance current from the centre element which glows a dull red, the two outer elements being black although under heat.

Should an element fail it is a simple matter to wind a new spiral on the existing former at the cost of a few pence; one element being out of commission does not affect the other two. Large quantities of liquid can be deliberately thrown over these elements when glowing at full heat, without fracture or damage, and the cookers can be subjected to a flash test of 2,000 volts to earth.

The fuses of each section are fitted above the switches and are of the D. & S. Home Office type.

During the last two weeks of October, 173 No. 20 cookers were dispatched by the makers for various hiring and housing schemes in this country, and over 40 of the No. 21 type.

The dimensions of the No. 20 cooker complete are: 34 by 26½ by 21½ in., and its net weight is 234 lb., that of the hob only being 86 lb.

Store Lighting.—The accompanying illustration shows a very effective lighting scheme which has been carried out by Messrs. F. Sage & Co., Ltd., at the Galeries Lafayette, Regent Street, W. The illumination is provided by "Osram" lamps sunk in elaborate plaster mouldings, and in this way



AN "OSRAM" LIGHTING SCHEME.

the lighting forms an integral part of the scheme of decoration. In order that the effect should not be marred by uneven brilliance, each lamp was specially tested. Over 15,000 20-watt and 1,000 40-watt lamps were used in this scheme.

Social Events.—Messrs. S. Charlesworth & Co., of Oldham, held their annual dinner on November 9th at the Café Monica. The toasts of "the Firm" and "the Visitors" were duly honoured. A whist drive was held, and the remainder of the evening was spent in song and dance.

Unemployment.—The latest available returns of the number of persons unemployed show a further increase for the week ended November 4th. Upon this date the total was 1,722,800, as against 1,611,476 upon October 25th. The increase is again said to be due to re-registration for benefit by those whose previous term had expired. On October 25th workers on short time numbered 251,606, a slight decrease for the week.

Our Foreign Trade.—OCTOBER FIGURES.—The following were the values of imports and exports of electrical goods and machinery during October, 1921:—

	Oct. 1921.	Inc. or dec. £	10 months, 1921 Inc. or dec. £
Imports.			
Electrical goods and apparatus	705,024	-130,292	+373,565
Machinery	10,423	-1,412,791	-7,009,856
Exports.			
Electrical goods and apparatus	894,196	164,577	+2,477,763
Machinery	747,650	503,676	+14,862,604
Re-exports.			
Electrical goods and apparatus	11,133	-3,522	+73,543
Machinery	90,742	-87,464	-322,344

Trade Conditions in Western Canada.—H.M. Trade Commissioner in Winnipeg (Mr. L. B. Beale) reporting to the Department of Overseas Trade on the trade conditions of Western Canada, as at the beginning of October, in dealing with general hardware, states that "British manufacturers are regaining their pre-war trade to Canada by going after the business, visiting the Dominion and giving the market just what it wants at a competitive price. What is equally important, British manufacturers are now securing trade here in lines never before exported to Canada, but in which the U.S.A. held practically a monopoly. The importing hardware traders of Western Canada are extremely pleased with our success, and would welcome still more aggressive methods on our part, which undoubtedly would reap the reward of greatly increased business." Of general trade conditions, Mr. Beale reports that while they remain quiet at the moment, the indications are that business has improved during the past few months and that better times are ahead.

The period of transition offers a good opportunity for British manufacturers to enter the market. With the appreciation of the American dollar and the depreciation of the pound sterling, and the ready willingness of United Kingdom manufacturers to suit the market's requirements, Canadian business men are looking to the United Kingdom to supply their wants. In the last few months ample evidence of this fact has been afforded, and inquiries for British sources of supply of goods, previously obtained from the United States, are on the increase. The United States Emergency Tariff Act, by its effect on Canadian export trade, has done nothing to improve the trade sentiment between the two countries. The Canadian business man is prepared to welcome British manufacturers in the West, but it is essential for British manufacturers personally to study the market, and make an effort to supply its requirements.

So important is the general development of British Columbia considered by the Dominion Government, that a branch of the Department of Trade and Commerce has been opened in Vancouver to study and make a complete survey of every feature of export trade on the Pacific Coast.

E.D.A. Activities.—The aim of the latest pamphlet (E.D.A. No. 215) published by the British Electrical Development Association is to emphasise the great gulf between good and bad lighting. It is pointed out that the incorrect use of electricity for lighting is likely to lead non-users to consider it inferior to other agents in this respect. The front of the pamphlet depicts three methods of lighting in contrast: good, bad, and indifferent.

We are reminded of the imminence of Christmas by another bunch of pamphlets from the E.D.A., which advocates electrical presents in an attractive way. Two of the leaflets are in verse which, while not exactly Miltonian, presents a good case for electricity. In one of these the democratic nature of electricity is made plain by the lines:—"And brings ye yoked and ye equine close to ye central station."

Local Electrical Exhibitions.—MESSRS. CROSS BROS., LTD., a Cardiff ironmongery firm, have opened a new department devoted to heating, lighting, and electrically-operated labour-saving devices for use in the home. Demonstrations are given of the utility of electrical washing machines, cooking ranges, tea and coffee urns, radiators, vacuum cleaners, &c. Lady shoppers are shown that it is possible with an electric washer to get through a week's washing for a family of six in one hour. The demonstrations attracted large crowds of visitors.

Commencing to-day and continuing to December 3rd the Newcastle-upon-Tyne Electric Supply Co., Ltd., is contributing largely to a "Housing and Home Life Economy Exhibition" at Newcastle. Other firms exhibiting electrical appliances are Messrs. Siemens Bros. and Co., Ltd., The Northern Steel & Hardware, Ltd., of Manchester, and three local firms—Messrs. Robson & Coleman, Gray Bros., and Electrical Device Ltd.

Foreign Electrical Engineers Invited to Russia.—It is stated in a North Russian paper that foreigners who have worked in Russia in the electrical industries and subsequently left the country, if they wish to return to Russia to resume work, can be immediately admitted, and should make application to the foreign representatives of the Russian Government in their respective countries in due form.

Germans in China.—In his report on the commercial situation in China as at June last, Mr. H. H. Fox, commercial counsellor at H.M. Legation at Peking, says that the Germans are gradually returning to China and picking up the threads of their former business; they are not, so far as can be ascertained, trading under their own names, but are carrying on their business in partnership with Chinese. German dyes and paints, needles, metals, drugs and sundries are beginning to appear on the Shanghai market, and it is reported that several important orders for machinery and electrical plant have recently been booked by German firms. Germany has recently purchased fairly large quantities of Chinese produce, notably, ores, seeds and oils, but the business has been done through foreign firms owing to the difficulty the Germans are experiencing in financing their shipments. There is no doubt that the Germans, assisted by the comparative cheapness of their products, will gradually recover the share they held in China's foreign trade before the war, but the process will be slow, as they have lost valuable connections; the business organisations they had so laboriously built up have been shattered, and they have suffered a serious loss of prestige in the eyes of the Chinese.—*Board of Trade Journal.*

Rubber.—At the meeting of the Institution of Rubber Industry, on Wednesday, Dr. Henry P. Stevens read a paper on "Plantation Rubber," and dealt with the many difficulties at present associated with its handling and manufacture.

Price Reductions.—The Swedish General Electric, Ltd., announces considerable reductions in the prices of "Century" single-phase repulsion induction motors.

The Claim Against the Sydney City Council.—The recommendation authorising negotiations with the English Electric Co., Ltd., with a view to obtaining a quotation for the supply of a 12,000 kW turbo-alternator and two rotary converters was amended by the City Council as follows: "That tenders be invited for supply of the plant in the usual manner."—*Tenders.*

Book Notices.—"Bulletin of the Cleveland Technical Institute." Compiled and edited by the director and secretary, Edward L. Johnson, F.G.S., Vol. 1, No. 1, October. Middlebrough: The Institute. This is the first issue of a monthly periodical containing abstracts of the most important scientific and technical articles published during the month. It is printed on one side of the paper only, to enable the items to be pasted to cards, to form an index. It deals with many subjects, including electrical engineering, fuel technology, foundry practice, &c.

The McGraw-Hill Publishing Co., Ltd., 6 and 8, Boulevard Street, E.C.4, has sent us a catalogue of technical and scientific books. This list gives the size and price of each book, with a brief review of the contents, and the company expresses its readiness to send copies of the catalogue to any who desire them.

Technologic Paper No. 199 of the U.S. Bureau of Standards, "Method for Precision Test of Large Capacity Scales." Washington: Government Printing Office. Price 5 cents. This paper outlines a method used for testing railroad master and grain hopper scales.

"M. and C. Machine Mining." Vol. I, No. 4. Glasgow: Mavor & Coulson, Ltd. Price 6d., post free. This issue contains, *inter alia*, "Notes on Coal-cutter Fitting": a description of "universal headers" or "punchers"; and aids to the erection of switchboards.

"Transactions of the South African Institute of Electrical Engineers. Vol. XII., Part 9, September, 1921. Johannesburg: The Institute. Price 2s. net.—This issue includes "Notes on Radiography," by H. G. Symons, and discussions on several previously published papers.

Wages Reductions in Sweden.—Notices were posted last week at the Ludvika works of the Svenska Allmanna Co. announcing wages reductions, as from November 14th, of 25 per cent. for mechanics, and 20 per cent. for packers and warehousemen, while the salaries of officials will be curtailed by 20 per cent. as from February 1st next.

Insurance of Diesel Engines.—The amended arrangements made by the Insurance Committee of the Diesel Engine Users' Association for the insurance of Diesel engines against breakdown, including periodical inspection and reports by engineers having special Diesel engine experience, were reported at the last meeting of the Association. The standard form of policy which was adopted by the Association some six years ago has been amended in some respects as a result of experience gained.

A very important provision under the Standard Policy is that which provides for arbitration in the event of a dispute without having recourse to the expensive method of proceeding under the Arbitration Act.

Inquiries.—ELECTRIC HOT-WATER GEYSER.—A correspondent asks for the manufacturers of spare parts for the electric geysers originally made by the British Electric Heater Co., of Glasgow, under patent 25,296/09.

"SUNSTONE" ELICITING BOWL FITTINGS.—A correspondent seeks the name of the manufacturer or supplier of these fittings.

The Electrical Trades Union.—SUSPENSION OF THE LONDON DISTRICT COMMITTEE.—We have received a circular dated November 8th, 1921, which is signed by Mr. J. W. Ball (General President), and Mr. J. Rowan (General Secretary) of the E.T.U., and states that after most grave consideration the executive has been compelled to suspend the London District Committee. This is the culmination of years of continued violation of the constitution, and defiance of the authority of the Executive by the London District Committee. The chief reasons for the suspension are:—

- (1) Repeatedly instructing members to cease work without either consulting the members involved or obtaining the sanction of the Executive Council.
- (2) Ordering strikes without making the slightest attempt at preparation, as witness, Ponders End, Greenwich, and London shipping strikes.
- (3) Breaking the rules by circularising branches time and again in defiance of the Executive Council.
- (4) Bringing the union and its officials into discredit by publishing broadcast in the *Electron* statements and insinuations, regardless of the rules prohibiting this.
- (5) Laying bare to the employers (whom it specially enjoins to read the *Electron*) the internal business of the union.
- (6) Conducting a campaign of vilification against officials and members who endeavoured to stop such irregularities, as witness the cowardly attacks on Bros. Morton and Bussey, of the Station Engineer Branches.
- (7) Compromising the union and its railway members by making an agreement with the National Union of Railwaymen without authority, which agreement is now being used against the union in several districts.
- (8) Antagonising the station engineer members by making them the butt of every industrial dispute.
- (9) Destroying the financial stability of the union by reckless expenditure. Had other district committees followed this example the union would have been broken long ago.
- (10) By its instructions debarring members from voting for or against amalgamation with other engineering unions.
- (11) Committing the members to affiliation with the Red International despite the adverse vote of the branches.
- (12) Authorising the payment of strike committee fees far in excess of the rules, leaving members in other districts to fare as best they could.

A circular from the London D.C. purporting to be a reply to the Investigation Committee's report on the London district finance is alleged to "teem" with gross untruths, scurrilous abuse, and vile personalities.

The District Committee is said to have antagonised other trade unions by seeking to organise workers not even remotely connected with electrical work, and at Ponders End to have disgusted members so much that most of these left the union immediately the strike was finished.

In no district in the union have the rank and file had less real control than in London. The district committee has treated them with absolute contempt and disdain, and many branches are in revolt.

Pointing out that the next few weeks may decide the destiny of the Union, the Executive calls for the unwavering support of the members in general and the London members in particular to place the Union on a foundation of stability.

For Sale.—Aldershot Urban District Council Electricity Department invites offers for one direct-coupled 4-cylinder, 135-kW Carle-Peoples Diesel set.

The Neckar Hydro-Electric Works.—The Neckar Works Co., of Stuttgart, which has now commenced the construction of hydro-electric works, has just raised a 5 per cent. loan which has been over-subscribed, and amounts, as accepted, to 450,000,000 marks. With the ordinary share capital of 300 millions and the contributions of 300 millions by the Reich and by Federal States, the total available capital exceeds one milliard of marks.

Catalogues Wanted.—Messrs. Aspinall & Co., electrical engineers, 63, North Street, Lockwood, Huddersfield, wish to receive catalogues of lamps, domestic appliances, motor car lighting and starting equipment, &c.

The Batti-Wallahs' Society.—At the luncheon held on Monday at the Holborn Restaurant, Mr. A. G. Deverill entertained the company by emitting "sparks from Deverill's Brush." The first informal evening of the Society took place at the Engineers' Club, Coventry Street, on Wednesday.

A New German Lamp Factory.—The Wolfram Lamp Co., of Augsburg, whose factory was destroyed by fire, has acquired a new site for the erection of a works, which is to be ready in the middle of next year, and to have a productive capacity of 3,000,000 lamps per annum.

Ediswan Wiring System.—At the invitation of Mr. A. E. Smith, District Superintendent of the Edison-Swan Electric Co., Ltd., a party of 72, consisting of the leading electrical engineers of the district and their men, assembled at the company's showrooms at Hull, on Monday evening last, to hear and discuss a lecture on the Ediswan Wiring System by Mr. F. C. Raphael. Many practical points were raised in the discussion, which was wound up by Mr. Herbert Bell, O.B.E., the city electrical engineer, who expressed the opinion that some form of surface wiring system was essential in many cases to reduce the cost of electrical installations.

Adjustment of Wages in the Electricity Supply Industry.—The following agreement with regard to the adjustment of wages, issued by the National Council for the Electricity Supply Industry on the 4th inst., has been circulated:

1. That the National Council adopt the principle of a sliding scale of wages, in accordance with the Board of Trade index figure of the cost of living as published monthly in the *Labour Gazette*.

2. That the datum figure be 120 per cent. above the July, 1914, figure, as published in the *Labour Gazette*.

3. That the next wages revision shall take place as from November 15th, 1921, based upon the cost of living index figure as published in the *Labour Gazette* in October, 1921 (110).

4. That the next following wages revision shall take place as from January 1st, 1922, based upon the cost of living index figure as published in the *Labour Gazette* in December, 1921.

5. That there shall be a three-monthly revision thereafter, based upon the average cost of living index figure as published in the *Labour Gazette* for the three preceding months.

6. That the method of variation, up or down, shall be an increase or a decrease respectively of $\frac{1}{4}$ d. per hour for every completed six points, calculated from the datum figure of 120.

7. That this agreement shall be subject to termination at the end of any period of three months by either party giving to the Secretary three months' notice in writing to that effect, but no such notice shall be given prior to March 31st, 1922.

8. That nothing in this agreement shall be deemed to alter the basic rates for the purposes of superannuation.

As stated above, the cost of living index figure for October was 110, i.e., a fall of 10 points from the datum figure of 120. In accordance with Clause 6, there will therefore be a reduction of $\frac{1}{4}$ d. per hour (for the complete six points) as from November 15th, leaving four points to carry forward to the next revision, which will be based upon the cost of living figure for December.

Surrender of Accumulator Patents.—Notice is given in the *London Gazette* of November 11th, that Batteries, Ltd., has offered to surrender the undermentioned Letters Patent granted to Svenska Akkumulator Aktiebolaget Jungner:—No. 5,545 of 1912 for "Process of manufacturing negative electrodes for alkaline accumulators," No. 72 of 1914 for "Process for restoring the activity of a positive electrode mass for alkaline accumulators," and No. 121 of 1914 for "Improvements relating to electric accumulator cells."

Lantern Slides.—MESSRS. BOVING & CO., LTD., have a complete new set of lantern slides showing examples of modern water turbines and hydro-electric installations, which they will lend to responsible members of institutes, technical schools, &c., for lecture purposes on request.

Commercial Research Fellowships.—The Executive Council of the British Empire Exhibition has approved a scheme for establishing five or more Commercial Research Fellowships in connection with the exhibition, for competition among Chambers of Commerce in the United Kingdom. The value of each Fellowship will be not less than £500, and will include a first-class return passage to the Dominion, Crown Colony, &c., to which the Fellow will proceed. The subjects of research will be as follows:

The best means of promoting inter-Imperial trade in a selected staple industry.

The methods whereby the British Empire Exhibition can further the interests of this trade.

The potential resources in raw materials, &c., in the Dominion or Crown Colony visited, and the best means for exploiting these in the mutual interest of the Dominion and this country.

The means whereby these undeveloped resources may be adequately represented at the British Empire Exhibition and brought to the attention of interested financial or industrial groups. The closing date for entry on the part of local Chambers of Commerce will be December 15th.—*Daily Telegraph*.

Japanese Visitors.—It is stated that about the middle of December an important commercial delegation from Japan will arrive in England. The London Chamber of Commerce will give it a reception during its stay here.

A Mission from Cuba.—H.M. Government entertained Gen. M. S. de los Angeles and the other members of the Cuban mission, now on a visit to this country, at a dinner given on Thursday last week. The General referred to the fact that Cuba purchased British munitions because they were to his liking, and because they were excellent. The mission had verified the many possibilities of business development between Cuba and the United Kingdom. Visits were recently paid to provincial industrial centres.

Settlement of a Strike in the Rubber Industry.—A strike affecting 10,000 india-rubber workers, largely women and girls, and mostly members of the Amalgamated Society of India-rubber Cable and Asbestos Workers, in the Manchester, Oldham, and Hyde districts, was settled on 11th inst. by a workers' mass meeting vote in favour of compromise terms.

The strike started a few days earlier on the rejection of a proposal by the employers, who are members of the India-rubber Manufacturers' Association, that the working hours of 47 per week should be increased to 52½ per week without alteration of wages. The union were willing to accept a wages reduction of 5 per cent., but were firmly opposed to any interference with the shorter hours they had gained during the war. There is to be an advance of one hour only in the length of the working week and a reduction of 7½ per cent. in wage rates.—*The Times*.

Trade with India.—There will shortly be published by the Department of Overseas Trade a review by Mr. T. M. Ainscough, O.B.E., H.M. Senior Trade Commissioner in India and Ceylon, of the conditions of British trade in India during the years 1919/1920 and 1920/21, revised to October 1921, and the prospects for the future. The report deals with a most interesting and abnormal period, and the mass of information (the report covers over 350 quarto pages), if properly read and digested, will go far towards assisting traders to form their conclusions from the general tendencies which are gradually shaping themselves and which will in due course crystallise into the future normal position. Conditions have, in many instances, undergone radical changes, and a new India, in a commercial sense, has been, and still is, in the course of development.

The Premier on Signs of Trade Revival.—In the course of his speech at the Lord Mayor's Banquet, the Prime Minister referred to a number of favourable symptoms of the trade situation. The first was the fact that the great glut of products which followed the 1920 boom was being liquidated. That was a very important element in trade revival, as until those goods had been disposed of there was no room for more. The world needed goods and British goods, and it would get them. "To those too impoverished to pay we hope to help to give an upward fillip by our new exports credit scheme and trade facilities. But that is not what will produce a restoration of trade. Work alone will fill the depleted tills of the world. You have got to create purchasing power. That is what we have got to look to, and I, therefore, come to the second favourable symptom. In every land the dazed slowness that seemed to have overcome labour is passing away. It is true of every country that has been engaged in the war. These are the reports we get. It is altogether true of our own country. I hear reports from employers of a perceptible improvement in the quality and quantity of work which is being put in. That is what in the end will recreate industry, trade, and commerce. The world is everywhere settling down to work. By that means you not only increase wealth, but you reduce cost; and that is vital. The third favourable symptom is this:—In this country the foundations of our credit are solid and uncracked. . . . I think our reward is coming. It is coming slowly. It is, perhaps, crawling, but when you see anything coming at a distance it always looks as though it were crawling. But the soundness of our commerce and industry and financial policy has been vindicated. Prosperity, when it comes, can walk without fear of hidden trap-doors. Our exports in October were better than they have been since the month of March. Orders are beginning to flow in from the deluged lands, and the blue sky is beginning to emerge."

An Effect of the Exchange Situation.—An important Basle firm, Haefeli & Co., manufacturers of electrical fittings are leaving Basle, and two other firms are ready to leave, owing to the exchange situation.—*The Times*.

L.E.E. Smoking Concert.—The L.E.E.O.C.A. are opening their second season with a smoking concert at the Bridge House Hotel, London Bridge, on Friday, November 25th, at 7 p.m. Mr. F. Frankling, 106, Heathwood Gardens, Charlton, S.E.7, is the honorary secretary.

Stoker Contracts.—The following are among the more important orders recently received by the UNDERFRED STOKER CO., LTD.:—

St. Pancras Branch Council, Dover Station. 12 travelling grate-stokers.
Wolveringham Corporation Electricity Works. Two travelling grate-stokers and ash hoppers.
Salford Corporation Electricity Works and Newcastle-on-Tyne Electric Supply Co. Ash conveyors and hoppers.
Huddersfield Corporation. Two travelling grates.
Rotterdam Electricity Supply Department. Four travelling grates.

The B.E.A.M.A. Cable Code.—The *Beama Journal* announces that the B.E.A.M.A. cable code for the electrical and allied industries is now ready, and the price is five guineas net.

Chinese Electrical Notes.—The Tsung Sing Electric Co., of Sin chen, Kiahsin, has petitioned the Ministry of Agriculture and Commerce for registration.

The Tsung Hua Electric Machine Manufacturing Co., Ltd., has been registered by the Ministry of Communications.

The Yung Yau Electric Power Co., of Ningpo, has increased its capital and notified the Ministry of Agriculture to that effect.

The Chamber of Commerce of Fan Kia Tsung, Fentien, proposes to establish a telephone company. The Ministry of Agriculture and Commerce has been petitioned for its approval.

LIGHTING AND POWER NOTES.

Aylesbury.—**LOANS SANCTIONED.**—The Town Council has received sanction from the Electricity Commissioners to loans of £24,922 for new plant and £4,500 for mains and services.

Bedwas.—**LIGHTING SCHEME POSTPONED.**—Doubt having been expressed as to residents being able to avail themselves of a supply of electricity on account of the present low wages and trade depression, the Urban District Council has decided to defer its electric lighting project, which was to cost £17,000, for twelve months.

Bristol.—**ELECTRICITY EXTENSIONS.**—The City Council has come to an agreement with the Keynsham Electric Light and Power Co. for the purchase of the company's undertaking at a cost of £4,650. It is estimated that £2,425 will be spent on alterations to mains, &c.

WORKS EXTENSIONS.—It is proposed to purchase 15½ acres of land adjoining the Feeder Road Works, for extensions and other purposes, at a cost of £14,000. The matter is to be brought before the Electricity Commissioners.

Cannock.—**ELECTRICITY IN BULK.**—The Wolverhampton Corporation is to supply the Cannock Council with electricity in bulk, and the mains are being laid from Wolverhampton to Cannock. The Corporation will bear the cost of the main to the Cannock boundary, the Cannock authority bearing the cost of the mains to be laid in its area. A special cable is to be laid from the transformer station in Queen Street, Cannock, to the West Cannock Colliery, and it is anticipated that other collieries in the area will take supplies in the near future.

The Cannock U.D.C. has decided to apply to the Electricity Commissioners for sanction to a loan of £30,000 in connection with the scheme.

Continental.—**SPAIN.**—The Sociedad Valenciana de Electricidad has requested the Government to make it an advance of 2,500,000 pesetas for the utilisation of a waterfall supplying 4,500 h.p.—*Reuter's Trade Service* (Madrid).

RUSSIA.—Moscow correspondence states that the constructive work on the largest central station in Russia (Kaschir) is completed, and the intention was to inaugurate it on the Octobrist anniversary. The equipment of the Yamburg electric station is also completed. Power will be taken from this station for the mechanical work on the river Zuga station.

A Moscow message says that the Ukraine Electricity Commission has approved the project for the electrification of the Lower Bug district.

Deal.—**ELECTRICITY SUPPLY.**—As the Gas Company has decided not to proceed with the carrying out of its electric lighting order, the Town Council is to consider the question of carrying out a municipal scheme.

Dublin.—**REDUCED CHARGES.**—The Corporation has decided to reduce the charges for power, heating, cooking, &c., by 1d. per unit, as from October 1st last. It is not proposed to make any reduction in the charges for lighting at present.

East Grinstead.—**ELECTRICITY SUPPLY.**—The Urban Council has decided, in view of the Electricity Commissioners' sanction to the purchase of premises, to proceed immediately to draw up a scheme for an electricity supply, in accordance with two Provisional Orders granted to the Council.

East Ham.—**YEAR'S WORKING.**—The accounts of the Corporation electricity undertaking (engineer: Mr. W. C. Ullman, M.I.E.E.) for the year ended March 31st last show a total revenue of £63,267, as compared with £51,813 in the preceding year. Operating expenses amounted to £58,796, as against £43,194, leaving a gross profit of £14,777 (£8,619). The net result, after payment of all capital charges, was a deficit of £7,003; in 1919-20 there was a loss of £2,340. The total number of units sold decreased from 4,537,758 to 4,477,186. The average price per unit sold was 3.35d., as against 2.71d. in the previous year.

Electricity Districts.—**NORTH-EAST MIDLANDS.**—With regard to the local inquiry which the Electricity Commissioners were to have held at Sheffield on the 29th inst. in connection with the Corporation's scheme for the formation of a Joint Electricity Authority for the above-named area, inasmuch as interested parties have requested further time in which to consider supplementary technical particulars, the Commissioners have postponed the inquiry.

SOUTH-WEST MIDLANDS.—Sir Harry Haward, an Electricity Commissioner, opened the local inquiry, as arranged, at Birmingham on Tuesday last in connection with the area to be included in, and the schemes that have been submitted for, the reorganisation of the supply of electricity in the proposed South-West Midlands Electricity District. A report of the proceedings will appear in our next issue.

At the Worcester City Council recently Mr. W. J. Hill moved a resolution authorising him to act in negotiations with the Shropshire, Worcestershire and Staffordshire Electric Power Co., with reference to the formation

of electricity districts. Negotiations had been proceeding with the company, and he thought the efforts made by the Electricity Committee had resulted in satisfactory arrangements being made between the company and the Corporation, subject to the consent of the Electricity Commissioners being given at the inquiry opened in Birmingham on November 16th. The Committee had been able to arrange for a very much extended area round the City of Worcester, an area which would cover the sites of the factories, which had already been erected. The proposed terms, moreover, included a valuable concession by the Power Co., to allow the city to lay a transmission line to link up with the Hereford undertaking.

Hemel Hempstead.—**ELECTRICITY SUPPLY.**—The Town Council has decided to take steps to revoke the electric lighting order held by the Chesham Electric Light & Power Co., Ltd., under which nothing has been done. The Watford Urban Council is to be asked under what terms it will supply electricity.

Hetton (Co. Durham).—**STREET LIGHTING.**—The Urban District Council has entered into a contract with the Houghton-le-Spring & District Electric Light Co. for the lighting of the existing street lamps of the Council as from September 14th, 1921, to April 14th, 1924.

Hythe (Kent).—**ELECTRICITY SUPPLY.**—The Town Council has entered into an agreement with the Folkestone Electric Lighting Co. to supply electricity to the Council houses now being erected.

Lincoln.—**REVISION OF TERMS.**—The Town Council has decided to seek a revision of the terms upon which electricity is supplied to two large engineering firms.

SINKING FUND PAYMENTS.—A deputation is to wait on the Electricity Commissioners with a view to obtaining authority to suspend payment for three years to the sinking funds on loans sanctioned in respect of the electricity extension scheme. If this is granted there will be an annual saving of about £4,000.

Manchester.—**STRIKE SETTLED.**—The dispute between the electricity works employés and the Corporation over a reduction in wages of 2d. and 1½d. per hour for skilled and unskilled workers, has been settled. The workers have agreed that the question shall be referred to the Whitley Council for the industry.

Midgley.—**ELECTRICITY SUPPLY.**—The question of an electricity supply was under discussion at a recent meeting of the Urban District Council. It was stated that although the Council's consent had been given to the Yorkshire Electric Power Co.'s scheme, it was believed the company was adopting the shortest route to supply a private firm and would in consequence miss Midgley. It was decided to communicate with the company, pointing out the advantage of coming through Midgley instead of turning off at Redacre, Mytholmroyd.

Norwich.—**REDUCED CHARGES.**—The Electricity Committee has decided to reduce the charges for electric lighting by 1½d. to 1½d. per unit; and for power, the advance of 100 per cent. on the prices made during the war will be reduced to 75 per cent.

Peterborough.—**LOAN.**—Application has been made to the Electricity Commissioners for sanction to the borrowing of £24,500 for mains, services and electricity meters.

Rochdale.—**BULK SUPPLY.**—Owing to the great increase in the demands for the supply of electricity, the Rochdale Corporation Electricity Committee is considering the re-opening of negotiations with the Lancashire Electric Power Co. for a further bulk supply.

Spalding.—**ELECTRICITY SUPPLY.**—The Urban Council has rejected a proposal to apply for a Special Order for electric lighting, but has appointed a committee to consider the question of an electric lighting scheme for the town.

Walsall.—**ELECTRICITY EXTENSIONS.**—With a view to providing work for the unemployed, and subject to Government assistance towards the cost, the Electricity Department has received the Town Council's sanction to extend electricity mains at an estimated cost of £3,070.

Watford.—**YEAR'S WORKING.**—The report on the year's working of the electricity undertaking shows a total revenue of £54,507 as compared with £40,000 in the previous year. The result was a net profit of £2,155.

Wexford.—**ELECTRICITY SUPPLY.**—The Corporation has entered into an agreement with Mr. J. J. Stafford for the supply of electricity to the town. It is proposed to obtain a loan from the National Bank for the purchase of the necessary equipment.

Yarmouth.—**REDUCED CHARGES.**—A reduction of 5 per cent., from the Christmas quarter, is to be made in the charges for electricity.

York.—**LOAN SANCTIONED.**—The Electricity Commissioners have given sanction to the borrowing of £10,000 for electricity mains, the sum to be repaid in 25 years.

TRAMWAY AND RAILWAY NOTES.

Burton-on-Trent.—INQUIRY INTO ACCIDENT.—Major Mount, R.E., Ministry of Transport, held an inquiry into the circumstances of the tramway accident, recorded in our last issue, when a car fouled the points and overturned. One of the passengers, giving evidence, said that the front wheels appeared to take the points but the rear wheels did not. The driver applied his brakes, but the rear portion swerved, oscillated twice, and then fell over. The driver gave evidence to the same effect. The tramway engineer said that he thought the rear axle must have broken as the car was passing over the points. Upon examination a serious flaw had been found. In reply to questions the Inspector found that 18 axles had been broken during last year and 13 during the present year; renewal of axles was proceeding. The Inspector's report will be issued in due course.

Continental.—NORWAY. The Western Railway from Christiania is being electrified, and experimental working between that city and Asker is to begin early in the new year. The electrical plant, which is being supplied by a syndicate headed by the firm of Per Kure, includes 22 small locomotives and 3 large ones, each of 800 h.p. There is a transformer station at Asker which will receive power from the Hakavik works at 55,000 V. and reduce it to 15,000 V. for the line contact conductors.

East Ham.—YEAR'S WORKING.—The total revenue of the Corporation Tramway Department (engineer and manager: Mr. W. C. Ullman, M.I.E.E.) for the year ended March 31st last was £109,586, as compared with £95,235 in 1919-20. Working expenses totalled £123,912, as against £104,386, causing a gross deficit of £14,326 (£9,151). The payment of capital charges increased this loss to £33,647; the net deficit in the preceding year was £21,355. Although there was an increase in the number of car miles run from 1,886,377 to 1,440,464, the number of passengers carried declined from 19,192,452 to 17,779,901.

London.—REDUCTION OF FARES.—The Highways Committee of the L.C.C. has had under consideration the serious diminution of traffic apparent from the weekly returns and has ascertained that the reduction has occurred only in the case of the lower fares; the number of long-distance passengers has increased. It would appear from this that passengers, objecting to the increased fares, are now walking the shorter distances. To recover this lost traffic the Committee recommends that in place of the 1d., 1½d., 2d., and 3d. fares now charged the following scale be instituted: 1d. for approximately 1.2 miles; 2d. for 2.4 miles; and 3d. for 3.6 miles. The general manager is of the opinion that the immediate result will be an increase of passengers but a reduction of receipts. Traffic will, however, build up rapidly, and the ultimate result will be a slight surplus on the year's working.

PROPOSED EXTENSIONS.—The L.C.C. is advised by its Highways Committee to seek powers to carry out the following works: (1) The construction of a tramway from Seven Sisters Road to Stamford Hill, via Amhurst Park (estimated cost £74,715); (2) the construction of a tramway from Forest Hill to Bell Green, via Westbourne Road, Perry Vale, and Perry Rise (estimated cost £92,831); and (3) the construction of a railless trolley route from West Norwood to Lee Green (estimated cost £148,670).

COUNCIL'S APPROVAL GAINED.—At Tuesday's meeting of the L.C.C., the Council approved the Highways Committee's recommendations as to fares, and the new rates will probably be put into force on December 1st. It was also decided to apply for Parliamentary powers to carry out the extensions mentioned above.

"UNDERGROUND" SCHEME AMENDED.—The amended scheme formulated by Lord Ashfield for the extension of the "Underground" system will be considered by the Cabinet Loans Committee during this week. The original scheme was not favoured by the Committee, owing to the alleged monopolistic tendencies it revealed, and it is understood that the objectionable features have been omitted.—*Financial Times*.

Manchester.—STRIKE SETTLED.—The dispute between the Corporation and the tramway employees over the question of a reduction in wages of 2d. and 1½d. per hour for skilled and unskilled workers has been settled, the men having accepted the Corporation's offer of arbitration.

Norwich.—YEAR'S WORKING.—The annual report of the Electric Tramways Co. shows a net profit for the past year of £3,933.

St. Anne-on-Sea.—LOAN SANCTIONED.—The Ministry of Transport has sanctioned the borrowing of £1,145 for the purchase of a *British Electric Traction* motor wagon.

The Tramway Industry.—THE 48-HOUR WEEK.—The National Joint Industrial Council for the Tramways Industry met on November 16th at the Ministry of Labour to discuss the question of the revision of the national agreement of March, 1919, which guarantees to the workers of the country a 48-hour working week. The employers urged that the time had arrived when the agreement should be revised, but no agreement was reached, and the meeting was adjourned for the employers to consult their constituents. A conference of all the municipal

tramway authorities in the kingdom represented by the Municipal Tramways Association, and of the private companies represented by the Tramways and Light Railways Association, is to be held. The Transport Workers' Union threatens to resist any attempt to enforce a longer working week.—*The Times*.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—WIRELESS TELEGRAPHY.—The Chairman of the Radio Corporation of America, who has just returned from Europe, announces that as the result of negotiations with representatives of the wireless interests in England, France, and Germany it has been agreed to build one powerful station in Argentina instead of one by each country as had been originally contemplated. The chief engineer of the company is now in London discussing technical details.—*Reuter's Trade Service* (New York).

Australia.—WIRELESS TELEGRAPHY.—The Amalgamated Wireless Co. is arranging to establish a direct service between Australia and England, conjointly with the Commonwealth Government, and is promising a 50 per cent. reduction on present cable charges for all classes of messages. A million capital is needed. The company has half a million and proposes to invite the Federal Government to invest the other half.—*Financial News*.

The *Daily Telegraph* states that there is every prospect of the Government's early acceptance of the proposal, for the company's experimental stations have been in direct touch daily for three years with New York, Bordeaux, Nauen, Lyons, Hanover, New Brunswick, and Carnarvon, and also occasionally with Rome. Twenty thousand words are received from Bordeaux and transcribed weekly. The company submitted three alternative schemes. One, to finance and operate the station itself; two, to finance the station jointly with the Government; and three, to sell its patents to the Government, which would control the stations itself. The second scheme will probably be adopted, the company operating the station subject to Government supervision. The scheme provides for a central station, probably at Sydney, with sub-stations in each capital.

Continental.—RUSSIA.—In the Government of Odessa, four receiving radio-stations have been established in the towns of Balta, Pervomaiska, Tiraspol, and Voskresensk. These stations are already communicating with Moscow.

Tests are being made in wireless telephony at the Ekaterinburg radio-station, where messages are already being received from Moscow.

A message from Moscow states that along with the work for the repairing of the Petrograd telephone station recently injured by fire, the question of constructing a new one has arisen. For preparing a scheme for a new station it is proposed to invite international competition.

AUSTRIA.—TELEGRAPH RATE INCREASE.—Owing to the deficit in the Budget, it is proposed to make very large increases in the postal and telegraph and telephone rates, &c. All postal rates will be doubled and foreign letters will cost 150 per cent. more. The minimum charge for inland telegrams will be 100 crowns and 10 crowns for every additional word. City telephones with an unlimited number of calls will cost 90,000 crowns a year, and with twelve calls a day 18,000 crowns.—*Reuter* (Vienna).

Imperial Wireless.—SCHEME REJECTED?—The Post Office scheme for the erection of an Imperial chain of wireless telegraph stations 2,000 miles apart, to embrace the whole Empire, is reported to have collapsed because of the refusal of Mr. Winston Churchill to have anything to do with it. According to the *Westminster Gazette*, in this attitude the Secretary of State for the Colonies is supported by Sir James Stevenson, business adviser to the Colonial Office, and Dr. Eccles, the Government expert on wireless telegraphy.

At the recent Conference of Dominion Prime Ministers the official scheme was received with aloofness, and the Cabinet appointed a sub-committee, comprising Mr. Winston Churchill, Mr. Kellaway (Postmaster-General), and Sir Robert Horne (Chancellor of the Exchequer).

Mr. Churchill, who was also Chairman of the Imperial Communications Committee, definitely rejected the scheme, Sir Robert Horne, with Mr. Kellaway, agreed to go on with it very slowly—the former on the grounds of finance, the latter because, as Postmaster-General, he did not want the Post Office to lose its hold upon wireless communications. Later, when the wireless advisers were forced to admit that the Post Office proposals were out of date, the matter was finally settled. An alternative proposal has been put forward by Mr. Robert Donald, Chairman of the Empire Press Union. He advocates the formation of an All-Empire Wireless Board on the lines of the Pacific Cable Board, which has one cable owned jointly by the Governments of Great Britain, Australia, New Zealand, and Canada.

There would be this difference: the Imperial Wireless Board would be organised as a commercial company—not as a Government department. This would mean that the company would be organised as a commercial company—not as a body paid on it. This alternative plan has the support of some of the Government wireless advisers, including Sir James Stevenson and Dr. Eccles.

The Postmaster-General, backed in a lukewarm fashion by the Chancellor of the Exchequer, continued the construction of the station at Cairo; the terminal station at Leafield was planned in 1913, and, according to the *Westminster Gazette*, it was fitted with an obsolete system; the Cairo station is now being erected with identical sets. It is easy to pick up Leafield's continuous-wave signals over a large range of wavelengths. This defect is so serious that a new aerial will probably have to be designed at a cost of £50,000, the present aerial being scrapped.

The Post Office Imperial scheme involved the co-operation of the Dominions and India. Australia was the corner-stone of the scheme, but has now definitely decided to have nothing to do with it.

The Commonwealth is convinced that a high-power station can be erected in the Dominion for direct communication with Great Britain, and the Overseas Cabinet is now considering the matter.

India will consider nothing but direct communication with England; she is opposed to a re-transmitting station at Cairo.

As regards South Africa, General Smuts's Cabinet has just decided that the Union cannot participate in the British Post Office scheme, and that there will be no money to spend on wireless development for at least four years.

Japan.—NEW CABLE.—In order to improve the connection between Japan and America, a new submarine cable is to be laid. It was first intended that it should run from Yokohama via the Aleutian Isles to Vancouver and Seattle, but this scheme had to be abandoned owing to the ice risks, says the *T. & T. Age*.

Telephone Service.—SUBMARINE CABLE.—The work of laying submarine telephone cables in the Tay, between Dundee and Wormit, has just been completed.

Wireless Telephony.—A wireless telephonic news service will shortly be commenced in France, says the *Daily Mail*, whereby messages from the Eiffel Tower can be intercepted by private organisations, such as banks and newspaper offices, which have receiving apparatus.

The same journal says that a commercial wireless telephone service will be inaugurated between London and Holland as soon as the Post Office authorities grant a permit. Successful tests have been carried out by the Marconi Co., and it is proposed that the service shall be by land wire to Southwold, Suffolk, thence across the North Sea by wireless to Zandvoort, and onward by land wire to Rotterdam or Amsterdam.

It is announced that the recent storm carried away the whole of the masts and aerials of the station at The Hague.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Argentina.—BUENOS AIRES.—January 19th, 1922. Board of Sanitary Works. Plant and accessories for a new generating station, comprising three four-cycle Diesel engines of 375 h.p., and three 3-phase alternators each of 250 kW, 2,200 V, 50 cycles.*

Australia.—MELBOURNE.—January 4th. Victorian Government Railways. One set pyrometer equipment (cont. 34,705), electrical equipment for cargo shifter (cont. 34,723), electric rivet heater and accessories (cont. 34,735).*

Five electric road trucks.—*Reuter's Trade Service* (Melbourne).

January 4th and 11th. Postmaster-General's Department. Telegraph instruments and telephone apparatus and material (schedule 1,718 and 604). (See this issue.)

SYDNEY.—April 24th, 1922. City Council. One 10,000-kW turbo-alternator and two 2,000-kW rotary converters.—*Reuter's Trade Service* (Melbourne).

February 22nd. N.S.W. Government Railways and Tramways Department. One 5,000-kW, 50-cycle turbo-alternator, with condenser and accessories, for the Newcastle power house.*

DRISBANE.—February 10th. City Electric Light Co., Ltd. Six miles of 3-core, 0.15-in., paper-insulated cable.*

Belgium.—November 28th. Municipal authorities of Saventhem. 250-h.p. gas engine and a 165-kW dynamo, with accessories. Particulars from Le Bourgmestre.

Bulgaria.—January 10th. Direction of Posts & Telephones. Sixty 50-line telephone exchanges, fifteen 100-line ditto. (November 11th.)

Chorley.—November 30th. Board of Guardians. Storage battery (128 cells—capacity 300 Ah) and booster for the Institution. Eaves Lane. (See this issue.)

Egypt.—ALEXANDRIA.—December 21st. Ports and Light-house Administration. Stores, including electric lamps, for six months.*

Glasgow.—November 28th. Health Department. Works (including electric lighting) in connection with the erection of doctors' and workmen's houses at Bobroyton Hospital. Office of Public Works, 64, Cochran Street, Glasgow.

November 30th. Gas Department. Two electric locomotives to haul 30 tons. (November 11th.)

Liverpool.—December 28th. West Derby Board of Guardians. Engineering work, including electric power installation, electric lift, telephone installation, boilers, stokers, &c. (See this issue.)

London.—METROPOLITAN ASYLUMS BOARD.—November 23rd. Installation of electric lighting cables throughout the training ship *Eamouth*, off Grays, Essex. (November 4th.)

PADDINGTON.—November 21st. G.W. Railway. Three months' supply of electric wire and cables, and telegraph instruments, apparatus, and stores. (November 11th.)

FULHAM.—November 12th. Electricity Department. 11,000 yd. 3 sq. in. h.p. (3,000 V) concentric, paper-insulated and lead-covered cable. (See this issue.)

Manchester.—December 2nd. Electricity Committee. Hand-operated overhead travelling cranes. Barton power station, Oldham Road, and Stuart Street sub-stations.

December 9th. Heating plant and hot-water service apparatus for offices, and self-sustaining electric hoist, Barton power station.

November 25th. Electricity Committee. Circulating-water flow and level recorders. (November 11th.)

New Zealand.—WELLINGTON.—January 31st. Public Works Tender Board. Two sets 3-phase, 6,600-V automatic oil circuit breakers, four sets disconnector switches, and one 66,000-V air-break, lever-operated switch for main transformer switches, for Lake Coleridge power house.*

Spain.—December 30th. Application has been made to the Spanish Government for the concession for the construction and working of an electric tramway between Pontevedra and Marin. Tenders to the Direccion General de Obras Publicas, Madrid.

Tunbridge Wells.—November 21st. Electricity Supply Department. One wooden cooling tower, cast-iron circulating water piping and valves. (November 11th.)

Warrington.—November 28th. Electricity and Tramways Committee. Sub-station ironclad switchgear, high and medium pressure lead-covered cables. (See this issue.)

Wexford.—November 28th. Corporation. Overhead 1-p. distribution mains, street lanterns, &c. (November 11th.)

Whitehaven.—December 1st. Electricity Supply Department. Two water-tube boilers with superheaters, economisers, pipework, &c. (November 4th.)

York.—November 21st. N.E.R. Six or twelve months' telegraph stores. (See this issue.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CLOSED.

Australia.—MELBOURNE.—Victorian Railways.

Lifting magnet and motor generator (£1,223).—British General Electric Co., Ltd.—Tenders.

SYDNEY.—According to *Tenders*, the City Council, in addition to accepting the tenders for the supply of consumers' meters (see *ELEC. REV.*, November 4th, p. 610), has decided to place orders with a local manufacturing firm, the Electricity Meter Manufacturing Co., Ltd., to the extent of the company's capacity to manufacture in order to encourage local industries.

Cannock.—In connection with the scheme for the supply of electricity to the West Cannock Colliery Co., Ltd., the Council has accepted the following tenders for plant, &c.:—

Ferranti, Ltd.; General Electric Co., Ltd.; British Insulated Co.; Messrs. Reyrolle, Ltd.

Doncaster.—Town Council. Accepted:—

Low- and high-pressure cables in connection with the Arksey housing scheme (£1,151).—Enfield Ediswan Co., Ltd.

London.—L.C.C. Stores and Contracts Committee. Electric goods lift at Stamford Hill Stores Depot. Holt and Willets, £895, recommended. Fourteen tenders were received, varying from £895 to £1,550.

Samarang Harbour.—The contract for the electrification of Samarang (Java) harbour has been awarded to the *Amsterdamsch Kantoor voor Indische Zaken* (Akiz). The installation comprises a main transformer station, two transformer sub-stations, and high and low pressure cables, as well as 11 transformers and 40 crane switchboxes. The Akiz represents the A.E.G. of Berlin.

Sunderland.—Electricity Committee. Accepted:—

L.p. service cables.—B.I. & H. Cables, Ltd.

Distribution board for boiler-house extension.—Switchgear & Cowans, Ltd.

Switchgear for boiler-house extension.—Reyrolle & Co., Ltd.

Meters.—Ferranti, Ltd., and Reason Manufacturing Co., Ltd.

Partial rebuilding of A.E.G. turbine.—Jas. Howden.

THE APPLICATION OF ELECTRICITY TO FARMING.

At the end of October, Mr. R. Borlase Matthews, M.I.E.E., in response to a special invitation, read a paper on "Electro Farming" before the Royal Dutch Institution of Engineers at Nijmegen (Netherlands). Evidence of the interest displayed in that country in the electrical development of agriculture was given by the presence of the Dutch Minister of Agriculture. A number of prominent Dutch agriculturists were also present. The meeting was held at 11.15 a.m.—an hour which may seem strange to English ideas for ordinary engineering meetings, but a very practical one from a Dutch point of view, as the members come from all over the country, travelling considerable distances so as to be present, and owing to the early closing of the meeting, are enabled to return to their homes the same day.

After some words of introduction and welcome by the President of the Institution, J. A. J. Roelofs, the paper was read by the author; a number of lantern slides were shown to illustrate the methods adopted by him on his experimental full-scale commercial farm at East Grinstead (Sussex).

The author contended that an extended use of electricity in farming operations was only a matter of the expiration of a comparatively brief time. Sufficient experimental and practical scale work had now been carried out in Denmark, Germany, Switzerland, Belgium, France, Italy, and Great Britain to demonstrate fully the necessity for the employment of electricity in modern agriculture, if the farms were to be really profitable concerns. Since the war, the day of the cheap labourer had passed, and hence the necessity for electro-mechanical aids. As an illustration, the author's farm of 600 acres, with such assistance, only required three horses, and no oxen. Further, the electrical equipment of a farm ensured that the various operations were more independent of the weather, since they could be carried out more quickly, when the weather suited; or in many cases they could be completed in spite of adverse weather (e.g., artificial electro-haymaking, corn-sheaf drying, &c.).

The uses of electricity on farms were divided into three main heads: (a) power uses in the farm buildings and barns, (b) power uses on the fields and arable land, and (c) uses which were specifically electrical, such as electroculture. Illustrations were given of typical applications of electric drives, emphasis being laid on the fact that, ultimately, the ideal machine for the farmer was one that incorporated its own direct-coupled electric motor, as opposed to operation by means of a line shaft.

Various forms of portable electric motors were discussed, particularly interesting among which were larger types of 30 h.p. or thereabouts, and the very substantial three-point suspension wagons employed for their support and conveyance. Electric light was referred to as advantageous to the farmer, not merely as a convenient and safe light, but also as a means of producing more eggs in winter, and bringing on young stock to earlier maturity by more winter feeding in artificial light.

Examples were cited of the electric motor driving of machinery for the food preparation for live stock, dairy machinery and general barn machinery, including pumps, &c. Similarly cases were given of applications on the land for irrigation, ploughing, cultivation and other field operations. Particular attention was drawn to the present-day development of electric ploughing, whereby, in skilled hands, 27 acres could be ploughed per day as compared with the bare acre per day of a man and team of horses. It was pointed out that on the "round-about" system, electric ploughing apparatus was now available for small fields, at a cost for power that was comparable to the big electric ploughing sets, which in turn were far cheaper to operate than steam sets.

The after-treatment of gathered crops was, of course, dealt with, as it is an important aspect of modern farming, as are likewise certain rural industries which can be conveniently operated in conjunction with a farm.

Considerable interest was evinced in the author's account of the present development of electroculture, which, he stated, had now arrived at the point where an increase of 10 per cent. in the crop could be confidently expected, at a nominal consumption, and a low outlay for wiring per acre (excepting the initial capital cost of the transforming apparatus, for which he had not yet been able to ascertain the simplest and cheapest design).

The employment of electric vehicles on farms was then touched upon, and also the author's semi-automatic system of keeping farm (or in fact any other) accounts by the aid of an electrically-operated machine—the author's contention being that detailed costings were the only true basis upon which it could be proved whether electro-farming was or was not a paying proposition; and any method which could produce these accounts without unnecessary expenditure of skill and time was certainly worthy of adoption.

The meeting concluded with a special vote of thanks, the President stating that more than the usual thanks were due by them to the author, as he had come from another country to address them on a subject concerning which he had much valuable experience of a practical nature, that would be of the utmost advantage to them.

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FORTHCOMING EVENTS.

- British Electrical Development Association.**—Friday, November 18th. At the Institute of Patent Agents, Staple Inn Buildings, W.C. At 8 p.m. Paper on "Fellowship in Wiring and Installation Work," by Mr. E. H. Freeman.
- Institute of Transport.**—Friday, November 18th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 5 p.m. Lecture: "The Operation and Development of Urban Electric Railway Services," by Mr. J. P. Thomas.
- Diesel Engine Users' Association.**—Friday, November 18th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Discussion on Mr. O. Wark's paper on "Some Recent Developments in Mechanical Design of Oil Engines using Heavy Oils."
- Institution of Mechanical Engineers.**—Friday, November 18th. At the Institution, S.W. At 6 p.m. Paper on "The Machinery of Floating Docks," by Dr. E. H. Salmon.
- Junior Institution of Engineers.**—Friday, November 18th. At the Grafton Hall, Westminster, S.W. At 7 p.m. Annual general meeting.
- Friday, November 25th.** At 8 p.m. Lecture: "Electro-Magnetic Instruments, Problems in their Design and Construction, Demonstrations," by Mr. G. F. Shore.
- Institution of Electrical Engineers.**—Informal meeting, Monday, November 21st. At the Institution, Victoria Embankment. At 7 p.m. Discussion on "Hydro-electric Power," to be opened by Mr. A. J. Hainsworth.
- (Liverpool Sub-Centre).**—Monday, November 21st. At the University, Liverpool. At 7 p.m. Paper on "Telephone Line Work in the U.S.A.," by Mr. E. S. Rigg.
- (East-Midland Sub-Centre).**—Tuesday, November 22nd. At the University College, Nottingham. At 6.45 p.m. Paper on "Modern Illuminating Engineering," by Mr. J. R. Aldrich.
- (South-Midland Centre).**—Wednesday, November 23rd. At the University, Birmingham. At 7 p.m. Paper, "Some Notes on the Design of Liquid Rheostats," by Mr. W. Wilson.
- (London Students' Section).**—Friday, November 18th. At the Institution, Victoria Embankment. At 7 p.m. Paper on "Modern Hydro-electric Practice," by Mr. E. E. Rutten.
- (Sheffield and District Sub-Centre).**—Wednesday, November 23rd. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Chairman's (Mr. S. E. Fodden) address and smoking concert.
- Nottingham Society of Engineers.**—Wednesday, November 23rd. At the Webbs Hotel. At 8 p.m. Paper, "The Economics of Long-distance Power Transmission," by Mr. A. T. Phillips.
- Royal Society of Arts.**—Wednesday, November 23rd. At John Street, Adelphi, W.C. At 8 p.m. Truman West Lecture: "The Coming of Age of Long distance Wireless Telegraphy and some of its Scientific Problems," by Prof. J. A. Fleming, F.R.S.
- Northampton Engineering College Engineering Society.**—Wednesday, November 24th. At the Institution, John Street, E.C. At 5 p.m. Paper on "The Methyl Thrust Bearing," by Mr. J. Ward.
- Industrial League and Council.**—Wednesday, November 23rd. At the Grafton Hall, Westminster, S.W. At 7.30 p.m. Lecture on "The Industrial Revolution in England," by Mr. H. E. Blain.
- Electrical Power Engineers' Association (Manchester Section).**—Thursday, November 24th. At the Association Hall, Peter Street, Manchester. At 7.30 p.m. Annual general meeting. Lecture, "Some Snapshots from my Camera," by Mr. Lum.
- (Southern Division).**—At the Central Hall, Westminster, S.W. At 7 p.m. Lecture on "Some Notes on Boiler House Plant," by Mr. A. W. Bennie.
- Chelmsford Engineering Society.**—Thursday, November 24th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Gas Products for Power and Heating," by Mr. N. E. Rambusch.
- Public Works, Roads, and Transport Congress and Exhibition.**—November 18th to November 25th. At the Royal Agricultural Hall, Kingston, N.
- Edinburgh Electrical Society.**—Friday, November 25th. At the Philosophical Institute. At 8 p.m. Paper on "The Manufacture of the Modern Electric Lamp," by Mr. A. S. Black.
- Institution of Production Engineers.**—Friday, November 25th. At the Institution of Mechanical Engineers, S.W. At 7.30 p.m. Paper, "Drawings and Production," by Mr. A. F. Guyler.
- King's College Engineering Society (University of London).**—Friday, November 25th. At the Holborn Restaurant. Twenty-fourth annual dinner.
- Physical Society of London.**—Friday, November 25th. At the Imperial College of Science, South Kensington. 5.45 p.m. Discussion on Hygrometry, to be opened by Sir N. Shaw, F.R.S.

NOTES.

Appointment Vacant.—Shift engineer (£383-£433) for the Dublin Corporation. (See our advertisement columns to-day.)

The Gyroscopic Compass.—At a meeting of the Birmingham and District Electric Club on November 12th, Mr. H. T. Stevenson lectured on the gyroscopic compass, which has been fully described in the ELECTRICAL REVIEW. The lecturer described the construction and action of the compass in detail, as well as the specially-designed motors used for the motive power. All modern warships were fitted with the compass and during the last two years it had been placed on over 50 merchant ships.

Freemasonry.—The next regular meeting of the Kelvin Lodge will be held at Mark Mason's Hall on Friday, November 25th, at 4 p.m. Morning dress.

Hydro-electric Development in Baden.—According to a correspondent of the *Electrical World*, the German State of Baden has passed a law for the purpose of supplying electrical energy all over the country by means of a State-owned company. The nominal capital of this company is fixed at 30,000,000 marks, but it has in addition been authorised to raise a public loan to the amount of 500,000,000 marks which will be fully guaranteed by the State. All electric plants owned and operated by the State, such as the important Murg power works, become the property of the new company. The existing power plants have not been nearly able to supply the increasing demand for energy. At the present time 500,000 tons of coal are required annually for the generation of power and light, corresponding to an output of 500,000,000 kWh. This it is now proposed to produce by development of water power.

In the south of the country, on the line from Basle to the Lake of Constance, a number of hydro-electric power stations will be erected. One of the largest power plants will be constructed at Schwörstadt, on the German-Swiss frontier, and in this plant Switzerland will be interested financially as well as industrially, as the latter country will receive half the amount of energy produced by this station, namely, 180,000,000 kWh. The total cost of this power station is estimated at 320,000,000 marks. In order to be able fully to utilise the Rhine power works, a great storage lake will be constructed in the southern part of the Black Forest with a capacity of 72,000,000 cu. m. Several subordinate companies, all controlled by the State, will be formed to carry out this part of the work. Similar steps have been taken for the electrification of the central and northern parts of Baden. The Murg power station is to have a large storage lake, to be created by means of a dam across the surrounding valley, at a cost of 200,000,000 marks.

Electricity in Italy.—Ten months after the event, our contemporary *L'Elettrotecnica* published the papers given before the yearly meeting of the Associazione Elettrotecnica Italiana, held in Rome on November 20th last. Although belated, a portion of the president's opening speech, in the light of later events both in Italy and abroad, is singularly significant. "The ruthless war," he said, "which has shaken so deeply our land, is ended, but the economic unrest remains and the preoccupation which weighs upon us for the future of our country holds our soul in suspense and anxiety. But in these days, the consecration of our victory and the sense of relief which pervades the peninsula has lifted our hearts, making us breathe a purer air and, with the reblossoming of the spirit of patriotism, permits us to hope that the pressing incubus is about to melt away, and that the calm which all long for will return, enabling us to initiate the economic renewal of our fatherland." After reference to the exertions of members of the Association in a forward direction, he continued—"in our region, electrical undertakings, far from lessening their activities during the war, rather intensified them to complete new plants in face of unnumbered difficulties, from lack of prime materials, fitful and inadequate transport, and scarcity of labour. Numerous new electrochemical works and electric foundries were also started, and among those yielding electric energy, the foundation of our industry, might be cited nine companies, among our members (Anglo-Romana, Iva, Elettrochimica, Marchigiana, Volsinia, Lazale, Umbra, Italia Centrale, and Mediterranea), which together increased their plants by over 30,000 h.p., while 54,000 were being installed. Furthermore, new concessions and schemes, hydraulic and thermic, were being studied for the creation of about 270,000 additional h.p." In a more serious note, he continued:—"In the two years that have elapsed since the glorious victory, the difficulties which obstruct have rapidly increased: material becoming increasingly scarce, prices ever more fantastic, labour still more exigent, undisciplined and unproductive; while concern ever deepened with regard to the selling price, always insufficient to cover the cost of working, itself always rising and leaving no margin of profit, so much so, that it was impossible to undertake the construction of plant which would cost seven times that of the first establishment. These difficulties which agitated electric companies, with political and social anxieties of the moment, rendered capital perplexed, and their effects were already pre-occupying banks and savings institutions. We wish for the rise of our country, that its active forces be co-ordinated, its material resources enjoyed, that industry be re-established, and for this is needed prompt and energetic work by the Government and the collaboration of all citizens to bring back the economic life as quickly as possible, to conditions of stability and equilibrium, without which no industry can develop."

X-Ray and Wireless Service Problems.—In a letter to the *Electrical World*, Mr. C. H. Mueller says the Duquesne Light Co. has supplied electric service for X-ray and radio apparatus over a period of about six years.

Owing to the operating characteristics of X-ray apparatus, many cases of flickering lights occurred when it first served such apparatus. However, these disturbances have been eliminated by the installation of 2,200/110-volt transformers

and services. Such an arrangement provides the X-ray operator with ideal service, since he requires uniform voltage after he has set a machine to make an exposure. The result has been universal satisfaction.

The amateur wireless operator, however, has caused the company considerable annoyance. The transmitting outfits have been the chief trouble makers. The following cases are selected from a hundred or more investigations.

Several years ago a customer complained of flickering lights and electrical discharges similar to, but not so severe as, lightning. It was found that a wireless transmitting outfit was situated next door, and that the flickering lights and discharges occurring on the switches and chandeliers were in synchronism with messages that were being transmitted. Earthing of the wireless outfit through impedances in numerous ways was attempted, but no relief was obtained. A one-to-one transformer was also inserted in the wireless supply circuit, without effect. Finally the wireless customer was disconnected from the 110/220-volt earthed-neutral distribution bank and served from a 1-kVA, 2,200/110-volt transformer installed for his individual use. The disturbance ceased and was permanently eliminated.

In another case the wireless amateur had attached one end of his aerial to one of the poles which carried a three-wire 110/220-volt distribution circuit and four or five customers' services. The aerial crossed the services at various angles and not more than two feet distant from any of them. During rainy or damp nights, when the operator was transmitting, streams of sparks could be seen between the aerial and the service lines directly beneath. The lights on these circuits flickered, the wall switches and chandeliers buzzed and emitted sparks, the telephone service was affected, and in one case the main house fuses were blown. The same disturbances occurred, but to a less degree, on dry nights and days. The aerial was removed to a safe distance, but the trouble was not completely eliminated until a separate 2,200/110-volt transformer was installed for serving the radio operator.

A more severe case of disturbance occurred quite recently. A wireless transmitting outfit broke down the insulation on the chandelier wiring in one room of the house next door. The ceiling canopy was melted, and a hole 6 in. in diameter was burned in the ceiling. The main house fuses and tablet board were badly burned. The wireless customer compensated his neighbour for the damages, and repetition of the trouble was prevented by installing a 2,200/110-volt transformer to serve the wireless outfit.

Rheostats with the Minimum of Material.—In *La Revue Générale de l'Electricité* for October 29th is given a translation of a long article in the *E.T.Z.*, by K. Richter, describing a new method of constructing rheostats with the minimum of resistance material. Instead of putting all the wire in series, the inventor connects it in parallel and series parallel in such a way that all the resistance is constantly more or less in use, and all its radiating surface is in action. By this means a considerable economy of material is effected. The arrangements described cover polyphase as well as single-phase and d.c. apparatus.

For instance, in the case of a shunt regulator, two paths are used; the maximum resistance is obtained when the two are in series, and by means of sliding contacts they are gradually brought through series-parallel to full parallel for the minimum value, when the current in each path is half the total and the heating effect only a quarter. Each of the sliding contacts takes only half the total current, and one slider carries them both. Similarly three or four resistance elements can be employed, the ratio between the maximum and minimum resistance values being equal to the square of the number of elements, and the heating effect being reduced in an inverse ratio.

Numerous combinations are described and their characteristics fully explained. Arrangements enabling the resistance to be reduced to zero are included.

Postponement of Sinking-Fund Payments.—Bill No. 230—Local Authorities (Financial Provisions)—received the Royal Assent last week. Amongst other provisions it contains the following important clause:—

(4) Where within twelve months after the passing of this Act money is borrowed by a local authority for the purpose of the construction of new or extension or alteration of existing works forming or to form part of an undertaking of a revenue-producing character, then, notwithstanding anything to the contrary contained in any Act, it shall be lawful for the annual provision required to be made by the local authority for the repayment of the money so borrowed to be suspended while the expenditure out of that money remains unremunerative for such period and subject to such conditions as the Minister of Health or other authority by whom the borrowing is sanctioned may determine. Provided that such suspension shall not be for a longer period than five years from the commencement of the financial year next after that in which such expenditure commences to be incurred.

Other clauses enable local authorities to raise funds for current expenses by short-term loans; to vary the provisions for repayment of loans imposed by statute; and to relax the limit of borrowing powers in certain cases in order to provide employment, always subject to the approval of the Minister of Health.

Fatalities.—An inquest was held at Neath on Friday regarding the death of Charles William Jones, 38, a wireman employed by the National Oil Remeries, Skewen, who was killed at the works two days previously. Trevor Hopkins, an electrician at the works, said Jones was regulating a line of cable. He had his left hand outstretched to withdraw the vice he was using, and must have caught hold of the stay-vice with his right hand. The electric supply at this point was 200 volts alternating. The current should have been turned off before deceased commenced working, and probably deceased did not know it was on. Arthur Abrahams, the foreman electrician, said he told Jones the preceding night not to use an iron vice, and warned him and the other men to see that all switches were taken out before work was commenced. After the accident, witness found that the jaws of the vice had cut through the vulcanised rubber insulation. Witness was closely cross-questioned as to the responsibility for turning off the current, and admitted that it could only be turned off on his instructions. He was at the sub-station at the time in question, and was not told that anyone wanted the switches taken off, though he knew that Jones and others were at work on the cables. In summing-up, the Coroner remarked upon the fact that the foreman made no effort to ascertain whether the men were at work when he found the switches still on. The jury returned a verdict that death was due to an electric shock, and expressed themselves of the opinion that there was forgetfulness on the part of Foreman Abrahams in not seeing that the current was cut off prior to the men commencing work. The jury also suggested that boards should be exhibited warning the workmen to see that all switches were off before commencing work.

Radiography and Radiology.—Within the past two years university diplomas have been established in the medical application of X-rays and electricity, and a special examination, the passing of which permits the use of the letters "M.S.R.," has also been established for persons who carry out under medical direction the technical side of this work. Between these totally different examinations a great deal of confusion seems to have arisen in the public mind. A brief explanation may, therefore, be of interest, thinks the *Daily Telegraph*, which says that about three years ago the British Association for the Advancement of Radiology and Physiotherapy, a purely medical body, approached the University of Cambridge with a view to the establishment of a diploma on the same lines as the "D.P.H." (Diploma in Public Health). The university authorities instituted the Diploma in Medical Radiology and Electricity—D.M.R. and E. (Cantab.). A special course is given for this, partly at Cambridge and partly in London, under the auspices of the B.A.R.P. Anyone desiring information should write to the secretary, Education Committee, B.A.R.P., 12, Stratford Place, W.1, or to Cambridge. A similar diploma has been established by the University of Liverpool, and others will no doubt follow. These courses and examinations are open only to medical men holding recognised qualifications, and are intended to supplement the somewhat scanty instruction in X-rays and electricity which is all that is possible in a crowded medical curriculum.

Next, the B.A.R.P. turned its attention to the question of the training and certification of technical assistants. In addition to medical knowledge such as is required in a nurse, the X-ray worker must be skilled in a technical sense—that is, he must understand the apparatus with which he has to deal. The B.A.R.P. therefore approached the Council of the Institution of Electrical Engineers and asked for co-operation. It was decided to form the "Society of Radiographers." The Council of this body, the constitution of which has been approved by the General Medical Council and the Board of Trade, consists of six medical men appointed by the B.A.R.P., six members of the I.E.E., and six elected by the general body of members. An examination is held twice yearly, and the successful candidate is entitled to use the letters "M.S.R."

The radiographer must be sharply differentiated from the radiologist. The former is the skilled technician, the latter is the medical expert who directs. Every member of the Society of Radiographers signs an undertaking that he will not examine or treat any patient except under the direction of a qualified medical man. The relationship between the two is very similar to that between the physician and the dispensing chemist.

The examinations of the Society of Radiographers are open to anyone who can show that he or she has a sound general education and has also had considerable experience of the practical side of X-ray and electrical work. No medical qualification is necessary. For candidates who have no experience, special courses of instruction are provided. Those desirous of detailed information should communicate with the secretary, the offices of this society being in the same building as those of the B.A.R.P.

An Australian Electric Furnace.—A recent issue of the *Communist*, a magazine contained a description of a large electric furnace installed a short time ago in the Victoria Iron Rolling Mills, West Melbourne. This is a 6.9-ton furnace, with 17 in. dia. carbon electrodes weighing 750 lb. each and having a nominal current-carrying capacity of 8,670 A. The average working current is 5,000 A. The electrodes are raised or lowered by means of a 3-h.p., d.c. motor, and a 25-h.p. motor, by means of a rack and pinion gear, performs the tilting operation. Power is supplied by the Melbourne City Council at 6,000 volts (3-phase), and this is stepped down by three single-phase air-cooled transformers. A secondary series

of transformers and a motor-generator provide the power for the motors. A cooling system pumps water through the roof glands and the electrode holders; all water connections and the holders are insulated from the frame of the furnace. The furnace shell is a 12 ft. dia. cylinder with a closed end, lined with refractory materials. The total weight of the furnace and charge is about 60 tons, and it will therefore be seen that the 25-h.p. motor and tilting gear is not too large. The method of employment is as follows:—After setting the hearth of the furnace, the roof is lifted on and bolted in place, the water jackets are put on, and the electrodes clamped in. About 6 cwt. of coke is spread on the bottom and the current switched on. The doors are sealed up and about 500 kW is put on the furnace for eight or nine hours. Power is then shut off for 12 hours. The next day the coke is raked out and a "heat" charged.

The Electro-Harmonic Society.—LADIES' NIGHT.—The concert held on Friday last attained a high degree of excellence, the singing of Miss Winifred Lawson, Mr. Ivor Foster, and Miss Violet Openshaw being particularly appreciated; Mr. Jack Salisbury's violin solos were also admirably executed. Mr. J. S. Highfield presided, and there was a good attendance, though the room was not completely filled.

Proposed Institution of Chemical Engineers.—At a meeting at the Engineers' Club, Coventry Street, on November 9th, presided over by Sir Arthur Duckham, it was decided to take steps to form an Institution of Chemical Engineers. "One of the greatest things such an institute as was proposed could do," said the chairman, "would be to create a real chemical engineer."—*Morning Post*.

INSTITUTION NOTES.

Institution of Electrical Engineers.—NORTH-WESTERN CENTRE.—Liverpool Sub-Centre.—The following are the published arrangements for the session:—November 21st, paper on "Telephone Line Work in the U.S.A.," by Mr. E. S. Byng; December 12th, lecture on "Single and Three-phase Commutator Motors with Shunt and Series Characteristics," by Dr. S. P. Smith; January 16th, paper on "An Oscillograph Investigation of the Guldstrand Relay," by Dr. S. S. Richardson; May 8th, annual general meeting and smoking concert.

SCOTTISH CENTRE.—Mr. James E. Sayers presided, and introduced the new chairman, Mr. E. T. Goslin, general manager, Clyde Valley Electrical Power Co., at the opening meeting of the session, held in Glasgow on November 8th. Mr. Goslin, in his inaugural address, dealt with the subject of rates and finance as they affected the supply of electricity. Referring to the problem of unemployment and bad trade, he said that electrical undertakings could help to overcome both. Cheaper production of electricity meant cheaper rates to the consumer, which, in turn, would bring about lower manufacturing costs and improved trade, with a greater demand for labour. The co-operation of supply authorities was necessary to secure the main object of the Electricity Supply Act, 1919. Without co-operation cheap electricity could not be supplied. Bulk supplies must eventually reduce costs, and with a cheaper supply the sale of energy and the income derived would increase, and the engineer would undoubtedly benefit by the general improvement.

INFORMAL DINNERS.—Arrangements have been made for the members of the I.E.E. to dine together at the Engineers' Club, Coventry Street, W., after the ordinary meeting of the Institution to be held on December 1st. The charge per cover is 5s. 6d.

Members wishing to be present at the dinner are requested to send their names to the Secretary a day or two in advance, either in writing or by telephone. Subject to accommodation being available, additional names will also be received by the Institution attendants from members when the latter sign their names before entering the Lecture Theatre for the meeting, but it is especially preferred that members should send in their names in writing or by telephone.

MODEL GENERAL CONDITIONS FOR CONTRACTS.—The work of revising the I.E.E. Model General Conditions for Contracts, which began in April, 1920, was completed at the end of last session, and a new edition was published on November 1st, 1921. In addition to the members of the Committee of Revision nominated by the I.E.E., the Committee included a number of representatives of other Associations within, or closely connected with, the electrical industry, and through these representatives the Committee had the benefit of the views of the governing bodies of the various Associations interested in the Model General Conditions for Contracts. The new Conditions have been issued in such a form that they can be used as the actual contract by filling in the blank spaces.

Edinburgh Electrical Society.—On October 28th, the Society held their first "Questions and Answers" night of the session. Mr. D. S. Munro presided, and numerous questions were dealt with, chiefly relating to peculiar breakdowns in plant and installation work.

On November 11th Mr. D. Landale Frew gave a paper on "C.T.S. Cable," which was illustrated by lantern slides and numerous samples of cables and fittings. The history and manufacture of C.T.S. cables were described, and its many uses were indicated.

North-East Coast Institution of Engineers.—At a meeting of the Institution on November 11th, Mr. C. Whillie, M.I.E.E., read a paper on "The Working of a Modern Telephone System." The author considered that the manual switchboard system still had a long career in front of it; the automatic system was still in its early stages of development. The problems of design were many and difficult on account of the violently fluctuating load. Although the current in one circuit was very small, in a large exchange the discharge from the battery might at times be as high as 200 A. The author described the manual system in detail, giving particulars of protective devices, Pupin coils, &c. He also indicated some of the possibilities of the thermionic valve, and referred to the large schemes of placing trunk mains underground now being proceeded with by the G.P.O.

Greenock Association of Electrical Engineers.—On November 9th Mr. Rolling, of Glasgow, delivered the opening paper of the session before a large attendance of members. His subject, "Automatic Electric Control Gear with Special Application to Shipyard Equipment," was well illustrated by lantern slides and diagrams. Mr. Rolling's *pièce de résistance* was a self-resetting breaker, which discriminated between temporary and other short circuits.

Belfast Association of Engineers.—At the meeting held yesterday evening, a paper on "Electric Industrial Illumination" was read by Mr. George Herbert.

King's College Engineering Society.—The 24th annual dinner of the Society is to be held at the Holborn Restaurant on November 25th. Mr. J. S. Highfield, President, I.E.E., will preside, and the principal guests will be Mr. W. B. Worthington, B.Sc., President, Inst.C.E.E., and Sir R. A. Hadfield, Bart., F.R.S.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

It is announced that having in view his long association with electrical progress in this country, and his great services to the Institution in connection with the obtaining of a Royal Charter and Royal Patronage, when his enthusiastic help, by counsel, advice and active co-operation with the Charter Committee proved invaluable, the Council of the Institution of Electrical Engineers has elected as an Honorary Member LORD SOUTHBOROUGH, P.C., G.C.M.G., &c.

Lord Southborough, who is a Privy Councillor, and better known to electrical men under his older title of Sir Francis Hopwood, has had a distinguished career in the Board of Trade and other Government Departments, and in the eighties was closely associated as Assistant Solicitor to the Board of Trade with electrical legislation. From 1901 to 1907 he was Permanent Secretary to the Board of Trade, and subsequently Permanent Under-Secretary of State for the Colonies, and just before, and during part of, the war Civil Lord of the Admiralty.

As British delegate to the International Railway Congresses of 1895 and 1900, as Vice-Chairman of the Development Commission, 1914, and as member of the Royal Commission on London Traffic, he has been closely associated with the problem of railway electrification, and he is also a member of the board of directors of the London Underground Railways.

He is on the Board of Control of the National Physical Laboratory, where he has actively supported research and experimental investigation of electrical matters.

Mr. F. GEERE HOWARD, A.M.I.C.E., electrical engineer, of 59, Berners Street, W.1, has been elected Mayor of Hampstead.

Councillor J. BELL, is the new Mayor of West Bromwich. His chief work on the Council has been done as chairman of the Electricity Committee.

Councillor JAMES THOMPSON, who has been re-elected Mayor of Wolverhampton, is chairman of the Corporation Electricity Committee.

Councillor H. K. BEALE has been re-elected chairman of the Birmingham Electricity Supply Committee.

Councillor F. SMITH succeeds Councillor Lee as chairman of the Birmingham Tramways Committee, and the latter is the new chairman of the Public Works Committee.

The Swedish Academy of Sciences has awarded the Nobel Prize for Chemistry for 1920 to Prof. WALTER NERNST, of Berlin, the inventor of the Nernst electric lamp.

Sir A. K. BUTTERWORTH is retiring from the post of general manager of the North-Eastern Railway at the end of the year, and Mr. R. L. WEDGWOOD, the present deputy general manager, takes up his position as from January 1st.

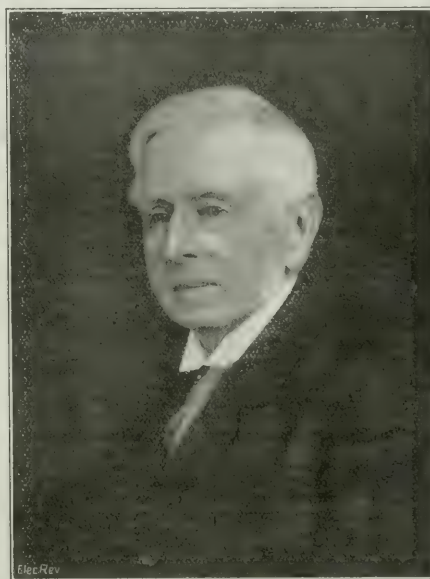
Mr. R. L. MCCULLOCH, who recently went to Australia, has been appointed general manager to the City of Hobart (Tasmania) Municipal Electric Tramways at £750 per annum salary.

Mr. F. H. MANN has joined Messrs. Moffett & Rosher, consulting engineers, of Birmingham, as a partner, he having been formerly associated with the firm as assistant engineer. The style of the firm will now be Moffett, Rosher & Mann. At the conclusion of the war, Mr. Mann was a Lieutenant (E.)

in the battle cruiser H.M.A.S. *Australia*, being in charge of the electrical generating plant and equipment. Early in 1919 he was engaged upon the extensions to the Grimsby Corporation electricity works, and was occupied on this work until he resigned to rejoin his old firm.

On Saturday last the staff of the South Shields Electricity Department presented Mr. E. Moxon, the borough electrical engineer (who is leaving to take up a similar position at Southport), with a silver tea and coffee service and salver. The presentation was made by Ald. J. W. Henderson, chairman of the Electricity Committee.

Obituary.—SIR DOUGLAS FOX.—We regret to state that Sir Charles Douglas Fox, the well-known engineer, passed away on Sunday last in London after a few hours' illness, in his 82nd year. Sir Douglas was the eldest son of the late Sir Charles Fox, who was the constructor of the 1851 Exhibition building which was afterwards re-erected as the Crystal Palace. He joined his father as an articulated pupil in 1857, and in 1862, after practical experience, he became a partner in the firm. When Sir Charles died, Douglas and his brother Francis succeeded to the business, which is now so well known amongst engineers as Sir Douglas Fox & Partners. This firm was responsible for numerous large railway undertakings, among which the Liverpool Overhead Electric Railway and the Mersey electric tunnel line, also two London tube systems, the Great Northern and City, and the Charing Cross, Euston and Hampstead railway, are of direct interest in these pages. In their other consulting engineering operations may be mentioned their part in connection with the North Wales hydro-electric



Elliott & Fry

SIR DOUGLAS FOX.

London.

power scheme, the great piece of bridge work across the Victoria Falls, the preparation of new plans for the Channel Tunnel, and many railway and other undertakings in different parts of the Empire and in foreign countries. Sir Douglas Fox had been a member of the Institution of Civil Engineers since 1865, and he was its president in 1899 to 1900. He was prominently connected with the British engineering Standard Association from its commencement. Sir Douglas received the honour of knighthood in 1886, as recognition of his work, in association with the late Sir James Micklethwait, as engineer of the Mersey Tunnel. He has left one son, Mr. Francis Douglas Fox (a partner in the firm mentioned) and four daughters. The funeral service was to be held yesterday at Sevenoaks.

Mr. E. WINDSOR RICHARDS.—We regret to record the death of Mr. E. Windsor Richards, the well-known ironmaster, which occurred last Saturday, at the age of 90 years. The deceased gentleman was a past president of the Iron and Steel Institute, of the Institution of Civil Engineers, and of the Cleveland Institution of Engineers.

Mr. W. H. BOOTH.—We deeply regret to learn that Mr. W. H. Booth died at Worthing on November 12th. Mr. Booth was for over 30 years an esteemed contributor to our columns, and a valued friend. In our next issue we shall give an outline of his career.

Will.—The late Sir H. B. ROWELL, chairman and managing director of Hawthorn, Leslie & Co., Ltd., left £97,734 gross and £89,072 net.

CITY NOTES.

**Barcelona
Traction, Light
& Power Co.**

The financial papers have published particulars of the situation which has arisen, necessitating the calling together of the holders of the 5½ per cent. first mortgage bonds and income bonds, on November 25th, for the purpose primarily of modifying the interest payable on the first mortgage bonds.

Financial Times, the committee for the purpose, states that at the commencement of the European war it was such that it was found impossible to pay the interest on the First Mortgage bonds on "B" bonds, and provision was made to convert them in short-term notes, which, by the year 1918, were subsequently converted into

In 1918 the hydro-electric installation of the Ebró Irrigation and Power Co.—which in 1915 was in an unfinished state—was completed and nearly the entire output was sold, and work on the new installation at Camarasa, which had been undertaken to meet the demand for additional power, was well advanced. The industrial conditions in Barcelona at this conclusion of the war were so encouraging, and the growth of business so satisfactory, that there was every reason to assume that the power available from the first two units of Camarasa would be rapidly sold, and the revenue from operation considerably increased. The directors' and bondholders' committee, therefore, felt that they were justified in recommending that at least 2 per cent. interest should be paid in cash on the First Mortgage bonds, to be increased to 4 per cent. as from the 1st June, 1921. This recommendation was approved by bondholders in December, 1918, and from then to the present time interest at 2 per cent. per annum has been regularly paid, the revenue not having justified a higher rate being paid. By the arrangement the minimum rate was to be increased to 4 per cent. per annum as from 1st June, 1921, but the committee regrets to inform bondholders that owing to the change in world conditions since 1918, from those of a trade boom to those of world-wide depression, with the consequent disorganisation in exchange, the revenue of the company will not permit of the interest being raised to 4 per cent., and bondholders will be asked at the forthcoming meeting to agree that the minimum rate should continue at 2 per cent. per annum.

The directors' committee advise bondholders to agree to the proposals. These, shortly, are that the minimum rate of interest should remain at 2 per cent., but that the maximum amount payable should be raised from 5½ to 6 per cent.

Monte Video
Telephone
Co., Ltd.

At the annual meeting held on November 10th, in London, Viscount St. Davids stated that during the summer he had been out in the River Plate, and he went to Monte Video and made a very careful inspection of the company's property. He further inquired into the whole circumstances arising out of the present position of affairs. They did not boast that they gave a perfect telephone service; they gave what was a good service in the conditions under which they were permitted to work. The speaker, according to a report in the financial Press, said that the company had been at a disadvantage for a good many years in that they had not got a concession that would enable them to do the work properly. That had been the outstanding position for a long time past, but the Government had lately made up its mind that it wanted a system of its own. Recently the Government had made a contract with the Western Electric Co. to put in a system, but the contract had been made subject to ratification by the Legislature, and, as far as he knew, that ratification had not yet been given. The contract was also made subject to the capital being raised, and when he was over there there seemed to be no prospect at all that the Government would agree to the terms, as the conditions that the Americans were seeking to impose were undoubtedly somewhat onerous. So far, nothing at all had been done.

**The Zurich
Bank for
Electrical
Undertakings.**

The Zurich Bank for Electrical Undertakings.

Supplementing the report for the year ended June 30th, 1921, the management stated that since the latter date the bank's credit in marks, as a result of sales of marks and the exercise of the right of subscription to new shares, had receded from 75,000,000 to 27,000,000 marks, of which a sum of 6,500,000 marks was already engaged for impending capital increases of German undertakings. As compared with the end of June, the assets of the bank at present quotations and rates of exchange showed a further depreciation of 3,000,000 fr. The receipts from dividends and interest were being further prejudiced by the constant fall in exchange, but if the

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

lasted to the extent of £500 on August 16th and £200 on October 11th, 1921, of advantages of 1921 and 1922, and March 2nd, 1915, securing £1,300.

24,000 debentures, authorised November 1st, 1921, present issue £1,000, charged on the company's undertaking and property, present and future, including uncalled capital.

Radio Communication Co., Ltd.—Particulars of £25,000 debentures, authorised October 24th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Turner, Atkinson & Co., Ltd. (60,501).—Return dated September 8th, 1921 Capital, £175,000 in £1 shares 87,500 ordinary and 87,500 preference). 61,842 ordinary and 73,811 preference shares taken up. £26,487 paid £100,106 considered as paid. Mortgages and charges, nil.

21st, 1921. Capital, £50,000 in £1 shares (5,000 preference, 38,000 ordinary, and 7,000 deferred). 4,375 preference, 31,711 ordinary, and 7,000 deferred shares taken up. £28,680 paid. £14,400 considered as paid. Mortgage and charges about bank £47,776 13s. 2d. (about £15,000).

Every Eugene & Co., Ltd. (1914) — Return dated July 14, 1921. Capital, £45,000 in 41 shares, 1,000 lb. per cwt. common stock, preference, 20.97 cent a lb. 3 " A " 3.000 preference, 26.73 cent a lb. and 3 " A " stock of 412 520 new 417,516 (assessed) is paid Mortgage and charges, nil.

On 1 September 2012, £121,000 (previously £110,000) of 9,500 preferred shares of £1 each and 10,000 shares of £1 each, 5.512 preferred and 5.713 deferred shares taken up, £3,269.98, 3d paid above £1 per share on 2,871 preferred shares and £2,713 deferred shares and including £112.66, 3d paid on 205 shares forfeited. £2,634 considered as paid. Mortgages and charges, nil.

Return dated October 19th, 1921. Capital, 250,000 in 87,500 "A" and 12,500 "B" shares of 10s. each. 42,297 "A" and 12,500 "B" shares taken up. 91 per share called up on 42,297 "A" shares. 10s. per share considered paid on 12,500 "B" and 5s. per share on 42,297 "A" shares. Mortgage interest 414,721

South Metropolitan Electric Light and Power Co., Ltd.

Mortgages and charges, £374,000.

Brooklyn Bridge & Engineering Co., Ltd.—Incorporated in Great Britain. Capital £250,000, of which £250,000 is paid up. The company is engaged in the construction and maintenance of bridges, tunnels, and other engineering works. The company is also engaged in the construction and maintenance of bridges, tunnels, and other engineering works. The company is also engaged in the construction and maintenance of bridges, tunnels, and other engineering works.

Central Electric Lighting & Power Co., Ltd.—Particulars of £1,500 debentures authorized October 11th, 1921; present issue \$800 charged on account to property, present and future, including under the same high voltage line, and also the company for current supply and subject to the amount already bonded to the security already given in London County, Wisconsin, First Bank.

1921, to secure £500 charged on the company's undertaking and property present and future, including uncalled capital. Holder: J. H. Butler, 94 Woodland Gardens, N. 10.

after did not become still worse, the surplus from the ordinary receipts for 1921-22 would be about sufficient to cover the legal instalment of the redemption of the uncovered differences in exchange. During the discussion, Herr Wilchek, resident of the Bank für Handel und Industrie, stated that the Zurich undertaking ought to undergo a fresh reorganisation, as it was necessary to renounce the hope of any improvement in exchange. The uncovered exchange differences of 3,000,000 fr. must completely disappear from the balance sheet, the ordinary share capital be extinguished, and the majority capital be reduced by about 50 per cent. In reply, Mr. Frey, president of the bank, expressed the opinion that all hope of an improvement in exchange should not be abandoned. Germany, which introduced the gold standard in 1871, had not only the legal but also the moral obligation to restore her currency to the former basis. That would, of course, occupy many years, and the bank would have to take into consideration the question of a further re-organisation. The time for that must be left to the directors, who could produce their proposals as soon as the exchange situation had cleared somewhat, perhaps after the Washington conference.

The directors of the *Compagnie Générale d'Electricité* recommend a dividend at the rate of 60 fr. per share for 1920-1921, as in the previous year.

The *Société Industrielle des Téléphones*, which distributed dividend at the rate of 35 fr. per share out of net profits amounting to 4,119,000 fr. in 1919-1920, is reported to have earned net profits of 7,014,000 fr. in 1920-1921, for which the rate of dividend has not yet been fixed.

The *Société des Accumulateurs Electriques (Dinon)* reports profits of 592,000 fr. for 1920-1921, exclusive of any provision for depreciation, as contrasted with 1,676,000 fr. in the preceding year. As the statutory rate of interest of 6 per cent. is already being paid on the shares, no further distribution in contemplation, the balance of 246,000 fr. being carried forward. The report states that improvements had been made in the accumulators, which permitted of the batteries being put away in a charged condition without acid, the latter being added when the batteries were required for use.

An extraordinary meeting of the *Constructions Electriques du Dauphiné* held on October 15th sanctioned the increase of the company's capital from 5,000,000 to 10,000,000 fr.; the issue of 8,000 500-fr. shares, with a premium of 25 fr.

An extraordinary meeting of the *Forces Motrices de la Rochette et de Quincampoix* has approved the raising of this company's capital from 1,000,000 to 3,000,000 fr., the increase to be expended as follows:—400,000 fr. for the assets of the *Société Sarthoise d'Electricité*; 500,000 fr. for those of the *Société d'Electricité de la Sarthe*; 1,000,000 fr. for the assets of the *Omniun Française d'Electricité*; and 100,000 fr. for those of the *Compagnie Générale des Flots Electriques*. The *Forces Motrices Co.* has now changed its name to *Energie Electrique Maine-Anjou*.

Electric Construction Co., Ltd.—The directors have declared interim dividends at the rate of 7 per cent. per annum on preference and 6 per cent. per annum on the ordinary shares, both less tax, in respect of the profits for the year ending in next March.

Companies to be Struck off the Register.—The following are to be struck off the register within three months unless notice is shown to the contrary:—

Blackpool Electric Tramways (South), Ltd.
British Lamp Manufacturers, Ltd.
Electric Generating Stations, Ltd.
Electromotor Equipment Co., Ltd.
Simplex Insulators (Boulton's Patent), Ltd.

Manaos Tramways & Light Co.—The financial Press states that the ordinary meeting of this company will be held at 9, Cloak Lane, E.C.4, on Monday next, but in consequence of the appointment of the receiver and manager there are no accounts available for presentation to the shareholders.

United Electric Tramways Co. of Caracas, Ltd.—A dividend of 8 per cent. less tax for the year is announced in the financial. £14,852 is carried forward subject to E.P.D. and corporation profits tax.

American Telegraph & Telephone Co.—According to the financial Press, the \$50,000,000 bond issue of this company is been five times over-subscribed, this testifying to the abundance of money seeking investment.

Stock Exchange Notice.—The undermentioned have been listed to be officially quoted:—

United River Plate Telephone Co.—108,000 ordinary shares £5 each, fully paid (Nos. 324,001 to 432,000).

Indian Electric Supply and Traction Co., Ltd.—An interim dividend of 3 per cent. on the ordinary shares has been declared.

Chloride Electrical Storage Co., Ltd.—A dividend of 5 per cent. actual on the ordinary shares, tax free, has been declared.

British Thomson-Houston Co., Ltd.—The "Times" City Editor stated in Wednesday's issue that underwriting arrangements were being made on that day for the issue of £1,000,000 7 per cent. mortgage debenture stock of this company at the price of 92½. The prospectus will probably be published next week. The issue, which forms part of a total of £3,000,000, will be repayable by May 1st, 1962, by the operation of a sinking fund beginning next year.

North Melbourne Electric Tramways & Lighting Co.—The financial Press states that the gross receipts for the year ended September, 1920, were £53,683, against £45,764 in the previous year, and the net revenue was £18,232, against £11,225.

STOCKS AND SHARES.

TUESDAY EVENING.

THE strength of most Stock Exchange markets continues unabated. There is plenty of money available for investment in gilt-edged issues. One after another, substantial lines of stock are offered to the public, and these find, as a rule, a home readily enough. At all events, there is no difficulty in getting them underwritten, and this is what the promoting-houses desire first of all. The railway markets are not exciting. Undergrounds have given way in consequence of the proposal of the L.C.C. to re-institute penny fares on the trams. It is thought that this step may have to be followed by the L.G.O.C. on those routes over which there is tram competition. Coming at a time when the company is contemplating big extensions and capital expenditure, any prospect of diminution of fares puts a little anxiety into the minds of stockholders. Therefore Underground Incomes are down to 66½, and the £10 shares to 30s. Metropolitan Consolidated is ½ down, but Districts gained the same fraction.

The international event of the week has been the proposal of the United States to Great Britain and Japan, that the three countries should agree upon a battleship-building holiday for ten years. On the strength of this, armament shares promptly dropped. Vickers were 12s. and gave way to 10s., Armstrongs following less rapidly, but in the same direction. There has been a trifling rally from the worst, on the assumption that, in any case, it will be months before anything definite is done. The bold suggestion would be gladly welcomed if it were felt to be practicable in the light of the insular position of this country, the present unemployment difficulties, and the steady resuscitation of German industry. There is plenty of material upon which the theorists, statesmen, and others can sharpen their wits. Apart from the heaviness in Armament shares, the mere prospect of freedom for ten years from excessive naval charges has helped the strength of the tone in gilt-edged stocks and shares.

The River Plate Electricity Co. has sent out a letter to the holders of the 5 per cent. debenture stock, in which the secretary says:—

"We shall be glad if you will present the certificate for debenture stock held by you to be exchanged for a new certificate to bear reference to the Deed of 22nd June, 1914, whereby there was secured to the Trustees for the benefit of the stockholders a fixed mortgage charge upon certain heritable property of the company at La Plata and a floating charge upon its undertaking and all other assets."

This has aroused comment from the fact of the matter having been apparently overlooked for no less than seven years, and some stockholders are inclined to wonder why the step now proposed was not taken previously.

Matters in Mexico seemed to have marched once more to their favourite deadlock. President Obregon cannot arrive at a satisfactory basis for agreement with the United States Financial Commission with regard to a formula agreeable to both, which shall enable recognition of Mexico by America, and the subsequent issue of a loan from the latter to the former. Efforts are still being made, we understand, to bring about a frame of mind compatible with the dignity of both parties, but sufficiently complacent to enable mutual agreement to be reached. Meanwhile, as is natural, prices of Mexican issues, Government, utility, mining and railway, continue to languish, and this is the reason why prices of the Mexican tramway and lighting companies have been depressed during the past few weeks. Mexico Tramways First mortgage bonds are 4 points lower.

Charing Cross Ordinary at 4½ are ¼ up, and St. James's at 6½ are similarly better. The electric lighting market is good throughout. County of London new debenture stock has risen to 8 premium. Metropolitan Electric Extension debenture is better at 104. South Metropolitan preference hardened to 16s. 3d. The improvement has extended to the manufacturing group.

General Electrics at 17s. 6d. are 9d. higher, and rises have occurred in Electric Constructions, English Electric ordinary and preference, and Siemens. Recent uneasiness has been replaced by a better tone, and prices had slumped to such

levels as tempted speculative purchasers to take a hand. In addition to this, there came a little buying into the market on behalf of people who had bought shares at substantially higher figures, and, who were content to average at the present levels.

Cable manufacturing shares are also better. Callenders improved to 27s. 6d., and the company's $\frac{3}{4}$ per cent. "B" preference shares are higher at £1. Henleys have risen to 29s. 3d., the preference to 3 5/16. Telegraph Constructions are unchanged at 21s. Amongst other miscellaneous issues may be mentioned India-Rubber shares, which, nominally 13s. 9d., changed hands the other day at 11s. 9d.

Shanghai Electric ordinary at 15s are 10s. higher. Anglo-Argentine Tramways 5 per cent. debenture stock at 64½ is 1½ up. Metropolitan Electric 4½ per cent. irredemable debenture advanced to 57½. Manasos Tramways first debenture at 40½ is 8 points down, which is not very surprising, considering the financial condition of the company.

Marconi's eased off to 32s. 6d., and other wireless shares are dull. Cable stocks are scarcely so steady, there being small falls in Eastern Telegraph ordinary and Anglo-American preferred. Chili Telephones shed ½; United River Plates, however, hardened to 5½.

Rubber shares are again better. The price of the material is within a few farthings of 1s. a lb., and, with very little stock about, substantial buying orders from the North and Midlands caused material recoveries in share prices. The market continues firm, though it is noticeable that upon any profit-taking the list easily yields ground. Business in the rubber and other industrial sections is better than it was at the beginning of the month. The reduction in the Bank Rate is obviously bringing a good deal of new capital into all the markets.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend.	Price.	Rise or	Yield
	1919, 1920.	Nov. 15, 1921.	fall.	p. c.
Brompton Ordinary	12 11	8 4	—	29 18 0
Charing Cross Ordinary ..	7 8	4 4	—	8 17 10
do. do. do. 4½ Pref. ..	4 4	4 8	—	7 4 4
Chelsea	4 6	5 4	—	9 4 8
City of London	10 14	28 9	—	10 6 6
do. do. 6 per cent. Pref. ..	6 6	17 6	—	6 17 2
County of London	8 8	8 8	—	9 10 4
do. do. 5 per cent. Pref. ..	6 6	7 4	—	7 10 0
Kensington Ordinary	7 9	4 6	—	9 14 6
London Electric	2 2	2 2	—	7 10 0
do. do. 6 per cent. Pref. ..	6 6	8 3	—	10 0 0
Metropolitan	6 7	8 9	—	9 6 8
do. 4½ per cent. Pref. ..	2 4	2 4	—	7 13 2
St. James' and Pall Mall ..	12 12	12 6	+ ½	8 17 10
South London	6 7	2 2	—	10 13 2
South Metropolitan Pref. ..	7 7	16 3	+ 6d.	8 12 4
Westminster Ordinary ..	10 10	6 4	—	8 13 10

TELEGRAPHS AND TELEPHONS.

Anlo-Am. Tel. Pref.	6 6	8 2	— 1½	7 5 7
do. 1½ Def.	14 14	17 17	— ½	4 18 6
Chile Telephone	6 6	6 6	— ½	5 17 3
Cuba Sub. Ord.	7 7	7 7	—	10 0 0
Eastern Extension	10 10	10 16	—	6 1 0
Eastern Tel. Ord.	10 10	10 16	— 1	6 2 4
Globe Tel. and T. Ord. ..	10 10	10 16	—	6 1 0
do. do. Pref.	6 6	6 6	—	6 9 9
Great Northern Tel.	22 24	25 25	—	9 12 0
Indo-European	10 10	10 30	—	6 8 8
Marconi	25 15	18 18	— ½	9 4 8
Oriental Telephone Ord. ..	12 12	2 2	—	8 0 0
United R. Plate Tel.	8 8	8 8	+ ½	8 2 3
West India and Panama ..	Nil Nil	Nil Nil	—	Nil
Western Telegraph	10 10	10 16	—	6 1 0

HOME RAILS.

Central London Ord. Assented ..	4 4	4 4	—	8 1 8
Metropolitan	14 14	23 23	— ½	6 10 5
do. District	Nil Nil	16 16	— ½	Nil
Underground Electric Ordinary ..	Nil Nil	14 14	— ½	Nil
do. do. "A"	Nil Nil	6 6	—	8 11 4
do. do. Income	4 2	6 6	— 2	4 10 4

FOREIGN TRAMS, &c.

Anglo-Arg. Trams, First Pref. ..	5 12	22 22	—	10 9 6
do. do. 2nd Pref.	Nil 5	22 22	—	19 4 8
do. do. 5 per cent. Deb. ..	Nil Nil	5 5	+ 1½	7 15 0
Brazil Traction	Nil Nil	20 20	— 1	Nil
British Columbia Elec. Rly. Pref. ..	5 5	5 5	—	8 12 1
do. do. Preferred	6 9 9	5 5	—	9 5 0
do. do. Deferred	3 12 4	3 3	+ 1	11 13 10
Mexico Trams, 5 per cent. Bonds ..	Nil Nil	3 3	— 4	7 5 4
do. do. 6 per cent. Bonds ..	Nil Nil	5 5	—	Nil
Mexican Light Common	Nil Nil	10 10	—	Nil
do. do. Pref.	Nil Nil	5 5	—	Nil
do. 1st Bonds	Nil 5	5 5	—	9 10 6

MANUFACTURING COMPANIES.

Babcock & Wilcox	15 16	2 2	—	6 18 8
British Aluminium Ord. ..	10 10	10 19	—	10 0 0
British Industrial Coal	15 16	14 14	—	10 0 0
do. do. 2½ Pref.	15 16	14 14	— ½	10 18 2
Crompton Ord.	10 10	14 16	—	13 15 10
do. do. 5 per cent. Deb. ..	5 5	5 5	—	7 9 1
Electric Construction	10 10	17 6	+ 9d.	10 6 6
English Electric	8 8	10 9	+ 3 3	14 18 0
do. Pref.	6 6	12 6	+ ½	9 12 0
Gen. Elec. Pref.	10 10	16 6	+ 6d.	7 17 6
do. do. 2nd Pref.	10 10	17 6	+ 8d.	11 8 6
Honey	15 15	29 3	+ 1 9	10 5 2
do. 4½ Pref.	4 4	4 4	—	6 15 10
India-Rubber	10 10	5 5	—	9 18 8
Mot. Vehicles Pref.	8 8	10 10	—	9 10 10
Stemens Ord.	20 20	21 21	+ 9d.	5 11 9
Telegraph Com.	20 20	21 21	—	5 11 9

Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 16th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
Acid, Oxalic	per lb.	9d.
Ammoniac Sal	per ton	26s
Ammonia, Murate (large crystal) ..	"	46s
Bisulphide of Carbon	"	"
Borax	"	28s
Copper Sulphate	"	230
Potash, Chlorate	per lb.	6d.
Perchlorate	"	1d.
Shellac	per cwt.	£17 10s.
Sulphur, Sublimed Flowers	"	21s
do. Lump	"	21 4
Soda, Chlorate	per lb.	24s.
Crystals	per ton	27
Sodium Dichromate, casks	per lb.	6 3/4
METALS, &c.		
Babbitt's Metal Ingots	per ton	£80 to £275
Brass (rolled metal 3" to 12" basis) ..	per lb.	10 3/4
do. Tubes (solid drawn)	"	10 1/2 to 10 3/4
Wire, basic	"	1 1/4
Copper Tubes (solid drawn)	"	1 1/2
Bars (best selected)	per ton	£101
Sheet	"	£101
Rod	"	£101
(Electrolytic) Bars	"	27 10s.
Wire Rods	"	£145 10s.
Wire Rods	"	£145 10s.
H.C. Wire	per lb.	1 1/4
Ebonite Rod	"	8/6
Sheet	"	8/6
German Silver Wire	"	2/9
Gutta-percha, fine	"	13/6
India-rubber, Para fine	"	1 1/2
Iron Pig (Cleveland Warrants)	per ton	Nom.
Wire, galv. No. 8, P.O. qual. ..	"	4/ to 8/
Lead, English Pig	"	25s 6s.
Mercury	per bot.	£9 10s. to £10
Mica (in original cases) small	per lb.	3d. to 3/
do. " " medium	"	4/ to 5/
do. " " large	"	10/ to 20/- & up
Phosphor Bronze, plain castings ..	"	"
do. " rolled bars and rods ..	"	"
Silicon Bronze Wire	per lb.	1/8
Steel, Magnet, in bars	"	1/8
Tin, Block (English)	per ton	£156 10s. to £157
Wire, No. 1 to 18	"	22 to £210s. in.
White Anti-friction Metals	per ton	£65 to £275

Quotations supplied by—

G. Boor & Co.	J. James & Shakespear.
Thos. Bolton & Sons, Ltd.	Edward Tilt & Co.
Frederick Smith & Co.	Bolling & Lowe.
F. Virgine & Sons.	Richard Johnson & Nephew, Ltd.
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	P. Ormiston & Sons.
W. F. Dennis & Co.	

Water Power in Finland.—Mr. Hugo Malmi, one of the engineering members of the Finnish State Water Power Committee, which has under consideration the question of utilizing the falls of the Imatrate for railway and other purposes, states that so far only the smaller waterfalls in the country have been brought into use, although these represent a total of 200,000 h.p., apart from steam generating stations. It is calculated that if the consumption of power grows in the same proportion as in pre-war times, an additional 300,000 h.p. will be required in ten years' time. The Government proposes to combine some of the lesser falls with the Imatrate, and the total amount to be paid for the expropriation of the former, and of adjoining land, has been appraised at 5,072,000 Finnish marks, which sum has already been sanctioned by the Parliament. It is not expected that the proposed hydro-electric works on the Imatrate will be able to supply power for five years. The method of financing the undertaking has not yet been settled, but it is suggested that a joint stock company may be formed for the purpose and the State hold a large financial interest therein, particularly as the State railways are to be converted to electric traction.

The Imatrate scheme is said to have awakened interest in other countries, and foreign experts have visited the site of the projected works, and also sought information on the question at the office of the Water Power Committee.

Reduction of Electrical Fires in the United States.—According to a recent compilation it appears that out of 138,553 fires which occurred in 1919, only 3,568, or 2.57 per cent. were of electrical origin. More recent reports state that in Cambridge, Mass., in 1920 there were 780 alarms, with a total fire loss of \$431,905. Only one fire was of electrical origin. In Springfield, Mass., there were 1,002 fires, with a total fire loss of \$360,115, of which only three were due to electrical causes. In Carthage, Mo., there were 64 fires, only one being caused by defective wiring. It is said that 56 cities and towns have reported no fires of electrical origin during 1920. The total fire loss for these cities and towns was over \$1,800,000. *Scientific American.*

RESEARCH ON INSULATING OILS.

THE SELECTION OF THE BEST FORM OF SPARK GAP FOR DIELECTRIC STRENGTH (BREAKDOWN VOLTAGE) TESTS.

We have received from Mr. E. B. Wedmore, director and secretary of the British Electrical and Allied Industries Research Association, the following communication:—

This problem is one of those arising out of researches initiated by the Institution of Electrical Engineers, which has been transferred to the Electrical Research Association, and owing to the importance and immediate value of the results obtained, it is decided to make some of these public in advance of other information.

These results lead to the conclusion that spherical electrodes should be employed, and it is recommended that they should be half an inch in diameter and spaced 0.15 inch apart. Such electrodes prove to be very sensitive to the presence of contaminating particles of moisture and fibrous and other material. The use of spherical electrodes admits of an accurate calculation of the maximum stress to which the oil is subjected.

The Association is indebted to Mr. A. R. Everest and the British Thomson-Houston Co., Ltd., for a valuable contribution to this subject contained in a report summarised below, which establishes two facts of the first importance:—

1. That different forms of electrodes show widely different degrees of sensitiveness to the presence of contaminating matter. The uniformity of results obtained by the use of a needle point electrode is proved to be due to want of sensitiveness of such an electrode to the presence of contaminating matter, and therefore indicates the unsuitability of this type of electrode for the purpose in question.

2. That the relationship between the test results obtained

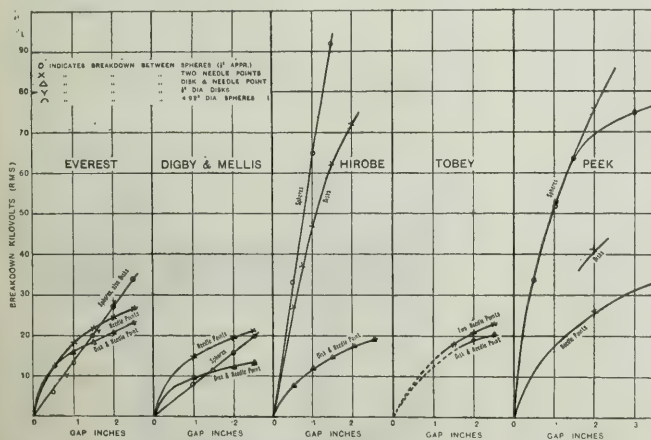


FIG. 1.—VARIATION OF BREAKDOWN VOLTAGE IN OIL WITH LENGTH OF GAP.

with different kinds of electrodes cannot be expressed by fixed ratios because the results are dependent upon the quality of oil tested with special reference to the amount of contaminating matter it contains.

INFLUENCE OF THE FORM AND DIMENSIONS OF SPARK GAPS ON THE OBSERVED BREAKDOWN VOLTAGE IN OILS.

Various types and settings of spark gaps are in use for commercial testing, principally:—

- ½-in. disks spaced 0.2 in. apart.
- 1-in. disks spaced 0.1 in. apart.
- ½-in. spheres spaced 0.15 in. apart.
- Needle points.
- Point and disk.

It is desired to ascertain the relation between them, and the relative merits of each type.

Table 1 shows the results obtained by various investigators (including the present investigation) with several different types of electrodes, and in each case with a gap setting of 0.15 in. The tests are arranged in the order of goodness of the oils indicated by the sphere-gap tests.

By examination of the figures it will be seen that the effect of thoroughly drying and filtering the oil shows up to the most marked extent in tests with sphere gaps; to a somewhat lesser extent with disks; while tests with needle points or point and plate do not indicate the quality of the oil as regards wetness or dirt.

The relative values of results obtained with different types of electrodes on a particular oil depend therefore upon the quality of the oil itself.

TABLE I.
R.M.S. BREAKDOWN VALUES WITH A COMMON GAP
LENGTH 0.15 IN.

Investigator.	Spheres gap 0.15"	Disks gap 0.15"	Needle points gap 0.15"	Point & plate gap 0.15"
Tobey, 1910 (1) ...	—	—	18,000	16,500
Digby and Mellis, 1910 (2) ...	11,500	—	17,500	11,000
Present investigations	20,000	20,000	22,000	18,500
American National E.L. Assn. transformer standard (3) ...	40,000	29,000*	—	—
Peek (4) specially dried and filtered oil ...	64,000	31,000†	22,000	—
Hirobe (5), do., do. ...	92,000	62,000	—	15,000

1. A.I.E.E., Vol. XXIX, 1910.

2. I.E.E., Vol. XIV, 1910.

3. Report of the Electrical Apparatus Committee, National Electric Light Association, June, 1917.

4. G.E. Review, August, 1915, and elsewhere.

5. "Electrical Insulating Properties of Transformer Oil," Report No. 25 of the third section, Electrotechnical Laboratory, Tokio, Japan.

THE PRESENT INVESTIGATION.

This was initially undertaken to establish a basis which would permit the correlation of measurements taken with different types of spark gaps upon commercial oils.

The conditions were, therefore, arranged to secure the following features:—

- (a) A good commercial grade of oil.
- (b) Neither unduly dry nor unduly wet.
- (c) Uniformity in quality throughout the tests.
- (d) Precautions to avoid false results due to foreign matter on the spark gaps and testing vessels.
- (e) Tests with each type of spark gap to cover a working range up to above 30,000 volts.

Oil Tested.—The oil used was the Vacuum Co.'s Gargoyle A.F. in the condition received; it was brought to the laboratory in two 5-gallon steel drums which had been properly cleaned, dried and filled from one large drum.

The Electrodes.—The electrodes used, as shown in fig. 5, were two ½-in. dia. spheres, two ½-in. dia. disks, two needle points and a needle point with a 1-in. dia. disk. The sphere and disk electrodes were of brass mounted on brass rods tapped with a 2 B.A. thread. The needle point electrodes consisted of graphophone needles ("His Master's Voice") held in split brass tubes. These

needles proved to have points with a radius of 0.0018 in. New needles were fitted after each breakdown, except in one or two tests with the 0.05 in. gap. In the case of the spheres, fresh points on the surfaces were brought opposite each other after half the total number of breakdowns had been made. The lengths of the gaps were adjusted to hardened steel gap gauges. In all cases the common centre line of the electrodes was horizontal.

The Containing Vessel.—The tests were made in a small rectangular glass cell, the oil being 1 in. above the electrodes.

Cleaning the Electrodes and Container.—The dielectric properties of oil being much affected by the presence of fibrous dust, the following precautions were taken to remove such dust left on the electrodes and the inside of the containing vessel after cleaning them with cotton cloths:—

A small quantity of oil was introduced into the containing vessel and the gap between the electrodes adjusted. The potential of one of the electrodes was then raised as high as possible without causing a breakdown in the oil in order to attract the dust particles to the electrodes and into the region between them by the electrostatic force. After about a quarter of a minute the electric potential was removed, the electrodes taken out and washed by pouring fresh oil over them, and the oil in the containing vessel poured away.

* The N.E.L.A. (Ref. 15) gives 40,000 V with ½-in. spheres as equal to 22,000 V with 1-in. disks spaced 0.1 in. apart. Other determinations show that this corresponds to 29,000 V. with ½-in. disks spaced 0.15 in. apart.

† Peek states that the oil gave 41,000 V r.m.s. tested between ½-in. disks spaced 0.2 in. apart.

This process of collecting and removing the dust particles was repeated two or three times after the cleaning of the electrodes with a cotton cloth, after which from 20 to 25 breakdown tests would be made before the electrodes were again cleaned.

Procedure of Test.—The r.m.s. value of the breakdown voltage was recorded for each oil sample, and only one breakdown was made with a sample. The mean of ten such readings with a particular gap length was taken as the breakdown voltage corresponding to that gap length. The voltage at which the first preliminary spark passed in each sample was also observed; with the two needles and needle disk electrodes, the sparking was violent and almost continuous at potentials just below the breakdown value.

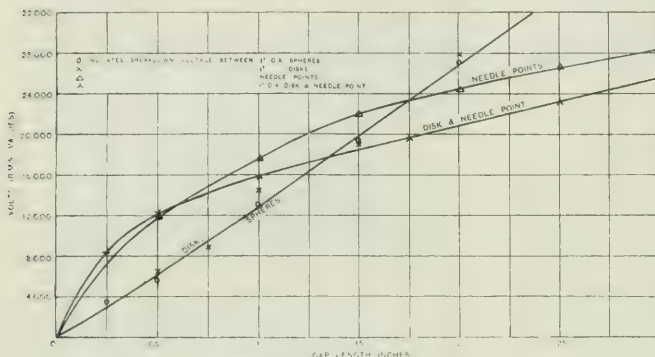


FIG. 2.—OIL SPARK-GAP TEST.

Results.—The average breakdown values are shown on curves in fig. 2, each point being the mean of ten readings. Both the breakdown and preliminary sparking values are shown in Table II.

TABLE II.

(Average) Values Observed (r.m.s.).

B.D. = Breakdown. P.Sp. = Preliminary Sparking.

Spacing	3/8" spheres.		1/2" disks.		Needle points.		Point and plate.	
	B.D.	P.Sp.	B.D.	P.Sp.	B.D.	P.Sp.	B.D.	P.Sp.
0.025"	3,570	2,910			8,430		7,075	
0.05"	5,712	4,351	6,510	4,680	11,950	8,140	12,250	8,256
0.075"			8,950	6,220				
0.100"	13,185	7,583	14,500	7,380	17,760	13,500	15,980	11,810
0.15"	19,530	11,140	19,060	11,070	22,090	16,300		
0.175"							19,660	11,680
0.200"	27,160	15,340	27,900	22,080	24,100	18,750		
0.250"					26,730	20,390	23,340	17,360

In order to determine the errors which might be introduced by burning of the needle point by spark or otherwise, a special test was made, from which it was found that the

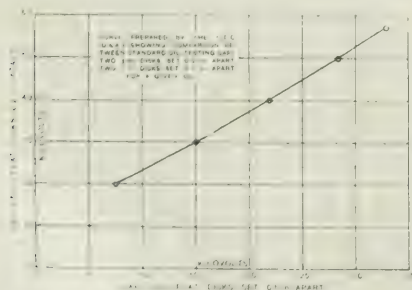


FIG. 4.—COMPARISON BETWEEN OIL TESTING GAPS.

burning of the needle point by testing did not sensibly affect the result, so long as the spacing was maintained.

CONCLUSIONS

Spheres and Disk.—The 3/8-in. disks and two 1/2-in. spheres at the same spacing have practically equal values for oil not abnormally dry and clean, and within the range of test values

generally employed in commercially checking the quality of the oil.

As indicated in Table I, spheres give higher values than disks for oil which is extremely free from moisture and dirt. **3/8-in. Disks and 1-in. Disks.**—The relation between 3-in. disks spaced 0.2 in. and 1-in. disks spaced 0.1 in. apart has been carefully determined by the General Electric Co., I. S. A., for oil in commercial condition, and is shown in curve fig. 4.

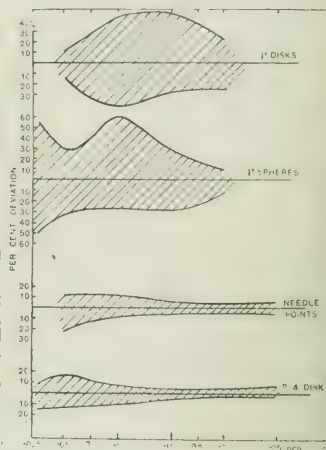


FIG. 3.—CURVES SHOWING PERCENTAGE DEVIATIONS OF INDIVIDUAL READINGS FROM THE MEAN.

Needle Points.—For small settings (below 0.18 in.) these give higher values than disks or spheres at the same spacing. For spacings above 0.18 in., the results with needle points are seen to be lower.

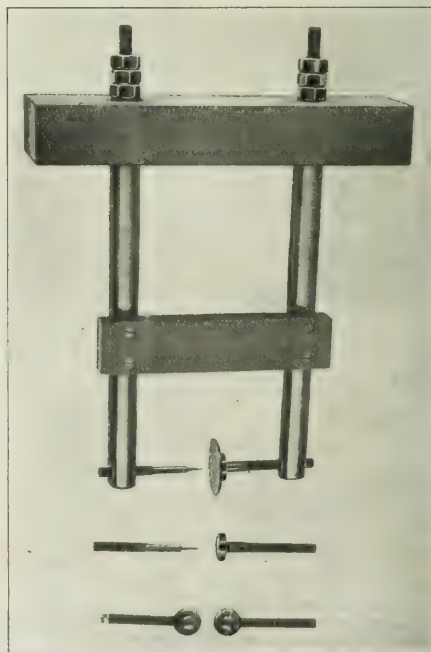


FIG. 5.—ELECTRODES USED IN THE TESTS.

As indicated in Table I, tests with needle points do not indicate the quality of the oil as regards wetness or dirt.

Point and Plate.—For small spacings and with the plane of the plate vertical, these give results very similar to needle points. Examination of numerous records shows that results in general depend largely upon the diameter of the plate (particularly with other than small spacings), and also upon

the position of the plane of the plate, i.e., whether horizontal or vertical.

Irregularity of Readings.—Curves in fig. 3 show the per cent. deviations of the individual readings from the mean of each set. It will be seen that with oils of the character tested, the widest deviations occur when tested with spheres or with plates, while readings with needle points (or point and plate) are much more uniform. This is associated with the fact noted above, that tests with needle points do not indicate the presence of moisture or impurities.

Preliminary Sparking.—The observed values of the first preliminary sparking (P.Sp.) are shown in Table II. When testing between needle points, or between point and disk electrodes, the sparking was violent and almost continuous at potentials just below breakdown value.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Inaugural Address,

By J. S. HIGHFIELD, President.

(Abstract.)

(Concluded from page 659.)

I hope to see more engineers take a scientific interest in the finance of the works they control and design, so as to help in their better management. It should be realised that savings are invested in enterprise only with the hope of profit, and that those who shoulder the responsibility for financing industry carry a very heavy burden. On this subject I quote the words of Lord Kelvin on retiring from this Chair on January 9th, 1890. They show the wonderful range of his sympathy and understanding.

"The Institution of Electrical Engineers has for its province practical applications of electricity and allied branches of science. But science, whether of electric instruments or of nautical operations, or of the heavy engineering work of stress and strength of materials and machines for working with cables in depths of from two to three nautical miles, cannot go on without the sinews of war; and I feel that those who have supplied the sinews of war, and have stood by from the beginning of the submarine cable enterprise up to the present time, ought not to be forgotten by an Institution of Electrical Engineers. . . . Sir John Pender gave a guarantee of a quarter of a million sterling for the funds required to complete the enterprise of two cables across the Atlantic. Without that guarantee many and many a year would have passed before we should have had the Atlantic crossed by cables, and before ocean telegraphy would have had the great advance it has had. I repeat that a Society of Electrical Engineers has a double duty—a duty to science, to get all the good it can out of science; a duty to satisfy those who pay for the work that the work is good, a duty to encourage them to bring forward new work and to show that new enterprise has a chance to be successful."

Bearing this double duty in mind there is much technical work in front of engineers that will tend to the expansion of business.

A reduction in the cost of transmitting electricity is of first importance. We are far from the end of invention in this matter; new methods are required. There is more water power available in this country, and especially in Wales and Scotland, than has been realised, and in this connection the work of the Water Power Resources Committee—consisting largely of our own members—is to be commended. But the fullest use of these resources depends on cheap transmission. The cable makers have done much to help, and have succeeded, despite increased costs, in improving the design of cable so as to transmit electricity at little more than the cost before the war. The greater facilities for overhead lines given by the Electricity Act are useful, and should give opportunities for providing electricity in many districts, especially rural districts, impossible by underground cables. Attention should be directed to the means of connecting the lines to the consumers' apparatus; switchgear and other subsidiary plant should be simplified even at the expense of security, in order to reduce cost. In the past we have been very careful to provide a secure supply, but in view of the reduced wealth of the nation, I think we have gone too far in this direction. Many manufacturers are content to depend for the running of their mills and works on a single gas or steam engine, and suffer occasional stoppages, which they regard as events which cannot be avoided except at prohibitive cost. We can easily give greater security than this, without unnecessary safety devices or an undue amount of spare plant, and there is no sense in trying to provide more, since there is not the money to pay for it. In short, our attention should be directed, and in fact is being directed, to amending design so as to reduce cost.

On the management side of the business, there is the important problem of arriving at a satisfactory tariff. The introduction of the wire lamp, and its general use about 1910, resulted in the cost of lighting by electricity being reduced by one-half; further improvements in lamps have resulted in the cost of electric lighting, as compared with the cost in 1908,

being reduced by about one-half, so that the revenue from the lighting of small premises is now so small as not to pay the cost of service charges. In short, the lighting consumer has not paid his fair share of the increased cost. The result is that in many districts the cost of electricity for power and heating has, of necessity, been retained at too high a figure.

It is now generally realised that the tariff should be arranged so that two meters are not required. It is most desirable that the consumers should obtain the benefits of electricity for all purposes without being put to the cost of double wiring. This necessitates a system of charging which will enable electricity for all purposes to be supplied through one meter on what is known as the "contract system" or "two-part tariff." The Electrical Development Association has done excellent work in pressing that the "two-part tariff" should be made a legal tariff. Before the war, in thousands of cases, the "contract system" was used, the alternative being a flat rate of, say, 8d. per unit. Owing to the great increase in cost, it has not been possible to maintain the "contract tariff" with a maximum price of 8d. per unit, and the system has fallen into disuse, but since practically all items of cost are at the present time twice what they were in 1908, the logical thing would be to double the maximum price. This would enable the price for lighting to be raised to a reasonable figure and would avoid the necessity of overcharging for power and heating. It would also enable the "contract" or "two-part tariff" to be put into use at once, with its resulting benefit to the industry and to the consumer.

Apart from this technical work, progress in electricity supply rests first on a general determination to cease talking and to get to work. We must necessarily depend for guidance on the Electricity Commissioners, and I am sure the general view, and certainly my own, is that they provide for the supply industry a skilled tribunal in which increasing confidence is being placed. They have a very difficult task to perform, and all the help we can give them should, and will, be given.

The difficulty of their task was enormously increased by the Act that gave them a constitution. It gave them too little freedom from political control. It equipped them with duties both executive and judicial. This combination of duties necessarily increases their difficulties, and, in my humble opinion be of any value, they should concentrate on the judicial and advisory side of their work.

Among the duties of the Commissioners is the fixing of maximum prices, and I have unfortunately found a tendency to exercise too much control, a tendency to fix the actual selling price and not the maximum price. Before the war there was a wide margin between the price charged and the maximum price, and the margin is necessary to meet contingencies. There has been delay in dealing with applications. I think that we had all hoped that our Commissioners would be free from red-tape methods, but I am sorry to observe signs of that baffling material.

The question is important to us all, not only to the electricity supply industry. In my own direct knowledge, several hundred thousand pounds have been lost to the industry through delay, most of which would have been spent with electrical manufacturing firms for extension of plant and cables to supply waiting consumers with the electricity they desired.

I make these remarks in no carping spirit. I am sure the Commissioners, men whom many of us know and greatly respect, desire to form an ideal Government office; and I think it is doing them a disservice to allow faults to pass unnoticed, and I know they will not resent fair criticism which is one of the sources of efficiency. The efficiency of a Commission, possessing far-reaching powers, is vital to the electricity supply industry, and to the whole manufacturing industry of which it is the foundation.

Any public service must of necessity be subject to some degree of control. The important matter is that this control be directed with understanding and with sympathy. There is, I am sure, a general belief that these qualities will be shown by the men chosen as Electricity Commissioners. Their efficient work will depend on close co-operation and firm trust between them and the industry; given this, the Commissioners should be of great service in removing, in a fair way, all those obstacles which have, for so long, restricted full development.

What are the main obstacles to rapid progress? The first, I think, is a feeling of uncertainty and insecurity, unfortunately created by the Electricity Supply Bill as first presented. This threatened the existence of every company undertaking and contained admittedly unfair proposals for purchase of both municipal and company works by new State-aided boards. These boards were to carry out in all industrial districts the work for which the power companies were established with Parliamentary sanction. This feeling of uncertainty still exists in spite of the fact that in the Act this feature was removed.

This feeling can be dissipated only by a clear proof that in any scheme the existing rights both of companies and of municipalities will be respected. The restoration of confidence by a feeling of certainty that such is the policy of the Commissioners, is of the first importance.

Second in importance, I think, is that companies and municipalities should realise that they are both charged with the duty of providing the public with electricity, and should help each other to supply it in the least expensive way. I was

oughted to welcome the address of the President of the Incorporated Municipal Electrical Association. It is a courageous and just statement of the proper relations of companies and local authorities, and, if the advice be acted on, it should not be long before real progress is made in electricity supply.

The third obstacle to progress is the purchase clause in Provisional Orders. The 21 years' clause in the Act of 1882 absolutely stopped progress for six years. The present clause severely hampers the industry, and I should like to see it revoked unconditionally. I am aware that this is a radical suggestion, but I do not make it lightly. No single change would do more to promote enterprise and to supply the public at the least cost; any conditions must necessarily be paid for by the consumer. All the technical improvements in sight would not produce the beneficial results that would follow this change. It would enable much obsolete plant to be scrapped which now must be kept. It would give heart to the director who desires to raise more capital and to push forward his business, but who dare not and cannot raise money, when he may be forced to sell the undertaking in a few years. There would not be the very necessary tendency to keep prices as high as possible, in order to provide a sufficient reserve to purchase new plant to continue the business, and to provide for an unknown future. Again, the waste consequent upon a change of ownership of a great public business is enormous, and results in an increased price to the consumer.

The difficulty about the change is that the right of purchase is a Parliamentary bargain. The local authorities are entitled to enjoy it, and the difficulty can be overcome by their good offices alone, but since their desire is to benefit the general body of ratepayers, and since cheap electricity is so desirable, I hope they may consider the suggestion in the most liberal spirit and try to find a solution of the difficulty.

For dwelling on matters of money and trade my excuse is the present very serious state of business generally, and the urgent necessity to rebuild our export trade. This depends on a healthy home trade; home and export trades are mutually dependent; and since the prosperity of one trade usually helps others, I hope that all our members, while actively pushing their own business, will do what they can to help their friends. In this connection, the buying of goods from abroad is a matter that requires attention. The reasons for buying foreign plants are often sufficiently good. At the same time, it should be recognised that the price paid to the foreigner is not necessarily the whole sum paid; some portion of the price may take the form of increased payments in taxes and rates to provide for unemployment at home.

At the present moment profit is no longer earned by the great trading community of these islands, and, in consequence, many are wanting work and many are in distress.

As a trading community, we must reduce cost and increase output, and also, where possible, the reserve, and we must, as any trader has to do at times, reduce prices to recoup markets, even if an apparent loss results, and all concerned must shoulder their share of the loss.

Each trade, and each trading association, must attend to its own affairs and restore its own profit, to lead to the common end of restoring national prosperity. Masters should instruct their men and make clear the conditions for success. They are taking more trouble in this matter than has been usual in the past, and I have no doubt that the result will be a common understanding and co-operation between masters and men such as has not been known for years.

North-Western Centre. LIVERPOOL SUB-CENTRE.

On November 7th Mr. G. H. NISBETT, chairman of the Sub-Centre, read his inaugural address, of which an abstract follows.

As time goes on, that part of the electrical industry connected with power and lighting supplies is more and more dependent for its prosperity on the enterprise of the Electricity Supply Authority, and of the wiring contractor. It is only to the power and lighting consumer at present unconnected that we can look for new business, and it seems to me that power supply has been unduly boomed to the neglect of the greater possibilities of lighting. The cost of power to the average factory, eliminating exceptional cases such as rolling mills, &c., is no more than 1 per cent. to 2½ per cent. of the cost of the finished product. It is evident, therefore, that power supply need not be considered from the point of view of furthering any national object, but only with a purely business outlook. The profit obtainable from power supply will always be strictly limited, because the saving effected at a central station compared with power generated locally is largely offset by the cost of and losses in transmission.

Now, the lighting side of the business seems to be in a very different position. In a private house convenience comes a long way first, and cost is quite secondary. Moreover, the consumption of energy by the average lighting consumer is so small that it is out of the question for him to put down his own plant. Electricity as a means of illumination stands without a rival—one cannot imagine a single dwelling house being without a supply if only the initial cost of wiring could be overcome; all new houses, even workmen's cottages, are wired as a matter of course, so that the daily cost does not

stand in the way of even the poorest of us. This is evident from the fact that many districts have raised their price for lighting to 10d. and even 1s. per unit without the loss of a single consumer.

It follows that, electric lighting being so much more of a monopoly than power supply, very much higher profits on the turnover can be obtained, and generally are obtained. This fact has been presumed upon in many districts to subsidise power supply at the expense of the lighting consumer.

I hope I have said enough at least to call the attention of supply authorities to this question, and perhaps induce them to give the potential lighting consumer some added encouragement to wire up and use the supply. I am not suggesting the neglect of power supply, but rather the cessation of the neglect of the lighting side of the business that has taken place. The average man gets very little encouragement to become a consumer. The supply is given him inside his front wall, and he is left almost entirely to his own devices as to how to utilise it. He is told that he must get a contractor to wire his house, and has to make the best bargain he can, not knowing in the least what he ought to get for his money, or having any guidance in the art of illumination. It is necessary to see that he is saved from as much trouble as possible, and is assured of a sound installation at a reasonable price with a suitable number and disposition of lamps. To ensure this, I suggest that the Supply Authority should make itself responsible to the consumer for the wiring of his house; quote him a price for his wiring, and see it properly carried out both as regards quality of work and position and size of lamps. The authority would previously have made a list of approved wiring contractors in the district, and should prepare a specification to which the wiring contracts would be let, having in mind desirability and cheapness. Having obtained a consumer's order, it should sub-let the contract, without profit to itself, to one or other of the wiring contractors. Or as an alternative, the authority should act as consulting engineer for the job. This advisory work should be free of charge, as the authority receives its remuneration in the after business done with the consumer.

Both these proposals ensure good work and the avoidance of unnecessary cost, but bearing in mind that the great deterrent to a large expansion in lighting business is the initial cost of wiring to the consumer, I suggest that the supply authorities should themselves pay for the wiring and make no initial charge at all to the consumer, recouping themselves for the cost, either by an addition to the price per unit or by a separate rent charge.

Many years ago now I started the "free wiring" idea, and was instrumental in forming a company for the working of it. It undoubtedly brought a large influx of new customers on to the mains of those who adopted the system, but it broke down in practice because of legal difficulties. Now, however, that supply authorities have power to provide and let out on hire wiring and other apparatus, there are no difficulties in the way, and ample interest could undoubtedly be earned on the extra capital expenditure.

I seriously suggest to supply managers that they should carefully consider the possibility of offering to wire, up to the ceiling roses or equivalent, any premises for which supply application is made to them, provided they are satisfied that there will be reasonable usage.

Under the present system the total capital cost to the electricity works per lighting point connected to the mains averages about £2 5s., whereas the cost to the consumer of wiring from the main cutout to the ceiling roses or equivalent costs to-day is, say, 30s. per point. So that of the total capital of £3 15s. (excluding fittings) necessary for complete supply, only 60 per cent. is found for the consumer and the other 40 per cent. he has to find himself. A householder generally has his premises only on a short lease or a tenancy of a year or two, the law being such that from the moment he fixes his wiring its ownership passes from him, and he only has the use of it during his tenancy. Would anyone but an enthusiast spend his money under such circumstances?

By providing the wiring free of initial expense, the consumer's chief difficulty would be met, with results that would much more than outweigh the additional responsibility assumed by the electricity works. The wiring so provided would, of course, remain the property of the authorities, and its continued possession to them is secured by clause 23 (2) of the Electricity Supply Act of 1919.

The proposal that the authority should find the wiring instead of the consumer and charge him a commensurately higher price per unit or a separate rent charge for it would in fact cost the consumer rather less than he would pay in *total* under the present system, the reason being that the cost of both money and materials is less to the authority than the consumer. A charge of 5s. per annum per point would about cover the cost, or an extra charge per unit of about 2d. would on the average provide an equivalent sum.

The next point I would urge in view of the stumbling-block of cost is the simplification of wiring. One has only to look at our Institution Wiring Rules to see how far complication has gone in what is, after all, a very simple business. If we bear in mind that the problem only consists of running a wire from a fuse to a switch, then to a lamp, and thence back to another fuse in such a way that the current is confined to the wire, we see how far the electrical engineer has gone in strangling himself with red tape.

We have been hopelessly handicapping our business for the

sake of the fire insurance companies, and I suggest that all we are called upon to do is to give a reasonable modicum of safety, bearing in mind that perfection can never be reached, and that the attempt to eliminate the last element of risk can be too dearly bought.

Of the various systems of wiring, the conduit system is probably the most costly of any, and to my mind much the most unsatisfactory in practice. I have seen cases in which a lot of money has been spent in installing the conduit system under the impression, as I think, that elimination of fire risk was thereby effected, and then the supply authority has shown its contempt of the whole thing by installing its apparatus close under a wooden staircase and bunching the rubber-covered wires in tortuous heaps behind a wooden board on which the meter, &c., was mounted.

I am an advocate of either lead-covered wire throughout (the lead being bonded and earthed) or of going back again to the original system, namely, rubber cables in wooden casing where otherwise exposed and supported by porcelain cleats in such places as between floor and ceiling. I believe the lead-covered system to be a better job electrically in every way than the conduit system, and infinitely more durable. It is also much cheaper unless the cost is loaded unnecessarily by providing armour or other protection to prevent the remote possibility of damage to the cable. If the fuses are really efficient, there is no need to spend a lot of money in trying to ensure that conditions are made so safe that the fuse can never act.

The next thing that seems to require attention is the standardisation of fittings, particularly wall plugs. Nothing is more annoying to the consumer than to find that the plug supplied with a new lighting or heating fitting that he has bought will not fit into any of his existing sockets. A great deal of revenue is at present being lost owing to this want of interchangeability of plug. Lampholders and lamp caps require similar attention. Fuses also should be standardised.

I take this opportunity of drawing attention to the deplorable quality of many of the electrical fittings that are at present on the market, and are being used in practice by probably the majority of wiring contractors, owing to the stress of competition. These fittings form only a small percentage of the total cost of a complete installation, so that there is no economic excuse either for their manufacture or use. I have looked over samples of fittings taken from a stock heap and bought in the ordinary way (all these are of British manufacture) and I find the following obvious faults:—

Lampholders.—Brass casing parts much too light, weighing 1 oz. in. all, as compared with 2½ oz. a few years ago. Material too thin to allow of a full thread to shade ring. Contact screws too short, so that they bottom on the head when the point is 1/32 in. from the wall of the hole. Travel of contact plungers varies from 1/32 in. to 3/32 in. Internal diameter of socket varies by 1/32 in. between one make and another; cord grips drilled too small for standard flexible.

Switch Lampholder.—The key type should be prohibited, as its use involves severe bending of the flexible. Pressel type.—I found the wooden cover only engaged one thread, as did the cord grip socket before the insertion of any flexible. The brass contact strips were left black from the annealing. If the push bar was pressed over only 1/16 in. short of its full stroke, no contact was made.

Ceiling Rose.—Porcelain cover only engages for three-quarters of a thread, although three threads are provided. The weight is taken off the terminals by passing the flexible cord through holes in a bridge, these holes having dead sharp edges. The contact plates are so thin that terminal screws only engage by one thread. Terminal barrels are badly fixed to contact plates. Caps and bases are not interchangeable.

Wall Plug.—No cord grip is provided, the fastening of the fibre plate by screws into the porcelain top is most unsatisfactory. Plug and base cover are often made of wood, and this for a fitting that is perhaps more likely to give rise to heating than any other. No attempt has been made to take off the burrs, even at contacts. Plugs out of round, due to a wide saw cut, and the permanent compression of the soft brass. Diameter of the plugs appreciably less than the diameter of the sockets, so that contact only results from the accident that the plugs have not been set on the same centres as the sockets.

The adaptor was not provided with a cord grip, the terminal barrels were only 7/32 in. diameter, and the holes in them for the wires were full of burrs. The thread of the wooden cover was "drunk" and badly chipped, and it was only screwed into position at the third attempt.

The tumbler switch was perhaps the most satisfactory of all, but here the brass cap was much too light, the threaded portion very apt to break away, and in any case in the samples examined it frequently only engaged with one thread. The contacts were of soft copper and the spring was of poor quality.

I have, I think, said enough to show that serious attention needs to be paid to this matter, and I suggest that it is to the interest of the supply authority to see that none but reliable fittings are used on their circuits, as nothing gets electric lighting so bad a name as the small annoyances the user of electricity is subject to at the present time, because of petty troubles that should not occur.

It would pay both directly through the meter readings and indirectly in increased satisfaction to the consumer if the authority would send a sufficiently trained official periodi-

cally to visit each consumer. Such a man should allow a year as a minimum; he would inspect the whole of the installation and see that it was in working order, carry a small bag of tools and do small repairs, such as renewal of flexibles, tightening of terminals, &c., then and there. He would also advise as to the candle power and disposition of lamps if dissatisfaction was expressed, and last, but not least, he could canvass for orders for new business by drawing the householder's attention to the advantages of electric irons, kettles, and cooking or other apparatus, with which the consumer did not happen to be provided. Such a representative could be a woman, perhaps with advantage, seeing that calls would be made mostly when only the lady of the house was at home.

Still another point to which I should like to draw attention is the need for greater care in the earthing of appliances, such as kettles, irons and cooking appliances.

From the tenor of the last part of my remarks one might think that I was desirous of increasing the cost of wiring rather than reducing it, but reasonable freedom from risk to life is essential, and money spent in effecting this can be saved many times over by simplification of the wiring itself, and by cutting out all the fads that have grown up around it.

There are authorities—and they are by no means confined to municipal ones—who presume on the monopoly they have and take advantage of their position to impose irritating restrictions upon the consumer.

There would seem to be urgent need for increased support to the Electrical Development Association. Everyone seems to be agreed that it is doing good work in boosting the use of electricity, but the funds at its disposal are obviously inadequate for the purpose.

There is yet plenty of opportunity for us to reap the fruits of enterprise. It is doubtful if on the average more than 20 per cent. of the private houses are yet wired for the electric light, so that in this direction we have still before us and waiting the doing, given reasonable conditions, an amount of business aggregating about four times all that we have done up to date.

In conclusion, I hope that nothing I have said will be taken to be in any way a reflection upon the supply manager or the wiring contractor. Both these classes have generally shown much enterprise, and we have none of us the least reason to be dissatisfied with the progress made in electricity supply, especially during the last few years.

There remains, however, much more to be done, and I do urge that if only in the interest of the trade generally, supply authorities should now review the whole position afresh, and without prejudice in favour of hampering customs that have grown up round the business, solely, I believe, because of the Parliamentary terms under which the various franchises were granted, they should see if they cannot so modify the conditions of supply as to immediately secure a large proportion of the additional business that undoubtedly remains to be done.

South Midlands Centre.

In his inaugural address which he delivered at Birmingham on November 2nd before the above named centre of the Institution, Mr. R. A. Chattock, who has been elected to the chair for the second time, discussed the scheme that has been submitted to the Electricity Commissioners to deal with the South West Midlands Electricity District,* and in connection with which the Commissioners commenced a local inquiry on November 15th. In outlining what led up to the preparation of the scheme and explaining some of its technical details, Mr. Chattock said, *inter alia*:—

Sufficient evidence has been forthcoming to show that the working of Joint Electricity Authorities is likely to be attended by considerable difficulties, and the representation of the great number of interests involved in a district is likely to make the controlling body rather unwieldy. The combination of the interests of municipalities and companies on a single controlling board will be very difficult to effect. This is especially the case as regards finance.

In the South West Midlands District two existing undertakings are together responsible for the generation of about 98 per cent. of the total energy generated in the area, namely, the Birmingham Corporation and the Shropshire, Worcester, Shire and Staffordshire Electric Power Co. They felt that they were justified in suggesting that the control of generation in the whole of the district should be placed in their hands, and have consequently submitted a joint scheme to apply to the whole of the South West Midlands Electricity District, the proper control of which is proposed to be effected without the formation of a Joint Electricity Authority.

An Advisory Committee will form a connecting link between the Electricity Commissioners and the various authorities in the district.

By centralising the generation of electricity and locating the stations as near as possible to the bulk of the demand, advantage can be taken of the very low cost of production and the cost of transmission is brought to a minimum. The demand will grow at a slightly greater rate than that obtaining before the war, and whereas the cost of generation to-day is about 0.96d. per kWh, the cost in 1925 will be about 0.44d.

* *Elec. Rev.*, October 1st, 1920, p. 434.

per kWh. or a reduction of 54 per cent. In 1930 the cost will be about 0.33d. per kWh. or a reduction of 65.7 per cent. Such a result must have a very material effect in cheapening the cost of electricity to the consumer, which is the real object of the present development that is going on in the country.

Mr. Chattock concluded with a short description of the leading features of the Nchells power station.

AERO ENGINE IGNITION.
RESEARCH COMMITTEE'S REPORTS.

SEVERAL reports of electrical interest by the Internal Combustion Engine Sub-committee of the Aeronautical Research Committee (which are obtainable from H.M. Stationery Office; price 3d. net each) have recently been issued. The first No. 1, January and February, 1916 (I.C.E. 11), is a summary of the researches on magnetos that were carried out at the National Physical Laboratory by Messrs. A. Campbell, B.A., and D. W. Dye, B.Sc., and deals with (1) spark tests of a magneto with a series of magnets of widely different magnetic qualities, and (2) the nature of the current in the spark circuit of a magneto.

The report states that the efficiency of a magneto for ignition purposes depends on the quality of the permanent magnet (or magnets) used. If it be assumed that the efficiency of ignition depends on the energy per spark given by the magneto, then (so far as the magnets are concerned) the chief questions to be answered are: (1) Upon which of the magnetic properties of the magnet does the energy per spark chiefly depend? (2) What are the laws of this dependence? (3) What determines permanence of behaviour?

In testing permanent magnets for general use, the two properties which are usually of most importance are the reman-

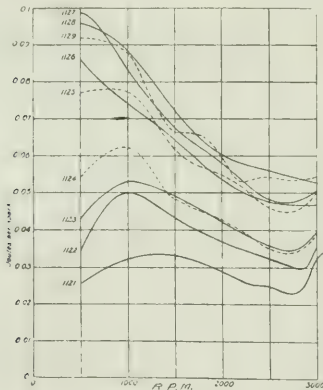


FIG. 1.

ence and the coercive field (or force). The remanence indicates the ability of the material to become a strong magnet, while the coercive field measures its capability of remaining permanent under the action of a demagnetising field. High coercive field also is found to ensure good retentiveness of magnetism against the demagnetising effect of mechanical vibration, shock, &c. This remark appears sufficient answer to question 3. The experiments here described relate to questions 1 and 2, and had for their object the investigation of the manner in which the output of a magneto at various speeds is dependent on the coercive field and the remanence of the magnet used, the coercive field, however, being the property mainly considered. In tungsten steels used in practice for permanent magnets the coercive field may vary within far wider limits than the remanence. (The present investigation had no concern with the connection between the magnetic properties of the magnets and their chemical analysis, heat treatment, &c.)

The magneto was of small type ("M.L."), arranged to work with a single wide permanent magnet. With it were supplied nine magnets of similar dimensions, and the series covered a wide range of magnetic quality. Each magnet was tested for coercive field and remanence, using an initial magnetising field of 300. The tests were arranged to give as nearly as possible the average values of each of these quantities over the whole length of the magnet. The first two columns in Table I give the values obtained.

The output of the magneto with a given spark gap was determined for each magnet at speeds of 500, 1,000, 1,500, 2,000, 2,500, and 3,000 r.p.m. respectively. The spark gap was between two brass spheres of 1.5 cm. diameter, and its length was fixed at 0.5 mm. in order to ensure that uninterrupted sparking should be obtained even with the weakest magnet and the slowest speed. The whole was enclosed in a carefully

calibrated air calorimeter, and from the thermal observations the output (in joules per spark) in each case was deduced. The results (Fig. 1) show how largely this output is dependent on the magnetic properties of the magnets. Table I gives, for each magnet, results averaged over the six speeds.

TABLE I.

Remanence.	Coercive Field.	10 ⁻⁴ H.	Joules per spark.
	H.	Rem.	Mean of 6 speeds.
10,000	42	42	0.029.
10,500	50	52.6	0.038.
10,080	56	56.5	0.043.
9,500	61	58.0	0.046.
10,420	60	62.6	0.061.
10,200	59	60.2	0.062.
10,420	64	66.6	0.067.
9,480	69	66.4	0.070.
9,410	75	70.3	0.068.

To a first approximation, the energy per spark may be taken as proportional to the square of the product of the coercive field and the remanence; however, this conclusion only refers to the particular type of magneto used in the experiments.

It was discovered that the current in the spark gap circuit contained a very large component of high frequency. This was further investigated, and experiments were also made with ordinary spark plugs in air at pressures up to eight atmospheres and temperatures up to 200 deg. C. The following conclusions were arrived at:—

1. The current in the spark gap circuit contains a predominant component of very high frequency (of the order of 10 million cycles per second).

2. Only a small part of the power spent in the spark appears to be due to the high-frequency component. The total current may vary between wide limits without causing any considerable variation in the power.

3. Thus it appears that measurements of the total current may be very misleading if taken as a criterion of the behaviour of the magneto or its capability for supplying power to the spark. On the other hand, it must not be assumed that the relatively large high-frequency component of current has no influence, beneficial or otherwise, on the properties of the spark.

4. Determinations of the electrical power taken by the spark in producing ignition under working conditions are somewhat difficult, but from the above experiments it seems probable that power tests at atmospheric pressure with a spark gap of 0.5 mm. between brass balls 1.5 cm. in diameter pretty fairly correspond with the practical conditions in a cylinder.

(To be continued.)

EXPORTS AND IMPORTS OF ELECTRICAL
GOODS FOR OCTOBER, 1921.

DURING October business in electrical goods and apparatus showed a decrease under all three heads—exports, imports, and re-exports. The comparative decline in the export total was not large, September's figure being £1,306,550. The fluctuations in the individual items were apparently normal. Imports fell by about 26 per cent., accounted for by reductions in the importation of carbons and unenumerated electrical machinery. The decrease in re-exports amounted to about 20 per cent. There were falls in the figures for telegraph and telephone instruments and apparatus and unenumerated electrical machinery, and an increase in the item "Electrical goods and apparatus."

VALUES OF ELECTRICAL EXPORTS AND IMPORTS FOR OCTOBER, 1921.

	Exports.	Imports.	Re-exports.
	£	£	£
Electrical goods and apparatus	137,504	37,619	6,118
Insulated wire	271,133	13,140	141
Glow lamps	22,886	16,722	113
Arc lamps and parts	310	315	20
Batteries	12,858	6,133	—
Meters	36,511	2,821	1,228
Carbons	3,728	3,737	450
Electrical Machinery.—			
Railway and tramway motors.	3,130	—	—
Other motors and generators	178,301	—	—
Switchboards (not telegraph or telephone)	19,240	188	32
Electrical machinery (unenumerated)	135,006	27,887	1,565
Telegraph & telephone cable & material.			
Telegraph and telephone wires and cable (not submarine)	145,872	4,308	192
Submarine telegraph and telephone cable	9,373	—	—
Telegraph and telephone instruments and apparatus	204,782	20,021	3,839
Totals	£1,210,623	£132,911	£12,698

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Prescot" Pillar.

Messrs. BRITISH INSULATED & HELSBY CABLES, LTD., have sent us particulars of their latest design of "Prescot" pillar. The accompanying illustration (fig. 1) shows the arrangement of one of these pillars.

The unit consists of a suitably stiffened enamelled sheet iron frame carrying porcelain insulators, upon which are mounted the copper cable and busbar terminals. The sealing chamber for the in-coming cable is screwed direct to the frame, and a compound-tight joint between the two parts is provided by means of packing. The sealing chamber is split to facilitate jointing and to avoid the necessity of breaking the compound-tight joint. Fuse clips may be readily changed without disturbing any other parts. The sealing chambers are supplied with brass glands, for plumbed joints to the lead covering of the cables and armour clamps are provided if necessary. Units varying in size are interchangeable, and can be added to or removed from standard pillars without the supply being cut off for more than a few minutes. The fuse carriers are of the shielded, cool handle type, and fitted with self-aligning contacts.

Mobile Electric Dock Cranes.

One of the principal Liverpool shipping companies, Messrs. Elder Dempster & Co., employ at the Toxteth Dock Sheds, Liverpool, about thirty mobile electric cranes of 7-cwt. lifting capacity (fig. 3) for handling goods in the dock sheds.

These cranes have been particularly designed for the stacking and unstacking of goods in warehouses or the like, and generally it is possible to work the cranes at stacks ten feet high. Being mounted on four ball-bearing road wheels, they can be easily towed by man or tractor power to work on any section of floor area, a trailing cable usually thirty yards long, being provided to supply the electrical energy for working. The motor and gearing for operating are mounted upon the centre post, and, when the crane is slewing, are effectively protected by a steel tower. The 4-h.p. motor is arranged for continuous running, and capable of withstanding severe requirements with very little rise in temperature.

The hoisting and slewing motions are operated by means of hand levers working friction clutches. To hoist a load, the

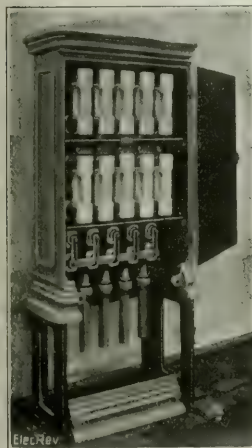


FIG. 1.—THE "PRESCOT" PILLAR.

hoisting lever (left hand side) is pulled towards the operator, this action simultaneously releasing the brake and operating the clutch for hoisting. To stop hoisting, the lever is pushed away from the operator, thus reversing the previous operation. To lower the load, the lever is pulled slightly toward the operator; this action releases the brake slightly, but the clutch does not go in. It is impossible to leave the hoisting lever in anything but a braking position, as, immediately it is released, it automatically brakes the load by means of a counterpoise weight attached to the brake lever. Taking an average lift of five hundredweight to a height of six feet, lifting speed 85 feet per minute, and slewing speed of 250 feet per minute, through a distance of 25 feet, the time occupied in sling, lifting the load, unhooking and returning is estimated at forty seconds.

"Lowke" Small Power Sets.

A number of special features are embodied in the small lighting and power plants made by Messrs. LOWKE & SONS, LTD., of Northampton. These are direct-coupled sets made in three standard sizes: 75, 1, and 3 kW, having, respectively,

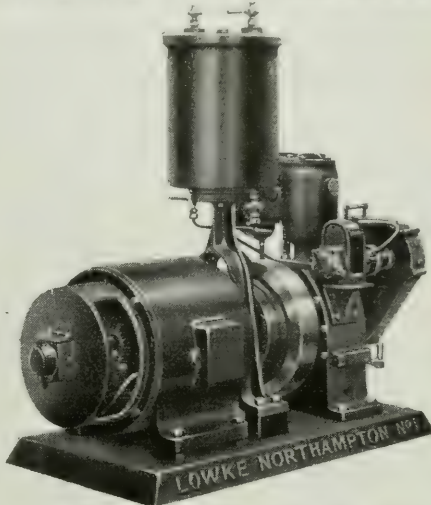


FIG. 2.—A "LOWKE" SMALL POWER PLANT.

engines of 2, 3, and 8 h.p. The two smaller sizes are fitted with single-cylinder engines with petrol-paraffin carburettors. The fuel is supplied from a two-compartment tank, with control cocks, and the engine is thermo-syphon water cooled. The

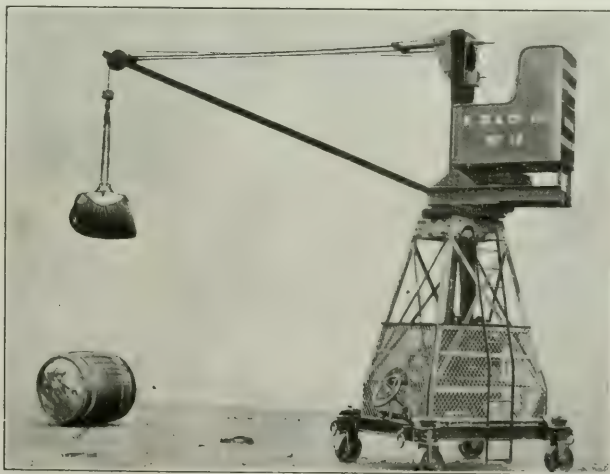


FIG. 3.—A MOBILE ELECTRIC DOCK CRANE.

generator is shunt wound, with interpoles, giving 20 amps. at from 50 to 70 V. It is connected to the engine by a flexible coupling allowing the armature free end movement. A polished enamelled slute switchboard is supplied. This has upon it a voltmeter, ammeter, automatic cut-out, d.p. fuses for generator and outside circuits, a d.p. switch for generator, an s.p. switch for the lighting circuit, a voltmeter key, a self-starter, and a voltage regulator. The 8-kW generator is coupled to a 2-cylinder, 4-stroke engine running at 1,000 r.p.m. The generator is of the shunt wound interpole type, giving 30 amps. at 100/140 V. A very complete set of 30-amp. fuse and switchgear and instruments is provided.

Apart from these standard sizes, sets can also be supplied with capacities of 2, 4, 5, and 6 kW.

Fig. 2 illustrates one of the smaller sets made by the firm.

IMPORT TRADE OF INDIA.

The following statistics of the imports of electrical and similar goods into British India in the year ended March 31st, 1920, are taken from the recently-issued official trade returns, details for the year ended March 31st, 1919, being added for purposes of comparison, and notes of any increases and decreases given. Owing to the adoption of a more detailed classification in the official statistics, a comparison with former years is not possible in certain instances.

Copper wire, including telegraph and telephone wire—		1918-19	1919-20	Inc. or dec.
Total	cwt.	11,238	6,861	- 4,377
	£	68,000	58,000	- 30,000
From United Kingdom	cwt.	502	3,460	+ 2,958
	£	4,000	26,000	+ 22,000
„ Japan	cwt.	8,200	1,880	- 6,320
	£	68,000	18,000	- 50,000
Iron wire other than fencing (a)—				
Total	tons	—	3,400	—
	£	—	170,000	—
From United Kingdom	tons	—	2,340	—
	£	—	90,000	—
„ Japan	tons	—	94	—
	£	—	7,680	—
„ United States	tons	—	3,280	—
	£	—	160,800	—
Electric generators—				
Total	£	15,000	252,000	+237,000
From United Kingdom	£	600	189,000	+188,400
„ United States	£	14,000	60,000	+ 46,000
Electric motors—				
Total	£	77,000	344,000	+267,000
From United Kingdom	£	25,000	126,000	+101,000
„ United States	£	50,000	215,000	+165,000
Other electrical machinery—				
Total	£	168,000	619,000	+451,000
From United Kingdom	£	108,000	244,000	+136,000
„ United States	£	43,000	356,000	+313,000
„ Italy	£	12,000	4,000	- 8,000
„ Switzerland	£	1,000	11,000	+ 10,000
Mining machinery—				
Total	£	73,000	156,000	+ 83,000
From United Kingdom	£	9,000	47,000	+ 38,000
„ United States	£	61,000	108,000	+ 47,000
Electric fans and parts thereof—				
Total	£	179,000	214,000	+ 35,000
From United Kingdom	£	15,000	25,000	+ 10,000
„ Italy	£	68,000	54,000	- 14,000
„ United States	£	89,000	135,000	+ 46,000
Electric lamps and parts thereof—				
Total	£	173,000	—	—
Electric glow lamps (a)—				
Total	£	—	15,000	—
From United Kingdom	£	—	7,500	—
„ Holland	£	—	2,000	—
„ Japan	£	—	1,000	—
„ United States	£	—	4,000	—
Electric lamps, other sorts (a)—				
Total	£	—	90,000	—
From United Kingdom	£	—	42,000	—
„ Holland	£	—	18,000	—
„ Japan	£	—	10,000	—
„ United States	£	—	19,000	—
Electrical wires and cables—				
Total	£	242,000	—	—
Electric wires and cables (rubber insulated) (a)				
Total	£	—	264,000	—
From United Kingdom	£	—	207,000	—
„ Japan	£	—	21,000	—
„ United States	£	—	34,000	—
Ditto (insulations other than rubber) (a)—				
Total	£	—	139,000	—
From United Kingdom	£	—	122,000	—
„ United States	£	—	12,000	—
Bare copper wire (electrolytic) (a)—				
Total	£	—	45,000	—
From United Kingdom	£	—	18,000	—
„ United States	£	—	9,000	—
„ Japan	£	—	19,000	—
Telegraph and telephone apparatus (a)—				
Total	£	—	63,000	—
From United Kingdom	£	—	24,000	—
„ Sweden	£	—	10,000	—
„ Japan	£	—	2,000	—
„ United States	£	—	27,000	—

1918-19 1919-20 Inc. or dec.

Electricity meters (a)—		£	£	£
Total	£	—	34,000	—
From United Kingdom	£	—	25,000	—
„ Switzerland	£	—	8,000	—
Batteries (a)—				
Total	£	—	31,000	—
From United Kingdom	£	—	6,000	—
„ United States	£	—	25,000	—
Switchgear (a)—				
Total	£	—	61,000	—
From United Kingdom	£	—	32,000	—
„ Japan	£	—	2,000	—
„ United States	£	—	27,000	—
Transformers (a)—				
Total	£	—	26,000	—
From United Kingdom	£	—	4,000	—
„ United States	£	—	22,000	—
Interior electrical fittings (a)—				
Total	£	—	21,000	—
From United Kingdom	£	—	13,000	—
„ United States	£	—	7,000	—
„ Japan	£	—	1,000	—
Electrical instruments, &c., unenumerated.				
Total	£	361,000	571,000	+210,000
From United Kingdom	£	158,000	279,000	+121,000
„ Japan	£	62,000	19,000	- 43,000
„ United States	£	113,000	264,000	+151,000
„ Holland	£	17,000	2,000	- 15,000
„ Italy	£	—	3,000	—
Telegraphs, materials for construction and accessories.—				
Total	£	4,000	3,000	- 1,000
From United Kingdom	£	3,000	2,000	- 1,000
Telephones, materials for construction and accessories.—				
Total	£	17,000	19,000	+ 2,000
From United Kingdom	£	3,000	12,000	+ 9,000
„ Sweden	£	6,000	4,000	- 2,000
„ United States	£	6,000	2,000	- 4,000
In addition to the foregoing, the following were imported as Government stores:—				
Machinery and millwork—				
Total	£	255,000	447,000	+192,000
From United Kingdom	£	244,000	404,000	+160,000
Telegraph material—				
Total	£	142,000	579,000	+437,000
From United Kingdom	£	141,000	578,000	+437,000
Instruments and apparatus—				
Total	£	306,000	419,000	+113,000
From United Kingdom	£	305,000	416,000	+111,000

(a) Not separately recorded prior to 1920.

THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO.

The thirteenth annual report of the Hydro-Electric Power Commission of Ontario, deals with what the chairman, Sir Adam Beck, describes as the most successful year in the history of the Commission.

Throughout the year ended October 31st, 1920, the country was passing through a period of re-adjustment following a sudden slump at the close of the war. Conditions have not yet become normal, and many industries are still awaiting a fall in costs before going back to ordinary production. This depression affected principally the Eugenia and Severn systems with a consequent serious reduction in revenue from these sources. The largest section—the Niagara system—also experienced a depression, but this was counter-balanced by increased business in other directions, and towards the end of the year the demand for power exceeded the supply. This was due in part to the expiration of a contract for a bulk supply from the Ontario Power Co., of Niagara Falls. It was found necessary during the year to increase the charges to a number of municipalities on this system, but in spite of this, increased business allowed practically every municipality to make a surplus. The cost of materials fell slightly towards the end of the year, and although labour costs remained high, the general efficiency improved. About the middle of the year arrangements were made for a supply of 9,000 h.p. by the Canadian-Niagara Power Co., and a further block of power is being negotiated for. This supply proved of great assistance, but restrictions had to be enforced when the power and light-

ing peaks became coincident. The Queenston-Chippawa development was somewhat retarded by labour troubles. In the first place the demand for unskilled labour could not be met. Owing to a strike the work was suspended for a month; this resulted in a loss of over \$600,000 in non-productive overhead charges, &c., and in the purchase of extra equipment to compensate, as far as possible, for the time lost in the progress of the work. During the year, the Commission contracted for three complete additional generating sets, so that the initial installation will now be five sets instead of the original two. By means of electrically-operated shovels earth and rock was excavated and removed at the rate of half-a-million cubic yards per month, and at the then existing rate of progress all the excavation work in the canal proper should have been completed by June last. It was hoped that the first two generating sets, with an output of 100,000 h.p., would be in operation in September this year. All that remained to be done at the end of the year under review, was to install the second turbine and the two generators. Most of the switchgear and transformers have now been delivered. The switchgear includes a number of 15,000 and 155,000-V oil circuit breakers manufactured by the Canadian General Electric Co., and the Canadian Westinghouse Co. The latter firm is also supplying 15 15,000 kVA, 12,000/63,500-V, single-phase, water cooled transformers, and two 2,300 kVA, 500 r.p.m., 25 cycles, 2,500-V, generators to furnish power to auxiliaries, such as cranes, elevators, pumps, reserve motor-driven exciters, lighting, &c. Among the auxiliary equipment are two 150-ton electrically-operated cranes with equaliser lifting beam, supplied by the Dominion Bridge Co. of Montreal. These cranes are designed to work either independently or together. The equaliser lifting beam is for use when lifting the 300-ton rotors of the main generators.

The Nipigon development was proceeded with rapidly during the year. The tail race which is about 1,000 ft. long necessitated the excavation of 122,000 cu. yd. of earth, and 57,000 cu. yd. of rock. The forebay excavation entailed the removal of about 20,000 cu. yd. of material, chiefly rock. In order that the first part of the plant might be put into immediate operation the steel for the superstructure of the power-houses was erected and temporarily sheeted in. This enabled the turbine and generator erection to be rushed to completion, and the No. 2 unit was placed in commercial operation on December 20th, 1920, which was the scheduled date for the delivery of power to Port Arthur. The present installation consists of two 12,500-h.p., vertical single runner turbines, operating at 120 r.p.m. under a head of 72 ft. These are coupled to 60-cycle Canadian-Westinghouse generators.

It was expected to have in operation the Niagara development—the largest of all hydro-electric schemes—by the end of the present year. The power-house excavation for the first two main units was completed during 1920. These two units will be placed in commission and the other three units of the scheme will then be proceeded with.

With regard to surveys prior to the extension of supply in rural districts, owing to the high cost of construction, power shortage, and labour conditions, these were confined exclusively to those districts from which petitions were received. The Power Commission Act was amended so as to provide that, in the supply of electricity to rural districts, systems should not necessarily be confined to the geographic township boundaries, but could be arranged to provide for the most economic distribution of power from the nearest centre.

Final surveys were completed during the year for the construction of 122 miles of new electric railway, apart from the acquisition of existing lines.

The year reported upon witnessed an enormous increase in the activities of the Electrical Inspection Department; this was chiefly due to the extensive building operations carried out all over the Province and to the ever increasing demand for all kinds of domestic electrical apparatus. During the year the Department received 87,399 applications for new wiring and 100,990 inspections were made. Apart from new installations the Department was successful in having a large number of old installations overhauled and improved. A considerable amount of revenue was derived from the annual inspection system, which is growing in favour with the owners of factories and other industrial establishments.

A considerable increase in the volume of tests and investigations by the Laboratories Department took place during the year. Among the new equipment constructed was a corona voltmeter, capable of registering pressures up to 300,000 V. Included in the special tests carried out in the High-Tension Laboratory were tests upon cutouts for distribution transformers; the analysis and compilation of test and theoretical data on the subject of interference between power lines and communication circuits; current-carrying capacity of transmission lines under various atmospheric conditions, &c. In the other sections there was little change in the character of the work, but in every case there was a marked increase.

The accounts of the several systems show very satisfactory financial results. In the largest system (Niagara) the revenue amounted to \$3,751,066; against this were placed the following items:—Power purchased, \$1,966,304; operation costs, \$585,699; interest, \$644,539; renewals, \$310,519; provision for contingencies, \$18,715; sinking fund, \$195,570. total, \$3,751,066.

MEXICO AFTER REVOLUTION.

AFTER all the misfortunes and upheavals that have occurred in Mexico during the past decade, it is encouraging to learn that the country is certainly a potential market for goods of British manufacture. Such is the opinion expressed in the report by H.M. Consul-General at Mexico City, which has recently been issued by the Department of Overseas Trade.* He adds an important proviso, viz., that price and delivery are satisfactory to the importer. Subject thereto, it may be taken for granted that any of the manufactured goods which were imported into Mexico before the war can still be consumed by that market.

Among the articles for which there appears to be a demand may be mentioned agricultural machinery and implements, mining requirements, such as belting, wire cables, ore cars, rails, &c., oil engines, tin plate, corrugated iron and roofing materials.

Mexico City, Tampico, and Vera Cruz and a few other towns have good systems of electric tramways. The company operating in the capital, which obtains its power from the plant at Necaxa supplying the electric light, maintains an excellent service of express cars connecting the town with the suburbs.

Owing to the shortage of the rainfall in 1920, a serious diminution in the producing power of the Mexican Light and Power Co. is foreseen. To ameliorate the situation, it will be remembered that the Government issued a "Daylight Saving" Order, advancing the official time in the city by one hour. The Consul-General says that of this Order a considerable part of the community take no notice—an indifference which caused much confusion.

The railways suffered terrible damage during the revolutionary disturbances, the losses in rolling stock and locomotives being tremendous. Travelling and transport is consequently very difficult, and the congestion of goods at Vera Cruz and Tampico has been very great.

There are great possibilities of development in Mexico, given peace. Apart from the oil industry, it possesses great stores of mineral wealth which have so far been unexploited. Considerable activity was manifested during the year by several of the large gold and silver mining companies in securing new properties to replace those which showed signs of approaching exhaustion.

Coal has been mined in Mexico for over 20 years. There are deposits of lignite coal near the border at Laredo, and other known coal-fields are in Oaxaca and Guerrero. But the most important deposits are in the coal-fields at Sabinas (where there are 700 bee-hive coke ovens and three retort coke oven plants, the latter having a capacity of about 10,000 tons of coke per month) and Coahuila, which are estimated to be about 400 square miles in extent.

After alluding to the advantageous position held by United States firms with regard to the Mexican market, the report comments on the extreme importance of the personal element in dealing with purchasers. Without good agents, it is impossible to succeed in Mexico. The course recommended is for the British house to send out a commercial traveller, with samples, to examine the market and appoint his own agent. In the case of machinery, a man with expert knowledge is practically indispensable. In this respect it is said that the British are outdistanced by their American and German competitors.

Petrol-Electric Transmission.—The *Commercial Motor* recently published an article dealing with the merits and demerits of the petrol-electric system of power transmission for vehicles. The writer says that lorry drivers and others have come to regard the gearbox as a necessary evil, and it has become a tradition, while vested interests are loath to substitute a better means of driving. A petrol-electric vehicle is subject to none of the violent jars inseparable from the best of gears, speed variation being effected in a very smooth manner. The absence of mechanical connection between engine and axle isolates the former from the shocks encountered by the engine of the gear-driven vehicle. As regards overall efficiency, the petrol-electric system compares very favourably with other systems despite the intervention of a dynamo between the engine and the driving motor. One point of the system, however, requires attention. The hand-regulation of the dynamo field does not get rid of the manual attention necessary with other drives; automatic regulation would make the system nearly ideal.

A Swedish Turbo-locomotive.—Sweden inaugurated the turbo-locomotive on her railways on October 29th with an express train run from Stockholm to Upsala and back, a distance of 80 miles, in less than 2½ hours; at times the speed reached 55 m.p.h., the highest allowed in Sweden, says the *Daily Mail*. After passing through the turbine, the exhaust steam is led to an air-cooled condenser, the hot water from which is fed into the boiler. The trials show, it is claimed, that the turbo-locomotive consumes only half the quantity of fuel that is needed for an ordinary locomotive of the same horse power, and the new engine is much less noisy.

* H.M. Stationery Office, 1s.

THE ELECTRICAL REVIEW.

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No. 2,296.

ELECTRICAL REVIEW.

ELECTRICAL SALESMANSHIP CONFERENCES.

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THE large attendance at the first of the series of informal discussions on salesmanship which have been organised by the E.D.A. is a good augury for the success of those which are to come. The meeting, which is reported on another page, was held in the hall of the Chartered Institute of Patent Agents, which proved to be none too large. Both contractors and supply authorities were well represented, and the informal manner in which the meeting was conducted set everybody at ease from the start. The growing popularity of informal meetings is little to be wondered at, and the absence of the restraint which is too often apparent at the more formal meetings of some of our institutions was, in this particular case, very noticeable. There was no dearth of speakers; in fact, the eagerness of some of those present to express their views and recount their experiences could almost be described as competitive. Many of the experiences recounted were not only interesting, but amusing, and one could not help feeling how delicate and intricate the business of selling really is.

Although the subject under discussion was electrical salesmanship, many of those present, as will be seen from the report, digressed a little, and took the opportunity to air their grievances. The suggestion made by the contractors that the supply authorities could do more for them, was met by the assurance that the supply authorities, for the most part, were anxious to co-operate; indeed, it was to their advantage to do so, but it was pointed out on their behalf that they also had to run their undertakings on business lines. Both the Chairman (Mr. S. T. Allen) and Mr. Beauchamp, the Director of the E.D.A., reminded the meeting that the subject under discussion was salesmanship, but on the whole the digression was excusable. It was evident, however, that relations between contractors and supply authorities generally are quite friendly, and that as the industry develops, so will the spirit of co-operation grow. The value of the series of conferences cannot be over-estimated, and as an indication of the interest which has been aroused, it may be mentioned that the desirability of obtaining a larger room is already under consideration. The suggestion was also made that the meetings might start earlier, in order to leave more time for discussion, and Mr. Beauchamp promised that this would also be considered. The arrangements for the next meeting, however, will have to stand.

Much that was said at the first conference was elementary, but it is, nevertheless, fundamental, and only a complete appreciation of the fundamentals of the whole art of salesmanship in electricity supply can achieve the desired result. Happily, there is now much more prospect of "push and go" on the part of contractors, for the relationship between them and the electricity supply authorities is now very different to what it was a few years ago. Without whole-hearted co-operation between the electrical contractors and the supply authorities, little can be hoped for. One of the greatest drawbacks in this matter is the question of mains. Too often there have been long and learned arguments as to how electricity supply should be increased and the great field there is for it, but insufficient attention has been given to the fact that in parts where there is a great potential demand, there are no mains. Hence

all the arguments in the world are unavailing if the prospective consumer cannot get the supply, and some of the efforts of the manufacturers to turn out cheap apparatus, and the contractors to induce people to use them, will be wasted until greater attention is paid to this subject. The difficulties now, of course, in laying mains on anything approaching a speculative basis are obvious. At the same time, in London alone there are hundreds and even thousands of streets of quite good class houses where a considerable amount of business would undoubtedly be obtained if the mains were laid. In many cases no attempt has been made to ascertain whether residents desire a supply, and when they approach the Department they only meet with discouragement. It is satisfactory, therefore, to find, almost for the first time, that this aspect of the problem which is facing us is fully appreciated. Closely bound up with that comes the question, Who is to do the wiring? Where the person is not the owner of the house he naturally will not incur the expense, and the landlord will, in the majority of cases, also refuse. Therefore, it is a wise suggestion to concentrate on the householder who is also the owner. A larger percentage of owners are occupiers than ever before, owing to recent property transactions. All this emphasises the difficulties that have to be faced; yet there is much to be done even where mains are laid. This is the part of the work which must be tackled first.

Local Authorities and the Supply of Fittings.

THE case of Attorney-General *v.* Liverpool Corporation, which was decided last week by Mr. Justice Russell, involved the discussion of a new and interesting problem in connection with municipal trading. A perusal of the judgment of the learned judge, which is printed at length elsewhere in this issue, shows that although a local authority may not originally have had power to provide, sell, &c., electrical fittings, it may acquire this important privilege by taking over the rights and powers of a statutory company. It appears that the Liverpool Corporation in 1896 and in 1902 acquired, by Act of Parliament, the undertakings of two companies which had the right to manufacture and supply fittings, and Mr. Justice Russell has held that this right was transferred to the Corporation, and that there was no rule of the common law relating to corporations which prevented the exercise of this power. Having distinguished the case of Attorney-General *v.* Sheffield Corporation, in which it was held that in the absence of statutory authority undertakers who are a local authority cannot provide lamps, fittings, motors, or apparatus other than meters, the learned judge went on to point out that on the evidence before him, the Liverpool Corporation had in fact made a profit which enured to the benefit of the ratepayers. We confess that it is not easy to understand why the question whether the business was profitable or not was relevant. If the learned judge was right—and we would be long sorry to question his finding—in holding that the Liverpool Corporation stepped into the shoes of the two companies, the question whether the business was profitable or not does not seem to be very material. But there was another point decided by the learned judge upon which he was fain to confess that he pronounced after much consideration. The Electricity Supply Act, 1919, provides that a local authority may provide, let on hire, repair and maintain fittings and apparatus, but it provides in parenthesis that it shall not, unless expressly authorised by special Act or Order, “manufacture or sell.” Mr. Justice Russell held that the necessary express authority to do this was to be found in the Act of 1896, which gave the Corporation all the rights and privileges of the Liverpool Company. In the result he dismissed an action which had been brought at the instance of certain ratepayers who sought a declaration that the Corporation was not entitled to carry on this form of municipal trading.

It has, of course, been decided that the Electric Lighting Acts do not authorise undertakers to supply electric fittings and apparatus other than meters.

The result of this case is somewhat remarkable. It seems that although the Liverpool Corporation has never been directly authorised to act as provider and vendor of electrical fittings, it has acquired this important power by virtue of private arrangement, confirmed by Act of Parliament, with companies which had these powers. Hitherto power to sell and let fittings has only been conferred by Statute. Thus it is common to find in the Acts of local authorities a special clause to enable them to sell, let, hire, but not to manufacture, lamps, meters, electric fittings, &c. The terms of these clauses vary somewhat. In the Nottingham Corporation Act, 1889, Sec. 4, the power conferred is to provide and let, &c., but not to manufacture, “lamps, meters, electric lines, fittings, apparatus and things, for lighting and motor power, and for all other purposes for which electric energy can or may be used, or otherwise necessary or proper for the supply, distribution, consumption, or use of electrical energy.” The Manchester Corporation (General Powers) Act, 1898, after the usual wide powers, contains these words: “Electrical motors, and apparatus for the use of electricity for motive power and other purposes.”

The Halifax Corporation Act, 1898, is even wider in its terms. It authorises the Corporation to “purchase, hire, sell, let on hire, or otherwise deal with dynamos, electric motors, accumulators, meters, burners, arc and other lamps, fittings, wires, plant, engines, conductors, machinery, apparatus, and appliances for and in relation to,” &c.

The London County Council (General Powers Act, 1906) confers certain general powers on Metropolitan boroughs supplying electricity, but expressly withholds power to manufacture fittings.

We do not gather, however, that Mr. Justice Russell’s decision will enable a local authority exercising its statutory power of purchase pursuant to Sec. 2 of the Electric Lighting Act, 1888, to acquire the right to “manufacture or sell.” This was expressly reserved by the Act of 1919, and can only be enjoyed by virtue of a “special Act or Order.” The Act of 1888, which gives the right to purchase, is certainly not a special Act or Order.

While, therefore, the case under notice may not lead either directly or immediately to what is regarded in some quarters as a very undesirable form of municipal trading, it is manifest that other local authorities, which have taken over the undertakings of other supply companies, may find themselves vested with power to sell and manufacture electrical fittings. We may be permitted to wonder whether when the Bill which became an Act in 1896 was before Parliament, any of those who opposed it were aware of the powers about to be conferred on the Corporation. If it does nothing else, the case which we have considered should serve to draw the attention of those who supply fittings to the activities of the local authority which may be seeking to acquire the undertaking of the existing supply company.

As will be seen from our “City Notes,” the directors of the Allgemeine Elektricitäts Gesellschaft, of Berlin, have resolved to pay a dividend at the rate of 16 per cent. for the year 1920-21, being an increase of 2 per cent. over the preceding year. The question was referred to in the *Daily Telegraph* last Saturday in a despatch from its Berlin correspondent, who seems to be enthusiastic concerning what he terms the “company’s abounding prosperity.” To those who for many years past have followed the fortunes of the A.E.G. and are familiar with its accounts, it is something remarkable to hear from the Berlin correspondent about this great degree of prosperity under the existing circumstances of German currency. If the correspondent had

taken the trouble to consult one of the German works of reference at his disposal and ascertained the profits and dividends paid by the company in former years, when the mark was at par value, he would not have indulged in the phrase of "abounding prosperity."

The company's annual report, however, has not yet been issued; as usual, only a summary of the financial results is sent out by the directors in the first place, and what does this summary show? Curiously enough, the correspondent omits to quote the net profits earned by the company, which are returned at 82,388,686 marks, as compared with 45,707,352 marks in the preceding year. Now the former amount at the present rate of exchange of, say, 1,000 marks to the pound sterling, merely represents £82,388. Even if the sum of 100,000,000 marks (£100,000), which has been placed to the formation of a reserve account for works' maintenance, is added to the net profits, the position by no means bears out the assertion as to prosperity.

But let us examine the question a little more closely and as compared with former years. If we refer to the company's accounts for the last year of former peace (1913-14), it is found that the net profits amounted to £944,000 sterling, of which £775,000 was distributed in the form of a dividend at the rate of 10 per cent. It will be seen that the company paid away in dividends in the last year of the former peace period nearly ten times the amount of the actual net profits realised in 1920-21. If the first two years of the war are taken into consideration, when the mark was still at about par value, the net profits in each exceeded £1,000,000 and the rates of distribution were higher than in 1913-14.

The time seems to have arrived to protest against the exaggerated statements published in English newspapers concerning the alleged high degree of prosperity in Germany. Such assertions, it is true, are not limited to any one newspaper. That a large amount of business is being transacted by German industrial works as a whole is a matter which it is not our intention to dispute; but it is merely a sham condition of prosperity based upon an enormously inflated currency. The limits in these directions will probably soon be reached, and the consequences may be extremely disastrous not only to those directly concerned, but also to the rest of Europe.

The Future of China. IN compressing into a comparatively short report, which we abstract on another page to-day, a survey of the salient features of China's economic history during 1920 and the first half of the current year, H.M. Commercial Counsellor at Peking, Mr. H. H. Fox, has performed a difficult task with care and skill. The report does not make light of China's troubles, but it confirms the views which have been expressed in these pages for ten years and more that the country will ultimately fully repay the most assiduous cultivation by the British engineering expert.

The record trade figures of 1920 are hardly a matter for congratulation from China's point of view, for after a series of years in which the value of her export trade gradually crept up until it reached in 1919 a point only 16 million taels short of her imports, last year brought an adverse trade balance amounting to over 220 million taels. It was, however, a year of revolution, famine and devastation to crops through typhoons. China's historic tea trade practically ceased. Yet its place was taken by other active exports, e.g., minerals, coal, cereals, and tobacco. And meanwhile machinery and materials for the country's growing industries were imported in steadily increasing quantities. This circumstance is of especial interest to the engineering trades, and in conjunction with other tendencies it confirms Mr. Fox in the belief that China is one of the greatest undeveloped markets of the world, and is destined in the fulness of time to take a place among its great industrial nations. Despite China's disastrous experiences during the period covered by Mr. Fox's report, despite lack of communications and neglect of the scientific development of her vast natural resources, he is of opinion that

the country is on the eve of a period of unexampled commercial and industrial development which will in a few years bring about a complete change in her economic situation.

At a recent gathering of the Rotary Club in London, Mr. Chao-Hsin Chu, Chargé d'Affaires, in referring to the commercial opportunity in China, said that the market was open to the world in general and to Great Britain in particular. He urged England to do more to induce Chinese students to come to English colleges and universities. America provided means and facilities in such a direction, with the result that there were over 2,000 Chinese students in her colleges and universities as compared with only about 250 in similar institutions in England. We have on many occasions dwelt upon the importance of this matter, and would once more urge British manufacturing and educational authorities, as well as the Department of Overseas Trade, to bear in mind the importance of the subject from the future international trade standpoint.

Telephone Line Work.

ALTHOUGH in this country the telephone service is enclosed in a watertight compartment, the conditions under which it is organised and conducted are fundamentally similar to those which obtain in the United States; the technique of the art, however, has followed widely divergent lines in the respective countries. One factor which has exercised great influence on trans-Atlantic practice is the immensely greater development of the public telephone service in the United States, where no fewer than 12,600,000 stations are connected to one vast system, in addition to 900,000 stations owned by independent companies.

Under the circumstances it is reasonable to suppose that we in this country have a great deal to learn regarding telephone work from our American cousins, and Mr. E. S. Byng, whose I.E.E. paper is abstracted elsewhere in this issue, has rendered excellent service to British telephone engineers by placing before them a unique and invaluable account of his observations made during a recent visit—an account which abounds in technical detail and is well illustrated with admirable drawings. We regret that we are unable to devote more space to the paper; every telephone engineer ought to possess a copy of the original in its complete form as a technical handbook. We have, however, by the courtesy of the author, been enabled to reproduce a number of photographs selected from the 52 views which he showed to the members of the Institution last week, in order to convey some idea regarding typical aspects of American telephone practice. We should add that the paper will be found of interest and value also to electric power engineers in many respects.

Mr. Byng, who is now on the staff of the Western Electric Co., Ltd., was formerly employed by the National Telephone Co., and afterwards by the Post Office, and his thorough acquaintance with British practice enabled him to identify the numerous points in which America methods differ from ours.

We are bound to refer in particular to the human side of his observations. He says: "Throughout . . . there appears to be a keen spirit of 'Service First' so that the public shall have no legitimate ground for complaint. . . . The ready acceptance of machinery and labour-saving devices by the working man, and the fact that they have been used to their full capacity, have been conducive to high efficiency. Trade unionism exists to some extent, but there is no desire to hamper output. . . . Any position in the Bell system is open to anyone who becomes qualified for it." These are admirable principles, all tending towards efficiency. We have equally good material in our own telephone service, but it is not used to anything like the same degree of efficiency, and it never can be so used, under the conditions obtaining in a State department, controlled by political considerations and with promotion regulated by seniority. In fair competition, private enterprise wins hands down every time.

ONE SOLUTION OF THE FREQUENCY PROBLEM.

By C. SUTTON, A.M.I.E.E.

NEGLECTING such cases as those of the North-East Coast, Birmingham, and certain railways, which are bound to other but moderately satisfactory frequencies, the 50-period, three-phase system is now the European standard system of supply. There are, however, in Great Britain the following plants operating at undesirable non-standard frequencies, and mostly single-phase; in some instances there is a direct-current traction supply from the same station:—

TABLE I.—Number of British Stations generating at periodicities other than 50.

Periodicity.	No. of Stations	Periodicity.	No. of Stations.
100 cycles	9	80 cycles	2
93 cycles	1	77 cycles	1
90 cycles	2	75 cycles	1
85 cycles	2	68 cycles	1
83 cycles	3	60 cycles	10

(There are also one or two 40-cycle and 25-cycle stations in 50-cycle districts.)

In nearly all these cases immediate or ultimate possibilities of linking-up and the intrinsic advantages of the standard system dictate that the latter shall be adopted in all future extensions of both plant and dis-

A double-rotation turbine set is used, one alternator being built for 50 periods and the other for the original station frequency. In the normal double-rotation turbine set, the two alternators are, of course, permanently connected in parallel, the speed of only one alternator being governed. In the proposed set, the speed of the single-phase alternator will be governed, but it will be impossible to connect two alternators of different frequencies in parallel and thus keep the speeds of the two ends in synchronism. The three-phase, 50-period, turbine-driven alternator stator will be connected permanently to the stator of a 50-period, three-phase synchronous machine, whilst the single-phase high-frequency turbine-driven alternator stator will be connected permanently to the stator of a single-phase high-frequency synchronous machine. These two synchronous machines will be designed to run at some moderate common synchronous speed, and will be direct coupled to each other mechanically, so that they constitute what is hereinafter referred to as a "synchronous coupler set."

The turbine set and the synchronous coupler set are run up to speed together, the two 50-period machines

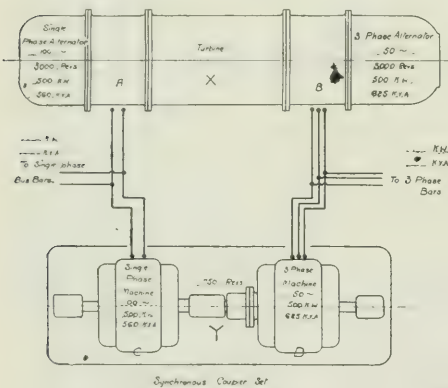


FIG. 1.

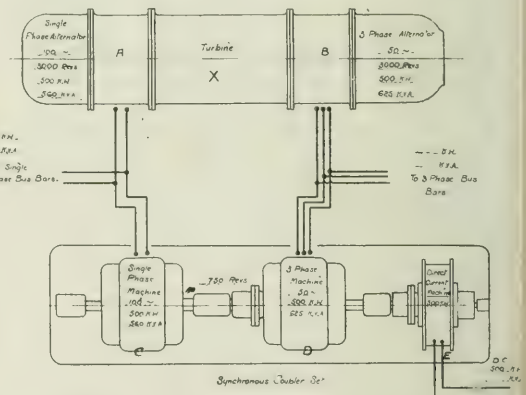


FIG. 2.

tribution network, and that the existing network and load shall gradually be changed over.

Let us consider the problem presented when plant extensions are required in one of these stations. The new unit should preferably be able to deal with the normal steady load in order that improved economy may be realised by using the relatively inefficient existing plant for stand-by and peak-load purposes only. On the other hand, the development of the 50-period, three-phase mains and load, and the change-over of the existing non-standard distribution system can only take place gradually during perhaps a decade or more. Especially at the present time is it desirable to defer large capital expenditure.

Initially, therefore, the new set will have only a small three-phase load, and to enable it to be loaded up by and to supply, the old network, a frequency changer must be installed of nearly the same capacity.

In time the three-phase load will grow, and eventually preponderate, but for many years there will be a considerable special-frequency load which will have to be dealt with either by obsolete generating plant or through a large frequency changer.

Clearly, what is required is a turbo-alternator unit which can generate its full output at either frequency or at both simultaneously, and it is the purpose of this article to examine a method which achieves this with minimum expense and conversion losses,

running in parallel, and the other two machines running in parallel also, and as the correct speed of one of the turbo-alternators is maintained by the governor, the "sister" turbo-alternator must run at its correct synchronous speed owing to the mechanical and electrical coupling effects of the synchronous coupler set. It would be advantageous to provide separate excitation for the two machines comprising the coupler set, and also for the field of the turbo set exciter, to ensure that the four machines will come into step at a minimum speed.

As an example, assume that the present load on a certain power station is a maximum of 1,000 kW, single-phase, 100 periods, power factor 0.9, with a gradually increasing three-phase, 50-period load, and that it is the intention of the power-station authorities to change over the single-phase, 100-period load to three-phase, 50-period load by degrees. Fig. 1 shows a combined set for dealing with these conditions. "X" is a double-rotation turbine unit, "A" alternator being a 4-pole machine designed for single-phase, 100 periods, and capable of an output of 500 kW with a power factor of 0.9. "B" alternator is a 2-pole machine designed for 3 phase, 50 periods, and an output of 500 kW, with a power factor of 0.8. Both these alternators must run at 3,000 r.p.m. to give their designed frequency. "Y" is a synchronous coupler set, consisting of two synchronous machines mechanically coupled together on the

same bedplate. The speed of this set is 750 r.p.m. "C" machine has 16 poles with a periodicity of 100, and is designed for an output of 500 kW at power factor 0.9 single phase. "D" machine has eight poles with a periodicity of 50, and is capable of an output of 500 kW at power factor 0.8 three-phase.

The stator windings of "A" and "C" machines and of "B" and "D" machines respectively are permanently connected in parallel. The connections to the

The synchronous coupler scheme shows an appreciable gain in efficiency which is explained by the fact that the power passing through the converting medium is never more than half the power generated.

It will be evident that while periodicities of 100 and 50 have been taken as an example, any other combination of frequencies can be obtained. For instance, with 50 and 90 periods the four-pole alternator of the turbine set would run at 2,700, while the two-pole alter-

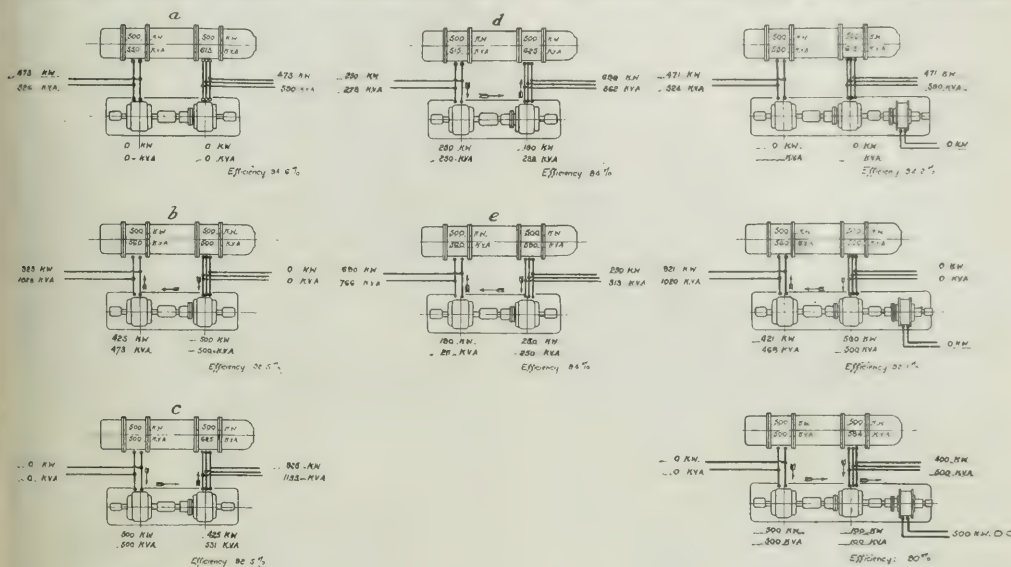


FIG. 3.

single-phase busbars are made from the leads connecting "A" and "C," and those to the 3-phase busbars from the leads connecting "B" and "D."

Now it will be evident that single- and three-phase load can be taken from this combination in any desired proportion up to the limiting output of the turbine, and in fig. 3 various examples of distributions of load are shown with the relative loadings on the synchronous coupler set. The efficiency given in each case is:—

Single-phase + three-phase load.

Total output of both turbo-alternators.

Comparing the two alternatives:—

- (1) 1,000-kW, 3-phase turbo set with 1,000-kW frequency changer;
- (2) 1,000-kW dual-frequency turbo set with 500-kW coupler set.

It will be evident that to obtain the same flexibility of supply, the output of the frequency changer must be double that of the synchronous coupler set (1,000 kW instead of 500 kW). Also, as regards efficiency, when the whole load is required at the non-standard frequency, it must all pass through the frequency changer, while with the synchronous coupler set combination, only half the load will have to be converted as a maximum.

Table II gives the relative efficiencies at the different proportions of load given in fig. 3 for a synchronous coupler and a frequency changer.

	OUTPUTS.		EFFICIENCY.	
	100 cycle Single-phase.	50 cycle Three-phase.	Frequency Changer.	Synchronous Coupler.
(a)	473 kW	473 kW	91.4 %	94.6 %
(b)	925 kW	0	88 %	92.5 %
(c)	0	925 kW	91.5 %	92.5 %
(d)	250 kW	690 kW	91 %	94 %
(e)	690 kW	250 kW	90.5 %	94 %

Comparative efficiency between the frequency changer combination and the synchronous coupler set assuming in the former that 50 cycles is the primary periodicity.

nator speed would be 3,000 r.p.m. In this case the output from each alternator would be proportional to its speed.

With a 50-cycle-40-cycle combination, the two machines constituting the turbo set could be made exactly similar, but by coupling them electrically through the synchronous coupler set, the one machine would be held at 2,400 r.p.m.

A further development of the idea could be made where it was desired to supply direct current as well as the two periodicities. In this case a direct-current dynamo is coupled up to the synchronous coupler set, making a

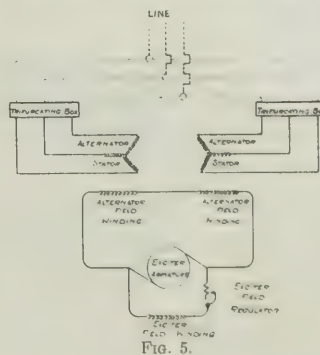


FIG. 4.

FIG. 5.

three machine combination, and the load can then be varied between the different systems in any proportion up to the limit of the turbine. Figs. 2 and 4 give an example of this. A direct-current machine of 500-kW capacity has been assumed, but this may be made of any size up to the limit of the turbine according to the amount of direct current required. The direct-current machine will automatically take its driving power from the more lightly loaded of the two turbo-alternators.

With the proposed arrangement of plant it is impossible to run the turbo set separately from the synchronous coupler set, as the latter is necessary to keep the two sides of the coupler at their correct speeds. It may be of interest to consider what alterations would be necessary to convert the turbo set to a standard 50-period combination, and also to enable the synchronous coupler set to be run as an ordinary frequency changer.

TURBO SET.—(a) One alternator 50 periods. The other alternator 60 periods. The special alternator would be four polar in this case, and it would be necessary to replace this machine by a duplicate of the 50-period alternator.

(b) One alternator 50 periods. The other 60 periods, or lower.—The two alternators could be duplicates, as a transformer could be installed if necessary to transform the voltage. The set would then be standard, and could always be used as a 50-period machine.

SYNCHRONOUS COUPLER SET. By adding a starting motor to the set it could be used as an ordinary frequency changer.

Considering the scheme from rather a different standpoint, it is a well-known fact that on turbine-driven alternators the power factor of the load has a considerable effect on the size of the machine, as the loading on the rotor increases very rapidly as the power factor decreases. As the machines composing the synchronous coupler set are permanently connected in parallel with the turbo-alternators, it is possible to arrange for them to take more than their share of the magnetising current, and thus relieve the turbo-alternators. On lower-speed sets it is much cheaper to provide the extra field strength necessitated by a low power factor than is the case on a high-speed alternator. In some instances, therefore, it would be possible with the proposed scheme to obtain a greater output from a given standard turbine set. Also it enables the set to be made approximately symmetrical mechanically by building the single-phase turbo-alternator for unity power factor and the three-phase machine for a power factor of 0.8.

References to divers adaptations to special cases are purposely omitted.

Summarising, the advantages to be obtained from the adoption of the synchronous coupler set are:

1. Considerable gain in efficiency over usual methods, as in the worst case only half the power passes through the converter, and usually much less than this, while the light-load losses are much lower.

2. Saving in first cost.

3. Maximum flexibility.

4. Direct current can be obtained from the combined plant if necessary.

5. Simplicity. No starting motor, transformer, or synchronising gear between turbo set and synchronous coupler set.

6. Part of the wattless component of the load may be transferred from the high-speed alternators to the lower-speed machines, thus enabling an increased output to be obtained from a standard turbo set.

Note.—For the sake of those unfamiliar with the double-rotation turbine, it may be of interest to give a diagram of connections of the "Brush-Ljungström" turbo-alternator sets as ordinarily arranged (see fig. 5). The alternator stators are permanently connected together in parallel and the rotors in series.

The turbine consists of a number of blade rings concentrically arranged, and fixed on two turbine disks. The live steam enters at the centre of the turbine inside the innermost blade-ring, and from thence passes through the blade-rings outwards in a radial direction, the two disks running in opposite directions. To each turbine disk an alternator rotor is coupled. On starting up the set the two alternators automatically synchronise and thenceforward run electrically as one machine.

I beg to thank the Brush Electrical Engineering Co., Ltd., of Longbridge, for information regarding the "Brush-Ljungström" plant.

WHY THEY FIGHT.

By W. PHILLPOT.

THE electrical wholesaler is undoubtedly having a very thin time at the present moment, worse even than his companions in misfortune, the manufacturer and the contractor. The struggle for existence on the part of the manufacturer is making him cut every fraction of costs he possibly can, and the result is undoubtedly a tendency to squeeze out the middle man. Whether this tendency be good or bad is not for me to say, but certainly it has had the effect of making the wholesaler sit up and take notice, and every business opportunity is now eagerly snatched at, or should be.

One of the chief stumbling-blocks in the way of business-getting with many firms of this type is often the lack of co-operation between the estimating department inside and the outside representative or travelling salesman, who is one of the most important units in the organisation of such firms. The writer hopes to point out in these notes a few of the snags on which business prospects are wrecked, with hints on avoiding them.

At the present time not the very faintest chance of a deal can be allowed to slip—and yet how very weary the inside man gets of continual quote, quote, quote in reply to inquiries with never the smallest sign of a bite to enliven the monotony! Experience, of course, soon teaches the estimator, by the way the traveller words an inquiry, whether there is any chance of an order, and the "why trouble" frame of mind soon develops with regard to these. Every estimator knows that a large proportion of inquiries are handed to travellers to shut them up and get rid of them, and his discerning eye easily picks these out. They are usually put on the file to be dealt with (much) later. The discerning eye, needless to say, is always quite wrong, and, on the well-known "cussedness of things" principle, the inquiries put on one side always include the one that contains the germ of an order. The only remedy is to plod steadily through every inquiry and give each its due share of attention on its merits, if any, and a bit more if none.

The chief cause of premature baldness, shown in the Industrial Diseases Reports to be devastating the ranks of the estimators, is the inquiry which doesn't know what it wants combined with an insufficient description of the same. However, the obvious course with such an inquiry is to write the customer, and the traveller for luck, asking for further particulars, "when our estimate will follow in due course"—and wait for a reply. If it never comes, the business is necessarily dead. It usually is, to the writer of this sort of letter, anyway. Nothing annoys a potential customer so much as being told that he doesn't understand his business, especially when he doesn't, and this is what the above letter implies. In addition, it is probable that the customer is waiting to pass his price on to someone else, and the delay while he writes you and you reply may ruin his chance. It is far better to quote sufficient alternatives to cover everything his inquiry can possibly mean, or if that should be impossible give him at least two, at the same time hinting that owing to your own extreme mental density you are not quite sure whether you have guessed right, and how pleased you would be to hear whether you are hot or cold, and guess again.

A third point, and we shall have finished with the three outstanding troubles of the estimator, the last being delay. If a customer inquires for something of which you have not the price at hand, you must go to the manufacturer for it, and this will entail a day or two's delay, which, of course, you can't help. Meanwhile the inquiry gathers dust in the abeyance basket. Very few people seem to trouble about acknowledging an inquiry if they can't quote right away, and by the time the information is ready the customer has usually gone in on somebody else's figures. It is a very simple matter to persuade the buyer that he is the darling of your flock, and he will probably hold up his order if you hint by return that you are just going into costs with a view

to further reductions, and will let him have something extra special in a post or two.

Now for the traveller. It is his business to get orders in the first place, but he is very thankful nowadays for an inquiry. But why on earth doesn't he ever seem to be able to get full particulars of what they want from his customers? Every traveller for an electrical firm must know that if he sends an inquiry in for a 10-h.p. a.c. induction motor for a 50-cycle supply one cannot offer a machine running at 2,000 revs. as so reasonably required by the customer; and if someone else wants a single-phase motor with a star-delta starter "because they seem to be cheapest" the traveller will send it in marked "Extremely urgent—business prospects very good," and leave it to the estimator to point out to the customer what an ass he is and why he can't have what he wants. It would, of course, be a lot easier and save much time for the traveller to point out what is wrong when he takes his note, at the same time finding out what really is wanted. Neither the traveller nor the estimator dare worry a customer too much over details, but the average traveller's fear of offending a customer being equal to his entire lack of the same quality with regard to the rest of creation, the result is that the office is overdosed with vague and absurd inquiries.

A second point for travellers and, in combination with the above, the chief cause of the antagonism referred to between inside and outside staff, is the inquiry given

him "to get rid of him." The aforementioned average traveller usually imagines that the more he talks and the longer he stays in the customer's office, the better chance there is of getting business. Perhaps he is right. The polite customer with no orders to give therefore hands him out an inquiry for something that he has no intention of buying, landing the inside man with the most dangerous form of the disease "work" — useless work. The only man who can really tell whether the inquiry is genuine or not is the traveller, and it is up to him to suppress it when it isn't. He never does.

One last hint for travellers and I have done. It is a very good thing to follow up quotations to one's customers by a personal call, and very few travellers neglect this part of their job. But who hasn't been worried to death by the pushful fiend who dances in and out of your office half-a-dozen times a day, starting from one hour after his firm's quotation arrives, to know whether that order is likely to come his way? No buyer is likely to be prejudiced in such a man's favour by having his time wasted in that way, particularly when he has to requote. The follow-up business can easily be overdone, and I know at least one busy man who avoids certain manufacturers of his class of goods because he knows that the smallest inquiry will bring a plague of travellers on him: a most ghastly affliction, and if Pharaoh had had it first Egypt would never have needed the other nine.

FUSES.

By A Central Station Engineer.

A short time ago, when talking to a friend who is an authority on switchboards, I happened to mention the word "fuses" in connection with high-pressure a.c. work. "Fuses!" said he, coldly, "I thought that people had given up fuses for 6,000 volts." It was an embarrassing moment, and I am afraid that my reputation for technical knowledge suffered considerably.

Yet fuses are used for high-pressure circuits, and apparently with much success. Their design has gone through a process of trial and error, during which, in this country at any rate, they have got a bad name. The early high-pressure fuse was about a yard long, and it was fixed horizontally. Some of them were used to protect certain cables which ran alongside of a canal.

into the oil after blowing. The Bristol switchboard was fitted with these, but one day something happened and the whole board blew up. This threw a cloud over oil fuses, and automatic switchgear took their place.

But auto switchgear has its troubles. A switch may be designed to open at 100 or 200 amperes, but if a bad short happens to take place before it can open, the switch may find itself dealing with a current of thousands of amperes. Cases have been known, in these circumstances, where switches have blown up, and have left little behind to tell the tale. The super-station indeed has brought its own troubles, among which is the terrific effect of short circuits. The heavy cost of switchgear is another, as many people are finding out to their sorrow. Electricity lives on finance, and it does not matter how perfect the technical part is if the scheme does not pay.

These considerations have driven designers back to the fuse. The June number of the *General Electric Review* (U.S.A.) described an oil-immersed fuse for 15,000 volts. The fuse has a breaking capacity of 25 times normal current for the heavy duty type, which is considerable. The fuse is very short, and is immersed in oil all its length, unlike the Ferranti type which is drawn under oil after it blows.

An interesting type of fuse (fig. 1) has been placed on the market by Messrs. Electric Control, Ltd., of Glasgow. This is contained in a strong glass tube filled with non-inflammable liquid. The fuse itself is very short, and it is protected from contact with the liquid by passing through a cork. When the fuse blows, a spring is released, which instantly contracts, thus introducing a large gap into the circuit. Simultaneously the liquid is forced into the gap, thus extinguishing the arc. The

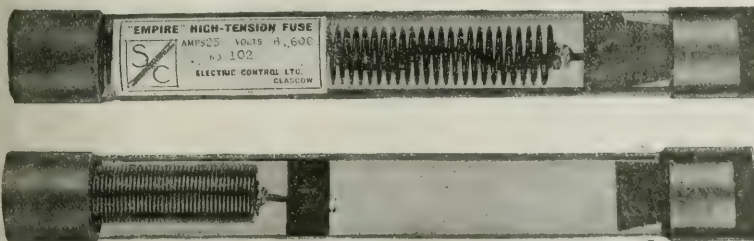


FIG. 1.—"EMPIRE" HIGH-PRESSURE FUSE—BEFORE AND AFTER BLOWING.

One night, a bargee drove a spike into the ground in order to moor his barge to it, and he hit the cable. The station fuse arced over, and that pattern was soon abandoned. Next the "sparklet" fuse had a run. This fuse, which was very short, was connected between two little bombs filled with liquid CO₂. When the fuse went, it blew a hole into the bomb, and let out a gust of CO₂, which was supposed to blow out the arc. Apparently it did not always do this. A 6,000-volt arc, with thousands of kilowatts behind it, is not always amenable to reason! Then there was the Ferranti oil fuse. This was arranged to blow above the oil, and to pull down

short fuse is cooled by the connections, and can thus be run at a high density, which makes it more certain of blowing at the rated current than it would be if run at a low density. The drop of pressure is also much less than for a long fuse, so that the loss of energy is small. Owing to the use of the highly insulating non-inflammable liquid, the fuse can be used for high pressures, up to 110,000 volts if necessary.

The makers give some interesting and useful information in their catalogue. The illustration, fig. 2, shows a fuse blowing on 60,000 volts, with very little splash. At high voltages, there are extraordinary rushes of current during short circuit. In the test on a one-ampere fuse the instantaneous current reached the astonishing peak of over 1,000 amps. At first it might be thought that this would rule the fuse out of action altogether, and that an automatic switch would be



FIG. 2.—FUSE BLOWING ON 60,000 VOLTS.

better, but the makers state that the longest time taken to clear the circuit in tests made on the fuses is less than 0.03 second, which is at least five times quicker than the quickest operating oil switch, which usually takes 4 cycles on a 25-cycle circuit, or a minimum of .16 second. Searching tests show that no severe voltage disturbances are produced, so that the rapid opening of the circuit cannot be considered dangerous. This is because S. & C. fuses open the circuit at the zero point of the current wave.

Fuses of this kind are not intended to blow on plain overload. One sometimes sees insurance company inspectors consulting their fuse tables to put in a fuse wire which will blow at a small percentage over the rated full load of the apparatus. This is a mistake. Fuses should never be used for this purpose. They are only suitable for opening the circuit when the overload is very severe, say, at over twice full load. The makers of the "Empire" fuses recommend that their fuses should be used on this basis. They will then efficiently protect the apparatus against anything like a short-circuit current. This will save the switch, which need not be made of an excessive size, even when supplied from a super-station. Incidentally, it might be a good thing to replace oil in transformer and in oil switches by a non inflammable liquid, somewhat similar to that described by the Electric Control Co. This liquid has a dielectric strength of 250,000 volts per inch, and is one of the most effective fire-extinguishing liquids known. The use of such a liquid should be a great help in enabling switches to break heavy rushes of current without danger.

If the "Empire" fuses fulfil their promise, they will be a valuable aid to the protection of apparatus, and they will also help to clear up, a most important item. It seems even possible that such an improved fuse would enable us to do without pilot wires and much of the elaborate and expensive protection now required on high-power systems, and that would be a gain.

LEGAL.

WESTON ELECTRIC LAMP CO. v. DUNN.

In the Shoreditch County Court on Friday, before Judge Cluer, the plaintiffs sued Mr. Dunn, of Ramsgate, dealer in electrical goods, to recover £3 ls. for goods supplied. Mr. Crispwell appeared for the plaintiffs, and Mr. A. R. Rule for the defence. Mr. CRISPWELL said the goods were sold on March 21st and sent on March 23rd, with an invoice the same night. Later they heard that on April 1st defendant had paid the traveller, a man named Stewart. The invoice clearly stated that travellers were not to be paid, but by an oversight he had omitted to give the defendant notice to produce it, so he could not produce a copy. Mr. HOWARD FENCROX, of the plaintiff firm, said it was an invariable rule to send out an invoice on the day the goods were dispatched. They could trace no line from their agent to say he had been paid. Witness admitted on being shown a receipt that it was signed by the traveller Stewart. Judge CLUER: Stewart is your traveller, and you must prove you told the defendant not to pay him. You have been cheated by this dishonest traveller, and unfortunately you have not prosecuted him. Mr. CRISPWELL: May I have an adjournment? Judge CLUER: Oh, no; that only means bringing them up from Ramsgate again. There will have to be a verdict for the defendant, with costs.

MATHER & PLATT, LTD., v. LOW & CO.

In the Commercial Court of the King's Bench Division on November 17th, Mr. Justice Bailhache was occupied with an action brought by plaintiffs, of Manchester and London, against Messrs. H. V. Low & Co., East India merchants, of London Wall, E.C., in which plaintiffs claimed to recover the price of machinery sold to the defendants in connection with the electrification of some jute mills in India. Defendants said they were not liable.

Mr. NEILSON, K.C., for plaintiffs, said it appeared that the defendants had some connection with a firm of the same name, a limited company in Calcutta, which again had a connection with jute mills in India. There was a company in India called the Behar Jute Mills Co., formed for the purpose of providing factories for the manufacture of jute, and this firm required machinery. A representative either of Low & Co. or of the Behar Jute Co., a Mr. Skinner, came home from India about the end of 1919 and got into touch with Mather & Platt with a view to discussing an order for machinery to go to the Behar Jute Mills. The matter was discussed at some length, and Mr. Skinner used Messrs. Low's offices in London for the purposes of his negotiations. Eventually a tender was prepared by Mather & Platt and sent on February 16th, 1920, to Low and Co. On February 23rd a letter was written upon which a great deal would turn, in which it was stated "We have much pleasure in accepting your tender." It was signed "W. Skinner" in his individual capacity and "H. V. Low and Co." below it. Upon the faith of that Mather & Platt proceeded to manufacture these goods and get them ready for shipment. Most of the goods were made in time, and some were, in fact, supplied but had not been paid for. The defendants said they were merely agents to hand such money as they got from the Behar Jute Mills Co. to the plaintiffs, and that they had incurred no personal liability themselves. That was towards the end of 1920, and at the beginning of 1921 the Behar Jute Mills Co. went into voluntary liquidation. The question was therefore whether Low & Co. had entered into such a contract with Mather & Platt as to bind them and make them answerable for damages for having repudiated their contract and refusing to pay. The parties had agreed that all his Lordship need be troubled with was the question of liability and an indication of what the proper measure of damages, if any, would be.

With regard to the goods, he thought they were entirely manufactured when the repudiation took place, and at that time the Indian market had disappeared. These were very special goods, and he understood they could not be used for any other industry. Some parts of them could be separated and the parts taken into stock by the engineers, and that Mather & Platt were prepared to do; but the others could only be treated as scrap.

Mr. MACKINNON, K.C., for the defendants, said Mr. Skinner was, and was known by everybody to be, manager of Behar Jute Mills Co., Ltd. Counsel submitted it would not be right to hold that the purchasers of this machinery were Messrs. Low. The right conclusion was that the purchasers were the Jute Mills Co., and that the document signed by Messrs. Low was signed only in their capacity as agents for those principals.

His LORDSHIP, giving judgment, said he had come to the conclusion in the circumstances of the case that H. V. Low and Co., signing this document, must be taken—particularly having regard to the fact that it was signed also by Mr. Skinner—to have held themselves out as the actual contracting parties or the parties who were in fact guaranteeing the performance of that contract. He sympathised with Messrs. Low, but there must be judgment against them. Plaintiffs would have judgment for £5,227 for the goods actually supplied. With regard to the rest, the plaintiffs must give credit for the amount they were able to take into stock, while as to that which could only be scrapped, credit must be given for

its value as such. The question of damages must be referred to a referee, and while Mather & Platt must be reasonably compensated, he hoped they would not press their claim for damages to an extreme.

ATTORNEY-GENERAL v. LIVERPOOL CORPORATION.

MR. JUSTICE RUSSELL, in the Chancery Division on November 17th, delivered his considered judgment in this action, already reported in the ELECTRICAL REVIEW.

HIS LORDSHIP said it was alleged by the plaintiffs that the Corporation were carrying on their business in electrical fittings in houses and buildings within and without the city, and also in houses and buildings to which they were not supplying electrical energy. The Corporation admitted supplying within the city, but denied the other allegations. Evidence in support of the allegation as to work outside the city broke down, and no evidence was offered on the third allegation. The question he had to decide was whether in the circumstances the Corporation were entitled, at the risk and expense of the ratepayers, to carry on the business complained of. Before the year 1896 the Liverpool Electric Supply Co., Ltd., carried on an extensive electrical fittings business, but in that year the Liverpool Electric Supply Transfer Act was passed, under which it was provided that the Corporation should purchase the whole of the company's undertaking, including all their property and assets, real and personal, together with all their rights, powers, and privileges. In 1901 the Corporation came to an agreement with the Garston Electric Supply Co., Ltd., whereby they purchased that company's undertaking and all their rights, powers, and privileges. His Lordship said he would deal next with the validity of the complaints made by the plaintiffs. The Corporation had carried on the business for many years now, and one thing was clear, viz., that in the absence of special powers they would not be entitled to do so merely because they were authorised to supply electrical energy. Their powers ceased with the supply of energy to the terminals. The Corporation raised two defences. The first was that they had the statutory authority to carry on the business by virtue of the Liverpool and Garston Transfer Acts, and the second was that they were a common law corporation, and as such they had all the powers and rights of individuals, subject only to the limitations imposed by the Municipal Corporations Act, and that they had never transgressed those limitations in the carrying on of this business. On the first, if the Corporation were right, no question of any alleged mis-application of funds could arise. Dealing with the different sections of the 1896 Act, he said the plaintiffs alleged that even if the undertaking of the Liverpool Co. was transferred to the Corporation, it was not the intention of the Act that the business complained of should be carried on by them. Apparently the Corporation were to spend money in acquiring something which they could not turn to account, either by selling it to somebody else or by working it for their own benefit. After considering the sections of the Act, his Lordship said he had no doubt as to their intention and operation. The Act was framed on the footing, and it provided in terms, that the Corporation were to step into the shoes of the company and to have the power to carry on the whole undertaking and the businesses of the company. In the result he decided in favour of the Corporation on the first ground of the defence. The second ground of defence therefore did not arise, but since the case might possibly come before a higher tribunal, he would deal with it. The evidence of the plaintiffs on the point that the defendants were a common law Corporation was directed to show that the business was carried on at a loss, and that the Corporation had resorted to their funds in transgression of the limitations of the Municipal Corporations Act. But he found that the business had, in fact, been carried on at a profit from 1911 to 1920, except in 1913, and that the Corporation had not contravened the Act. The Corporation were vested by the Transfer Acts with the power to sell and deal in electrical fittings, and the action therefore failed, and must be dismissed with costs.

Mr. ALFRED PAGE, K.C., for the plaintiffs, intimated that there might possibly be an appeal.

ELECTRICAL COMPANY PROSECUTED IN AUSTRALIA.

ACCORDING to Sydney reports dated September 20th and 21st just to hand, the Edison Swan Electric Co., Ltd., of Sydney, was summoned for alleged breaches of the Customs Act. There were six informations, which set out that in 1917 and 1918 the company, by its agent, George Wall, made, in a declaration produced to a Customs officer, untrue statements respecting the fair market value of certain goods imported into the Commonwealth, with intent to defraud.

The magistrate (Mr. Adrian) convicted in each of the six cases of making and producing the declarations in question, but not with intent to defraud the revenue. Fines aggregating £400, with £19 7s. in costs, were imposed.

In the course of the hearing it was stated on behalf of the company that no evidence would be tendered for the defence. Mr. Davis, appearing for the company, said that the invoices were prepared in London and sent to Sydney. The only way the company had of explaining the matter was to get a commission from London. He had nothing at hand and could only obtain it after a long and expensive investigation. The man responsible for the passing of entries had passed away

himself. The Crown had decided to charge the company in a serious way—that untrue statements had been made with intent to defraud—and it was for them to prove the allegations, but they had not done so on the evidence. Nothing had been done to show that any one invoice was false or untrue. There had been no deliberate attempt by the company to defraud the Customs Department. Only a small amount was involved. The company, he contended, could not, under the Act, be charged with "making" and "producing." It must be one or the other.

BRITISH THOMSON-HOUSTON CO., LTD., v. CORONA LAMP WORKS, LTD.

ON Tuesday, November 22nd, at the House of Lords, the arguments were concluded in the appeal by the British Thomson-Houston Co. in their attempt to establish the validity of their letters patent No. 10,918 of the year 1913, for "Improvements in incandescent electric lamps."

Last week, Sir Duncan Kerly, K.C., opened the case for the respondents, the Corona Lamp Works, Ltd., and said that the action was brought by the appellants for the purpose of obtaining an injunction against his clients, and after a protracted hearing Mr. Justice Sargant pronounced an oral judgment, holding that the letters patent were invalid on the ground that the appellants had failed sufficiently to define or limit the ambit of their claim. That judgment was upheld by the Court of Appeal. The appellants' alleged invention related to incandescent electric lamps, in which the filament incandescens in an atmosphere of gas or vapour instead of in a vacuum. This type of lamp was well known in 1913, and all the appellants could claim for their alleged invention was a statement in the specification that an advantage could be obtained if the filament was made of "large" diameter. The appellants' alleged invention was not subject matter of a valid patent, but was at most a discovery to the effect that a gas-filled incandescent lamp with a filament primarily thicker was more efficient than one with a primarily or secondarily thinner filament and was not a patentable invention.

On Monday this week Sir ARTHUR COLEFAK replied, and he took until midday on the following day.

Lord HALDANE said their Lordships would take time.

TELEPHONE COMPANIES' ARTICLES.

IN the Chancery Division on November 15th, Mr. Justice Astbury confirmed the alteration of the memorandum and articles of association of each of ten companies subsidiary to the Telephone Manufacturing Co. of 1912, so as to enable the respective companies to raise working capital which hitherto had been obtained by the parent company from its bankers, the latter company providing an issue of £300,000 debentures secured on the share capital of the subsidiary companies.

Mr. LUXMOORE, K.C., for the petitioning subsidiary companies, stated that the Manufacturing Co. owned or held by its nominees all the shares in the subsidiary companies. The parent company manufactured telephones, instruments, and apparatus for its system, which was specially designed for large buildings. The subsidiary companies bought these and let them to users on contract at a fixed rent, the companies fixing and maintaining the apparatus. There were 13 subsidiary companies. The 10 companies before the Court were the Sheffield, South Wales and Monmouthshire, Liverpool, Birmingham, Leeds, Bristol and West of England and Newcastle Telephone (New System) Companies, Ltd., Lancashire and Yorkshire Private Telephone Co., Ltd., I.T.C., Ltd., and New System Private Telephone Co., Ltd.

Electric Locomotives.—The Blackburn Corporation has in commission an electric locomotive supplied by the English Electric Co., on the railway siding that runs alongside the new electricity works at Whitebirk. It has a haulage capacity of 80 tons, and has at times drawn as many as eight 10-ton railway trucks. It rendered excellent service during the construction of the new electricity works in conveying the new plant, &c., from the railway sidings to the site. It has been stated by the Borough Electrical Engineer (Mr. P. P. Wheelwright) that considerable economies have undoubtedly been effected by its use.

Precise running costs are not available, but these, we understand, are being ascertained. The locomotive is staffed by two men. Chloride batteries are employed.

There is probably scope for electric locomotives on the dock estates of the various ports, at some of which, where there is rail transport between the quay-sides and the adjoining goods stations, there is a considerable amount of short rail haulage and shunting.

At Liverpool, for instance, where there is a "slow" goods line running the whole length of the docks and sidings alongside many of the dock transit sheds, electric locomotives might usefully be employed, but the trouble that is experienced at the Liverpool docks with regard to the employment of electric vehicles, is the inadequacy of the charging facilities.

ELECTRICAL PROGRESS IN LATIN AMERICA.

RECENT ACTIVITY IN HYDRAULIC INSTALLATIONS.

(BY OUR OWN CORRESPONDENT.)

The first electric locomotive manufactured for Brazil has arrived in that Republic. The engine was made to the order of the Companhia Paulista de Estrada de Ferro (Sao Paulo, Brazil), and has been built by the Baldwin-Westinghouse Co., U.S.A. A number of other passenger-locomotives of the same type are being rapidly constructed and will be delivered some time this year, and the balance towards the commencement of 1922. In the meantime, the electrification of the lines is making sensible progress. The Companhia Paulista de Estrada de Ferro is one of the most important company-owned lines in Brazil, and has distinguished itself by being among the first of the railway companies to take advantage of the large natural water supply of the country.

The Municipality of Sololá, in the Republic of Guatemala, is desirous of installing an electric light plant, for which purpose a loan of \$15,000 (£3,000) has been raised.

A neighbouring Municipality, that of Nuévo Progreso, is about to expend a smaller sum—\$3,750 (£750)—for the same purpose, taking power from the same river.

In addition to the existing electric light and power plants of Mexico City, the original concession for which expires next year, and, which it is understood, will not be renewed upon the same terms as previously, the original company has, in the meantime, been given permission to construct two additional plants below the dams of Necaxa, on the river of that name. It is estimated that twelve to eighteen months will be required for the purpose of constructing the first plant, and three years for the second. When both are in operation, they will be in a position to supply 30,000 horse-power, which will be in addition to the 60,000 h.p. which the company controls at present.

The Ferrocarril Oeste of Buenos Aires has received authorisation from the Ministry of Public Works to extend the electrification of its lines to the town of Moréno.

In accordance with the Presidential decree issued from the palace at Havana, Cuba, a factory for the making of electric light bulbs is about to be installed in the capital of the Republic.

The Municipal Council of Ibará (Ecuador), has decided upon the installation of an electric plant for public and private lighting service in that city, the power to be derived from neighbouring water-falls.

A three-year concession has been granted by the Municipality of Autogasta (Chile) for placing electric signs upon some of the principal buildings in the city. The concessionaire will pay the municipality 20 pesos monthly for each sign erected, and the proceeds will be used for school-prizes.

A contract for the lighting of Port au Prince and Cape Haitien, in the Republic of Haiti, has been awarded to a new Haitian company capitalised at \$250,000 (nominally £50,000).

A hydro-electric station is about to be constructed on the river Pirisicaba, in the State of Minas Geraes, Brazil, in order to operate the large iron mines of Itabira de Matto Dentro. A portion of the railroad already in existence will, at the same time, be electrified.

Progress is being made upon the construction of the largest electrified sugar-mill yet erected in Central America, namely that of La Lima, in Honduras. Power is being developed by a 1,000 kW turbo-generator set, with an auxiliary 200 kW set for lighting and general purposes. The electric installation is 440 volts, 60 cycles, and has a Curtis steam turbine prime mover running at 3,600 r.p.m.

The town of El Refugio, in the Republic of El Salvador, has signed a contract for the construction of an installation of electric lights which will be under the management of the newly-formed electric light company of the city of Chachuapa.

In Havana (Republic of Cuba), a modern service works for the prompt repair of all kinds of electrical machinery has been established.

In Ecuador, a special trial illumination has been installed on the Calle Pichincha, between the two streets, Aguirre and Bolívar. The system consists of 100 and 150 c.p. globes with special shades which project the light into the street. New Diesel engines have been installed in the power station, and these render it possible to furnish all the light needed at a lower cost than that of the former system of central lighting.

The Mexican Government of Industry and Commerce has granted a concession to the Companhia de Luz y Fuerza Eléctrica to construct an 80,000-h.p. electric plant in the State of Michoacán. A similar plant is about to be erected in the city of Puebla, utilising a waterfall which will furnish a minimum of 70,000 h.p.

The important port of Tampico (Mexico), which has hitherto put up with mule-drawn tramways has received a concession for the construction of a complete electric street-car service running from the Plaza de la Union through the principal points of the colonies of Volatin, Azteca, Rosario, Americana, Toluca and Rodriguez, joining the Aguila line near the same station.

The Peruvian Government is offering every encouragement

to those wishing to exploit the hydraulic potentialities of the country, which are said to be exceptionally promising. The available water area is from 50 to 150 kilometres from the scene of population, but close to the mining districts on the Andean table-land. It is proposed to construct a canal from a stream which will render available many thousands of horse-power. An estimate of the hydraulic potentiality of Peru is 15 million h.p., whereas the total capacity of the present electric plants scarcely exceeds 52,000 kW. Of this, over 41,000 kW is derived from waterfalls.

The Municipalities of Santiago and Puerto Plata, in the Republic of Santo Domingo, have recently purchased from the Companhia Anónima Dominicana de Agua, Luz y Fuerza Motriz, the whole of their plant and machinery which supply both cities with water, light and electric power. It is proposed thoroughly to overhaul and reconstruct the works, and to introduce some of the latest and most economical class of machinery.

A complete installation of electric cranes and other loading plant will be required in connection with the new port works at Buenos Aires, where 1,000 men are now employed upon the construction. Orders have been received for the work to proceed day and night in order that the new port may be ready at the earliest possible moment.

The Guatemalan Government is considering the construction of an electric line from the city of Guatemala, the capital of the Republic, to the former capital Antigua. Tenders will shortly be invited from foreign contractors, who will be expected to accept part of their payment in government bonds, duly secured.

The electric lighting companies at Guaymas and Hermosillo, in Mexico, have recently obtained large quantities of poles from the State of Oregon, U.S.A. Cedar poles are mostly in use.

ELECTRICITY DISTRICT INQUIRY.

SOUTH-WEST MIDLANDS ELECTRICITY DISTRICT.

THE local inquiry by the Electricity Commission with regard to the area to be included in the South West Midlands Electricity District took place at the Council House, Birmingham on Tuesday, Wednesday, and Thursday last week, before Sir Harry Havard (vice-chairman of the Commission), Mr. H. Booth, and Mr. A. Page. The object was to hear objections and representations made on account of the inclusion in, or exclusion from, the district of certain areas, and to consider (a) a scheme which had been submitted jointly by the Birmingham Corporation and the Shropshire, Worcestershire, and Staffordshire Electric Power Co. for effecting an improvement of the existing organisation for the supply of electricity in the district, and for the formation of a joint advisory committee; and (b) a scheme submitted by the Worcester Corporation for effecting a similar improvement in certain parts of Worcestershire, including the city of Worcester. The area of the district, as provisionally delimited by the Commissioners, comprises Shropshire, Worcestershire, and parts of Staffordshire and Warwickshire.

The case for the Birmingham Corporation and the Shropshire, Worcestershire and Staffordshire Co. was presented by Mr. W. B. CLODE, K.C. (with whom was Mr. H. H. JOY), who, having described the geographical aspects of the Midland area, said its electrical condition was exactly what might be expected, having regard to the somewhat parochial view Parliament had taken about electricity in the past. Some districts were absolutely unprovided with a supply, not being in a position to afford one, while other districts, which had embarked upon creating a supply for themselves, were now in possession of generating stations which were less efficient than they ought to be. Birmingham had risen to its opportunities, and was trying to meet the various needs of its constituents. There were small and large stations—the smaller becoming in course of time inefficient—and the city was looking forward to creating large power stations and a super-station at Hams, near Colehill. Counsel referred to the area supplied by the Leicestershire and Warwickshire Power Co., and stated that they had divided the entire district into two parts, and, by agreement with that company, suggested that the Leicestershire and Warwickshire Company should continue to supply the area over which it possessed powers, except that consumers in the portion nearest Birmingham should look to the Corporation for its supply in the first instance. If either party were unable or unwilling to supply in its respective area, then the other party should have the right to come in. Provision for Birmingham to supply the area over which the Leicestershire company now possessed powers was made in the draft scheme. With regard to the other side of the district, Mr. Clode said the Rowley Regis, Lye, and Stourbridge areas apparently did not want to be included in the South-West Midlands District, and he suggested that those areas should go out; Birmingham was unable to supply them. The Shropshire Co. had now power to supply in that area, subject to the consent of the Midland Electric Corporation for Power Distribution.

Mr. TYLDESLEY JONES, K.C. (with whom was Mr. NORMAN BIRKETT), for the Midland Power Distribution Corporation, informed the Commissioners that a provisional agreement had been signed by the companies concerned, whereby the area should be transferred to the North-West Midlands District, in which the Shropshire Co. had certain rights, on the understanding that the position of that company in the North-West District was in no way prejudiced. He asked the Commissioners at once to give a decision on the point, in order, on the ground of expense, that he and his witnesses might withdraw from the inquiry.

Evidence was given by Mr. L. J. Cook, of the Stourbridge Borough Council, to the effect that that town desired to be retained in the South-West District.

Mr. CLODE stated that in January, Stourbridge Council objected to being included in the South-West District.

Mr. JONES urged that the consumers of Stourbridge did not want to be included in that district. It seemed that Stourbridge was trying to play one company against the other for a financial consideration.

The Commissioners decided to exclude from the South West District the municipal borough of Stourbridge and the urban districts of Rowley Regis, and Lye and Wollescote.

Mr. CLODE, dealing with plans for development, pointed out that a question for consideration was whether the existing arrangements and organisation for the supply could be improved. They had provisionally determined that they should be improved. The Shropshire Co. and the Birmingham Corporation, desirous of giving the district a better supply, proposed to act in unison, and to set up an advisory committee. They believed that what would be done in a roundabout and more expensive way by the setting up of a joint electricity authority, could be done better and cheaper by those two large bodies (which were now generating 98 per cent. of the electricity in the district) acting together and in agreement. Counsel submitted that no advantage could be derived by calling into existence a joint electricity authority. Birmingham was willing that Sutton Coldfield, as the only other authority generating, should go on if it so desired, though ultimately he supposed it would see the wisdom of shutting down its station and getting its supply from Birmingham. Similarly, Kidderminster and Halesowen had already seen the advisability of looking to the Shropshire Co. for the supply of their needs. By this joint arrangement it was estimated that a considerable reduction in price would be possible: the estimate was that the price of delivery to authorised distributors in 1925 would be 0.953 of a penny per unit, and in 1930 it would be 0.866 of a penny.

After questions to Mr. CLODE, Sir HARRY HAWARD said he gathered the promoters of the scheme had not considered placing themselves under any sort of obligation to carry out the technical scheme.

Mr. CLODE: They don't think it ought to be asked of them in the circumstances in which they promote the scheme.

Mr. TYLER, on behalf of the L. & N.W. and G. W. Railway Companies, spoke of the attitude of the railway companies. They were not anxious to incur unnecessarily the capital expenditure of building generating stations for themselves. They would prefer to purchase rather than to generate, not abdicating, of course, any of their rights under the Electricity Act of 1919. The companies could not state definitely that they would need a demand for traction purposes before 1931, but it would be a mistake to allow the Commissioners to assume that there could not possibly be a demand before that year. He objected to a statement that if the railways were electrified it was estimated that approximately 60,000 kilowatts would be required to supply a system within a radius of 50 miles from Birmingham. There were 2,000 route miles within that radius, so that such an estimate was much understated. He promised, in reply to the Chairman, to give the best estimate that was possible now. The companies were reasonably satisfied that the scheme, so far as it was developed, would offer a reasonable prospect of their getting such a supply as they might require.—Mr. H. K. BEALE, Chairman of the Birmingham Electricity Supply Committee, said the view of the Birmingham Corporation was that a joint electricity authority would not be able to do any better than the Shropshire Co. and Birmingham acting together.—The Commissioners expressed the opinion that there ought to be something in the nature of an obligation placed upon the two undertakings to carry out the programme foreshadowed.

At the opening of the inquiry on Wednesday Mr. CLODE stated that his clients had tried to meet the suggestion, and proposed to insert in their scheme a clause "that it should be the duty of the Corporation and the company to provide or secure the provision of a cheap and abundant supply of electricity in the district, and that both parties should comply with any general directions given to both, or either of them, by the Electricity Commissioners through the medium of the Advisory Committee." Counsel said the clause was similar to one inserted in all joint electricity authority schemes under the Act of 1919, and he also suggested the insertion of a clause to obviate the possibility of an *impossé* arising by a two-and-two division on the Advisory Committee, which was composed of two representatives of the Corporation and two of the company. The clause provided that in the event of a majority decision not being arrived at by the committee on any particular matter the respective representatives of the Corporation or the company should report the same to the Corporation or the company, as the case might be, and in the event of a

decision still not being arrived at, either party should be at liberty to submit such difference of opinion to the Commissioners for their directions.

The CHAIRMAN asked if the parties would be prepared to carry out the specific directions of the Commissioners, and Mr. CLODE replied that he could hardly conceive any difficulty arising on that point.

The CHAIRMAN said the Commissioners were prepared to accept the first clause, with the addition of the words "or special" in relation to the directions which the parties undertook to comply with.

Mr. CLODE undertook to endeavour to meet the Commissioners.—The Commissioners also accepted the other clause with minor alterations.

Mr. EMILE GARCKE, Deputy Chairman of the Shropshire Co., said the joint scheme would be more suitable for the district than a joint electricity authority, and would be able to make better progress.

Mr. KENNEDY, for the Malvern Urban District Council, announced the withdrawal of Malvern's opposition as the promoters of the scheme had agreed to the insertion of a clause that it should not affect their rights.

The CHAIRMAN told Mr. Garcke that the Commissioners would need to be satisfied that the two promoters of the scheme were in a position in a reasonable way to meet the demands that were likely to come upon them.—Mr. GARCKE replied that the financial position of the company was quite strong and satisfactory, and capital recently raised would provide for the present commitments, and for the next year or two.

The scheme of the Worcester Corporation was submitted by the Hon. REGINALD COVENTRY, K.C. He said an agreement of mutual benefit to the Corporation and consumers had been made with the Shropshire Co., whereby, subject to the approval of the Commissioners, the city retained its power station. The agreement also gave it facilities and rights to supply an area outside the city boundary, which included some of the chief villages in the neighbourhood. The Shropshire Co. raised no opposition to a proposal to lay a transmission cable from the generating station to the borders of Herefordshire. Reciprocally, the Worcester Corporation offered no objection to the Shropshire Co.'s laying a transmission cable through its streets. Within a reasonable time the Corporation would be in a position to supply the whole of the extended area.

Evidence as to the financial aspect of the joint scheme was given by Mr. ARTHUR COLLINS, late Birmingham City Treasurer. It was pointed out that the scheme contemplated that Birmingham would have to raise during the next ten years over two million pounds as its share of the total cost, and witness said there ought to be no difficulty whatever from the capital point of view.—Mr. R. A. CHARTOCK (Corporation Electrical Engineer, Birmingham), stated that with the proposed Stourport power station in operation there would be no difficulty in the promoters meeting all demands. In the absence of that station, however, the Hams station would have to be running in about eight years' time. He agreed that if the Stourport station was not proceeded with a readjustment of the whole scheme would be necessary. Under the scheme the saving in coal in 1925 as compared with the present time would amount to 118,200 tons per year.

It was stated by Mr. J. T. H. LEGGE, engineer to the Shropshire Co., that they had a scheme for dealing with several of the more prominent towns, like Bromsgrove and Droitwich. Rural areas could not be economically served unless the question of wayleaves was very much eased. He had been asked to pay as much as £15 per pole for carrying an overhead line over certain land near Stourport. They hoped for assistance in this matter from the Commissioners. Overhead lines were essential in rural areas, and, so far, more opposition than help in erecting such lines had been experienced. Regarding the business of the company, ten million units were sold in 1913, and 64.53 million in 1918, but there had since been a falling off. The average price per unit was 1.62d. For lighting towns they charged 6d. per unit. There was no reason for asserting that they did not intend to proceed with the Stourport station; they looked forward to doing so as the demand came along—probably to make a start at the end of next year. Stourport had unlimited advantages as a site, because of its natural characteristics, and also because new coal fields were being opened in the area. With a joint scheme neither undertaking need carry the reserve plant necessary in working individually, and working costs would be lessened. His company would take supplies from Worcester Corporation for the next two or three years until the Stourport station was running, so as to meet the rural demand.

Mr. C. P. SPARKS (consulting engineer), expressed the view that the middle of next year would be the best period to purchase plant for the Stourport station, as prices were falling.

The promoters intimated that they had no objection to the inclusion of Kinver and Dudley rural district in the area.—The CHAIRMAN announced that the Martley Urban District Council desired to be excluded; that Upton-on-Severn wished to be included, but desired to take its supply from Worcester; and that the Tamworth Borough and Tamworth Rural District Councils desired the whole of their areas to be included.

It was urged by Mr. REAY-NADIN that Sutton Coldfield should be entitled to have representatives attending the

Advisory Committee when matters affecting it were under consideration.

Mr. CAPEL LOFT, Stourport, opposed the scheme on the ground that voluntary co-operation between the parties would be equally effective. In reply to Mr. BARNHART, (Electrical Workers), the CHAIRMAN said the question of the insertion of a fair wages clause in the agreement did not arise at the inquiry.

Mr. CLODE said he desired to make it perfectly clear that the promoters were most desirous of developing the district and doing their duty. They did not want to keep out anybody who wanted to come in. He pointed out that nearly all the objections to the scheme had disappeared.

The inquiry then concluded. The Commissioners will give their decision in due course.

THE PUBLIC WORKS, ROADS, AND TRANSPORT EXHIBITION.

ON November 18th, Mr. Arthur Neal, M.P., Parliamentary Secretary, Ministry of Transport, opened the above exhibition at the Agricultural Hall. The exhibition was primarily intended to present to representatives of municipal authorities the latest developments in machinery and methods for accomplishing the many and varied works now carried out by these authorities. Naturally building construction and road making and maintenance formed the principal part of the display, but lesser subjects, such as small holdings, office furniture, time recorders, &c., were also given space. Motor-driven machinery was not so much in evidence here as at most recent exhibitions, but this was, of course, due to the fact that such appliances have a roving commission, and are often (or perhaps generally) required where no electricity supply is available. As was to be expected, electric vehicles played a not unimportant part, and several firms exhibited examples of their work.

ELECTRICARS, LTD., showed a 2½-ton Edison accumulator wagon. In this vehicle the battery is placed in front of and partly underneath the driver's seat, and power is transmitted to two totally enclosed motors fixed at an angle on each side of the chassis. An extended shaft transmits the power to the rear wheels. The body is constructed of sheet steel channel sections on the outside, allowing a clear sweep for the load when tipping. The tipping gear is electrically operated by a small auxiliary motor; the time taken is about 20 seconds. This firm also had a similar chassis fitted with a 700 gal. tank, similar to one supplied to the Islington Borough Council for road watering.

CLAYTON WAGONS, LTD., displayed a 3-ton wagon of substantial proportions. This was driven by a single B.T.H. motor, fed from a Chloride Co. battery, the drive being transmitted to the rear axle by two chains. The road wheels were mounted on ball bearings.

MESSRS. RICHARD GARRETT & SONS, LTD., had a 2½-ton "electric" fitted with a wood end-tipping body measuring 11 ft. by 7 ft. inside.

BRITISH ELECTRIC VEHICLES, LTD., in addition to two electric trucks of 1,500 and 5,000 lb. capacity respectively, showed a battery locomotive designed to run on a 1-in. gauge track, and capable of hauling a load of 10 tons on the level. The locomotive is provided with two motors wound for series-parallel control. The controller is of the drum type, arranged to give four speeds in either direction. The battery is capable of providing energy for a run of about 20 miles.

THE GENERAL VEHICLE CO., LTD., had three vehicles on show. One was a 2-ton chassis fitted with a street-watering tank interchangeable with an end-tipping body. A 3½-ton chassis was shown bearing a "Craymer" unloader. The third exhibit was a 5-ton chassis with a 3-way (side or end-tipping) body. These vehicles were all fitted with "Ironclad-Exide" batteries and series-wound motors capable of a 300 per cent. overload. The ranges of the three vehicles are 45, 35, and 30 miles respectively.

MESSRS. W. GOODYEAR & SONS, LTD., included in their display a 2-ton "Greenbat" electric truck.

Mr. H. C. SLINGSBY also showed transporter and lifting trucks.

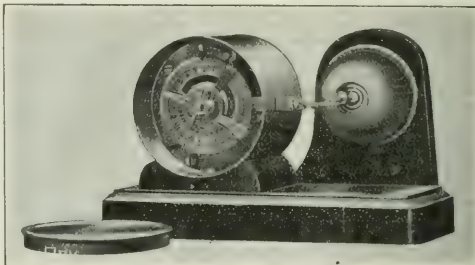
MESSRS. BENTON & HORSNBY, LTD., exhibited the 15-cwt. road and electric crane (Mossley & Ransome system), which was displayed by us recently in connection with another exhibition (ELEC. REV., Oct. 21st, p. 545).

STEVENS PETROL-ELECTRIC VEHICLES, LTD., showed a 3-4-ton petrol-electric chassis similar to those supplied to a number of municipalities and Government departments.

On the stand of Messrs. G. Percy Trentham, Messrs. BREWSTER, SAWYERS & CO., LTD., exhibited numerous examples of welded work. These included lap and butt welds of various types, single welds, &c. Sections through samples and welded pipes subjected to tests showed the efficiency and strength of the work. In an enclosure, screened with tinted glass, demonstrations of rail welding and building-up were given.

THE EVINRUDE MOTOR CO. (ENGLAND), LTD., showed the "Evenlite" small-power lighting set. The engine of this set is a 2 h.p. "Evinrude" petrol engine with a force pump cooling system. Connected to this by a flexible coupling is a 500-watt, four-pole, shunt-wound dynamo, with a full-load speed of 1,000 r.p.m. This machine has a comparatively large commutator and well-designed brush-gear. The engine and dynamo are securely bolted to a massive cast-iron bed-plate. The switchboard is of slate, 18 in. square, and of simple design. It bears a voltmeter, an ammeter, an automatic cut-out, and a d.p. switch and fuses. The battery consists of 13 Fuller's cells with a 100-Ah capacity and a pressure of 25 volts. The plant is supplied with a special adapter, which enables a supply to be taken from a petrol can.

THE HORSTMANN GEAR CO., LTD., displayed numerous examples of time switches. The "Newbridge" time switch has a 14-day clockwork unit with double-roller lever escapement. To this is attached a s.p. quick make-and-break switch with self-adjusting spring plunger contacts in circuit



THE "HORSTMANN" TIME SWITCH.

with a porcelain "damper" fuse and special contacts on an ebonite base plate connected to the outside wiring. The gear is enclosed in a strong cast-iron case. The "Horstmann" switch consists of a clockwork mechanism and an independent tumbler switch. The latter is actuated by a link moved in or out by tappets fixed to the rotating dial of the clockwork. The two parts of the mechanism are mounted on a teak base.

THE RAWPLUG CO., LTD., showed several applications of "Rawplugs" to various materials. These included instruments mounted on slate switchboards, and fittings on brick, concrete, cement, &c.

THE UNCHOKEABLE PUMP, LTD., demonstrated one of its appliances driven by a small electric motor. This was a 3 in. pump working under severe conditions, passing heavy solids, such as nuts, stones and tins, and such substances as cotton waste, rags and straw.

MESSRS. R. A. LISTER & CO., LTD., showed examples of "Lister-Bruston" power sets. These are automatic sets, consisting of a vertical water-cooled "Lister" engine driving by belt a shunt-wound dynamo. These are mounted on a heavy bed plate and a cylindrical fuel and water tank is mounted between them. The two sets shown were of 1 kW and 6 kW capacity. A special feature of the 6 kW set was the separate casting containing the bearing for the engine shaft, which was bolted on to the main casting. A 2-kW "Lister" lighting set was also shown.

During the exhibition a number of conferences were held by various municipal associations. To-day, which is the last day of the show, the I.M.E.A. is holding a conference, when papers on "Electric Vehicles for Municipal Purposes," and "The Application of Electricity to Municipal Services," are to be read by Messrs. F. Ayton & S. J. Watson respectively. We hope to say more of these papers in a later issue.

Electrical Supplies in South Africa.—The *South African Mining and Engineering Journal* (Johannesburg), in its issue of October 29th, says: "Dealers in electrical goods were more hopeful this week as to business in the near future. They confirm the improvement which has taken place during the past two or three weeks, and state that trading is now good again, both in town and country. There are no alterations to report in prices, which remain very steady, with, if anything, a tendency to rise. Stocks in all lines are now full, and consignments continue to arrive in fair quantities from Britain, America and the Continent. Those from the latter destination continue still to be much below British quotations, but signs are not wanting that a gradual levelling up is taking place, and it will not surprise dealers if within a few months' time the present discrepancy between the prices of British and Continental electrical materials, with one or two exceptions, disappears to a considerable extent."

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Construction of Rheostats.

We were interested in reading on page 681 of the current issue of the ELECTRICAL REVIEW, a note concerning "Rheostats with the minimum of material."

As manufacturers of a large variety of resistances of all kinds, we would like it to be known that we do not consider the method therein described new, because we have been utilising parallel and series-parallel methods of winding for some years.

We believe that it is an obvious fact, well known to makers of resistances, that an ordinary series resistance is, as a rule, uneconomical, as when the regulating switch is adjusted for high current values, only a small portion of the resistance material is in circuit, so that, instead of all the resistance material being utilised to radiate the heat, there is a comparatively small portion of it running at high temperature.

Many years ago Dr. J. A. Fleming pointed out the advantage of paralleling resistance wires in the manufacture of load resistances, and we are, therefore, surprised that R. Richter should claim this method as being new in his recent publication in the "E. T. Z."

L. F. Fogarty,
The Zenith Manufacturing Co.

London,
November 19th, 1921.

Current Limiting Simple.

Your correspondence columns have contained many interesting letters descriptive of current-limiting devices, and claiming particular advantages for each type. I should, however, like to point out that current limiting is a very simple matter, not requiring any separate piece of apparatus.

In an ordinary installation we often have a collection of supplier's switch and fuse, consumer's switch and fuse, meter or limiter, or both. If a contract system of charging is adopted the function of all these appliances can be performed by one fitting, viz., the Heemal overload switch.

This device is a small inexpensive free-handle overload circuit-breaker. The setting of the overload is adjustable, and can be sealed. It thus gives the supplier and consumer protection against overload, and is a means of isolating the installation. It also acts as a current limiter, because its overload setting is adjustable to such a fine point that, for example, in a six-light installation the switching-in of one additional lamp will cause it to operate. All that is then required to restore the circuit is to turn the switch on again.

Could there be anything simpler—or better?

Alan Williams.

London,
November 19th, 1921.

Free Wiring Systems.

I was unfortunate in not being able to be present at Mr. Nisbett's address to the Liverpool Sub-Centre of the Institution of Electrical Engineers on November 7th, but have read his paper and suggestions with regard to assisted wiring and also free wiring of consumers' premises.

The company, whose business I have the honour to control, carried out several hundred "Free-wired Installations" in good class residential property with rents ranging from £45 to £200 per annum between the years 1895 and 1909. Undoubtedly these installations were of great assistance to the company in those early days of carbon-filament lamps and fierce gas competition.

Owing to the lower quality of gas now supplied and the great improvement in electric lamps, I do not think gas competition for lighting purposes a very serious affair in these days.

At the present moment, in spite of bad times and shortness of ready cash, there is a steady and increasing number of new lighting consumers requiring connection to the supply mains. If this is so in bad times, how much more so will it be when materials are cheaper and money less scarce!

For these reasons I do not think a free-wired system is needed in good class districts, and in poor districts where tenants are constantly changing, the difficulty of keeping track of these changes and of obtaining signed and stamped agreements in each case would be very great—and without properly completed agreements the owner of the installation has very little status in cases of dispute.

In the area of the Liverpool District Lighting Co., Ltd., where premises do not often change hands, many installations have been disposed of to new owners when sales of property have occurred.

An extra charge of one penny per unit over and above the ordinary charge for electricity is made, with a minimum of one shilling per point per annum. Allowing an average cost

of twenty shillings per point for the installation, this would presumably bring in 5 per cent. per annum provided all the installations were in use. As, however, the cost of the service line has to be included in the cost of the installation and premises are at times untenanted, the rent charges have only amounted to about 3 per cent. per annum of the capital invested.

By the agreements the company is entitled to 5 per cent. per annum as interest on the capital cost of the installation—any surplus obtained being written off the value of the installation which has earned it. In actual practice only a few installations have written their capital account down by this means, and those only very slightly.

Then there is the case in which the installation is scrapped owing to alterations to premises or buildings being pulled down. In this case the installation is lost, and its value has to be written out of the depreciation fund.

In the case of my company a special depreciation fund has been formed to which all the rent pennies received are credited, but it has been found necessary, from time to time, to make additional payments out of revenue to this fund, as with the lower consumption of electricity by the metal-filament lamps a charge of one penny per unit is found to be quite insufficient.

From the foregoing it will be appreciated that a "Free-wiring Scheme" even under favourable circumstances is not self-supporting, and if such were undertaken with the present cost of money and the present cost of installation work, a serious loss would surely be added to the other difficulties of working such a system which, as I have already pointed out, appears to be unnecessary.

Edwin Hansom.

Waterloo,
November 21st, 1921.

The Vapour Accumulator.

In a recent issue you referred to a new accumulator invented by Dr. Ruths, and known as the Vapour Accumulator.

It may interest your readers to know that, as a result of a search at the Patent Office, this invention is found to relate to sulphide digester plants employed in cellulose manufacture, and has no possible connection with electric accumulators.

Bernard Drake.

London,
November 16th, 1921.

A Dynamo Problem.

The cause of "Electron's" dynamo trouble is that the field coils have developed leakage between windings which is impossible to pick up with the usual test.

This can be remedied by treating the coils with insulating varnish and then baking them. If facilities for baking are unavailable, the following is simple, can be carried out very cheaply, and will be found quite efficient: Unwind the tape outer cover (if there is any), pull the windings a little way apart, and submerge them in carriage varnish for about twelve hours; take them out and drain for about three hours. Tape them up and replace them in the machine. When the dynamo is run up do not expect it to take full load immediately, but run for a few hours under light load. In a very short time (about three or four days from the time of submerging in varnish) it will take full load. The first time of running, the coils will most probably warm up, but they will cool gradually, so that no heed need be taken of this. I have, personally, dealt with a dynamo treated with the last method, and have had it running under full load for six to seven months continuously.

F. G. Johnson.

Gillingham.
November 20th, 1921.

I suggest that a very close examination be made of the field windings, both series and shunt, and a test made for—

1. Short circuit between shunt and series coils.

2. Short circuit cutting series coils out of useful action.

No. 2 seems to be the most likely cause of the trouble, for the machine is now behaving exactly as a shunt-wound dynamo would do.

For the aggravation of the trouble I think it quite possible that the arm lifts off the studs when near No. 30, or makes bad contact. It must be remembered that if this happened, the machine would drop its load entirely if the series field was out of action.

Engineer.

November 20th, 1921.

In reply to the letter of "Electron" under the above heading, might I suggest that he thoroughly examines and tests all his connections (machines and switchboard) in relation to the series fields, equalisers, and + and - busbars, to make sure that he has not a loose (or hot) connection anywhere, more especially in relation to the machine, the engine of which does

not appear to become overloaded. I may remind him that the appearance of a connection is not sufficient proof that it is O.K.

R. Wilson Jones, A.M.Inst.M. & Cy. E.

Harrow.

November 21st, 1921.

[Mr. H. Barham, of Colchester, Mr. R. Swindlehurst, of London, Mr. W. T. Hilder, of Aberdare, "F.W.B.," "T.G.M.," and "C.A.B.," make similar suggestions, which will be forwarded to "Electron."—Eds. Elec. Rev.]

Repairing A.C. Motors.

With regard to the letter of "Jaques" in your issue of October 21st, 1921. The Editors' plan of spinning the stripped rotor in a suitable magnetic field would undoubtedly decide the state of the insulation of the rotor laminations. The stator, however, presents a different problem.

Apparently in "Jaques's" case the rotor is in order, and it is the stator which will have to be tested.

Assuming the insulation between the core stampings of any a.c. apparatus to have been destroyed subsequent excessive heating of such a core would most probably be due to eddy currents.

In taking efficiency tests, energy absorbed in generating

eddy currents is tabulated as a loss under the heading, Iron Losses.

Let "Jaques" then treat his a.c. motor as a transformer which he intends to test for iron losses.

If the stator is sound (as apparently it is), disconnect, or place the stator windings on open circuit. If unwound, or stripped, so much the better. Build up the machine as for running, but lock the rotor so that it cannot turn, connect the rotor slip-rings to a suitable a.c. supply (the voltage of which should approximate to the open circuit rotor volts) through a resistance by means of which regulate the current until it approximates to full load rotor current.

Full rotor currents will give approximately full magnetic flux density in both rotor and stator cores, at the periodicity of the supply, and defective insulation will soon be apparent in the excessive heating of the iron, by the eddy currents generated or stator iron losses. In case of difficulty in obtaining a supply at suitable voltage, lock the rotor of another similar motor, and use it as a transformer, the stator being the primary and the rotor the secondary. Other methods may suggest themselves to "Jaques." Of course the foregoing method is only practicable if the motor has a slip-ring rotor or if a suitable slip-ring rotor can be obtained.

Tanner.

November 16th, 1921.

BUSINESS NOTES.

Bankruptcy Proceedings.—WILLIAM EDWIN CHARLES JARVIS, 3, King Edward Street, Darlston, lately trading as the Darlston and District Electrical Engineering Co., 48, King Street, Darlston, Staffordshire, electrical engineer. The first meeting of the creditors was held on November 16th at the Official Receiver's office, 30, Litchfield Street, Wolverhampton. The liabilities were returned at £283, against assets £18. The matter was left in the hands of the Official Receiver as trustee.

T. D. WARING, electrical engineer, 55, Walmgate, York.—Receiving order made November 14th on debtor's own petition. First meeting November 29th at the Official Receiver's offices, Dunscomb Place, York. Public examination December 16th at the Law Courts, York.

C. P. M. DOWNIE (P. Downie), electrical engineer and factor, 355a, Westborough Road, and 88, Ronald Park Avenue, Southend-on-Sea.—Discharge suspended for two years as from October 17th, 1921.

G. DOLBY, electrician, 39, East Marsh Street, and 129, Freeman Street, Gt. Grimsby.—Trustee, J. F. Winttingham (Official Receiver), St. Mary's Chambers, Gt. Grimsby, released October 31st, 1921.

J. W. LAYTON, electrician, 5, Nobles Bank, Hendon, Sunderland.—Trustee, W. A. Ellis (Official Receiver), 3, Manor Place, Sunderland, released November 2nd, 1921.

F. A. S. WORMULL, trading as the Lewisham Electric Wiring Co., 273, High Street, Lewisham, electrical engineer.—The public examination of this debtor was held recently at the Court House, Greenwich. Debtor stated that he commenced business in January, 1919, with £150 capital, which was all absorbed in opening the premises. In 1919 his losses amounted to £279, and in the following year to £706. In 1919 the sales amounted to £2,188, while in 1921 they rose to £2,451. The liabilities were returned at £2,763, against assets £261. Debtor attributed his failure to heavy administrative expenses, lack of proper supervision of outdoor staff, losses incurred through inaccurate tendering for contracts carried out, trade depression, and the action of the trade unions in increasing wages. The examination was adjourned.

W. BENNETT, electrical contractor, Back Sitwell Street, Derby.—Receiving order made November 18th on debtor's own petition.

M. WATKINSON, H. WATKINSON, AND A. WATKINSON (WATT AND CO.), electrical and mechanical engineers, 22 and 24, Palmer Road, Sheffield.—Last day for proofs for dividend, December 8th. Trustee: Mr. T. C. Parkin, Jun., 36, Bank Street, Sheffield.

JOSEPH OWEN, trading as J. Owen & Sons, 186, Westcombe Hill, Greenwich, Kent, and 3, The Grove, Greenwich, electrical engineer.—The first meeting of creditors was held on November 18th at 29, Russell Square, W.C.1. The receiving order was made on debtor's own petition on November 7th. According to the statement of affairs the ranking liabilities amounted to £1,294, against net assets estimated to realise £289, owing to a deficiency of £1,005. Debtor started business in December, 1916, as an electrical engineer, and was successful until December, 1920, when the business declined owing to trade depression, followed by the coal strike. There was not a quorum of creditors present at the meeting, and the case, being a summary one, was left with the Official Receiver as trustee of the estate.

Company Liquidations.—STONECROFT ELECTRICAL WORKS, LTD.—Particulars of claims to the liquidator, Mr. E. Chetler, 26, North John Street, Liverpool, by December 28th.

STRATHAN OSWELL & CO., LTD., London, E.C.—Meeting of creditors, Friday, December 2nd, at Institute of Chartered

Accountants, Moorgate Place, E.C. 2. Liquidator: Mr. W. W. Read, 44, Gresham Street, E.C.

WELLMAN, HEAD, STOTHERT & PITT, LTD.—Winding up voluntarily. Liquidator: Mr. C. J. Barker, 36/38, Kingsway, W.C. 2.

DUBILIER CONDENSER CO., LTD.—Winding up voluntarily for reconstruction purposes. Liquidator: Mr. F. W. Hollings, Ducon Works, Goldhawk Road, W., who is authorised to enter into an agreement with a new company, Dubilier Condenser Co. (1921), Ltd.

Dissolutions of Partnership.—T. BAKER & CO., electrical engineers, 93, Upperton Street, Leicester.—Mr. T. Baker and H. A. Lock have dissolved partnership. Debts will be attended to by Mr. C. H. Bolton, 22, Millstone Lane, Leicester. Mr. T. Baker will continue the business.

ACCUMULATOR SERVICE CO., manufacturing electricians, 83, Forest Street, Forest Gate. Mr. S. T. Jolley and Mr. W. D. Eves have dissolved partnership.

Trade Announcements.—MESSRS. ELECTRICAL UTILITIES, LTD., have arranged an agreement with Electrical and Engineering Development, Ltd., whereunder they acquire the whole capital, patents, business, goodwill, and other assets of the latter company. Upon the formal completion of the sale, Electrical and Engineering Development, Ltd., will go into voluntary liquidation.

THE CABLE ACCESSORIES CO., LTD., has removed its London office to 13, Curator Street, Chancery Lane, E.C. 4 (Mr. Charles Lang, London manager). A range of "Revo" electrical manufactures is on exhibition.

MESSRS. FRIEND, WINTLE & CO., 8, Park Street, Cardiff, are opening an electrical showroom in St. Mary Street, Cardiff.

MESSRS. BILHAM & KIDNEY have opened showrooms for electrical goods in Pound Street, Carlshalton.

Copper and Lead Prices.—Messrs. F. Smith & Co. report November 23rd:—Copper (electrolytic) bars £76, 10s. decrease; ditto sheets, no change; ditto wire rods £92, 10s. decrease; ditto "h.c." wire, no change; silicon bronze wire 1s. 2½d., 1d. decrease.

Messrs. James & Shakespeare report November 23rd:—Copper (bars best selected), sheet and rod, no change; English pig lead, £26 5s., increase 20s.

Catalogues and Lists.—MESSRS. EDWARD LE BAS & CO. London.—A hanging card which, on one side counsels us all to "Be Happy, Smile, Make Life Worth While," and on the other side gives tabulated prices of welded gas, steam and water tubes and malleable fittings.

THE WALSHALL ELECTRICAL CO., LTD., 57, Bridge Street, Walsall.—An illustrated leaflet giving revised prices of generator and battery switchboards.

MESSRS. ISAACSON & BROWN, LTD., 39, Furnival Street, Holborn, E.C. 4.—An illustrated leaflet giving revised prices of copper earthing clips. Also a priced sheet of electrical fittings including tumbler switches, bell pushes, lamp holders, &c.

MATERIEL ELECTRIQUE ALX LEBREYRE, 9, Rue Arsène Houssaye, Paris (VIII.). "Special Bargain List," No. 53, a catalogue of British-made machinery for disposal in France including generating plant and other electrical machinery.

Mr. J. B. RUDKIN (representing Sprecher & Schuh Co., Switzerland), 212a, Shaftesbury Avenue, W.C. 2.—An illustrated booklet describing a number of switches and fuses of various types.

MESSRS. J. & W. B. SMITH, LTD., 15-23, Farringdon Road, E.C. 1.—An illustrated price list of electrical heating and cooking appliances, including kettles, irons, grills, fires, toasters &c.

MESSRS. A. VEREY & CO., LTD., 27, Buckingham Gate, Victoria Street, S.W.1.—An illustrated price list of numerous electrical appliances and accessories, including lanterns, bowl fittings, lamps, fires, kettles, &c.

MESSRS. WILLIAMS, PELL & BARING, 4, Regent Square, W.C.1.—Descriptive Leaflet No. III. 1, illustrating and giving full details of small automatic overload switches made by Heemaf, Holland.

MESSRS. E. P. ALLAM & CO., 107-109, Gray's Inn Road, W.C.1.—Monthly stock list for November giving full particulars of d.c. motors.

MESSRS. L. G. HAWKINS & CO., 116, Charing Cross Road, W.C.2.—Folder No. 760 illustrating and describing the "Universal" electric washer and wringer. Priced.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Leaflet O.S. 2,588, illustrating and describing the "Atrax" advertising sign projector. Priced.

THE GLOBE ENGINEERING CO., LTD., Brighouse, Yorks.—Owing to an error, the list mentioned in this column in our last week's issue was stated to deal with a.c. plant, whereas it was a catalogue of direct-current motors and dynamos.

Book Notices.—"The Book of the Ford," by R. T. Nicholson, M.A. (286 pp. illustrated). London: The Temple Press, Ltd. Price 3s. net. (6th edition).—The latest edition of this little volume, which, it is said, has so far had a circulation equal to the number of Ford cars sold in this country, has been entirely re-written. The electrical equipment is dealt with where necessary, but it has been found advisable to treat of this subject fully in a separate volume. Written in terms easily to be understood by the average owner, this book is of great value to the ever-increasing army of drivers of the car which has survived such a flood of humour.

"The Rights of the Ex-Service Man and Woman," by Wilkinson Sherren. (111 pp.). London: L. J. Gooding. Price 6d. net.—In a preface to this handbook the Rt. Hon. C. A. McCurdy, K.C., M.P., says that it has been impossible to make those who were entitled to them fully acquainted with their rights with regard to pensions, gratuities, &c. He gives a short summary of what has already been done for ex-Service men and women, and thinks that Mr. Sherren's work will be of great assistance to them. The work sets out very fully details of disability pensions and methods of assessment; employment is dealt with; land settlement and overseas settlement are treated of in a fairly adequate manner; and many points of lesser importance are touched upon.

"Journal of the American Institute of Electrical Engineers," Vol. XL, No. 11, November, 1921. New York: The Institute. Price 1s.

"Alternating Currents," Part I, by C. G. Lamb, pp. xiii+74, 61 figs. Price 5s. 6d. net. Part II, pp. iv+128, 82 figs. Price 7s. 6d. net. Cambridge University Press.

"The Emission of Electricity from Hot Bodies," by O. W. Richardson, F.R.S. Second edition, pp. viii+320; 35 figs. London: Longmans, Green & Co. Price 16s. net.

"Fuel and Lubricating Oils for Diesel Engines," by W. Schenker, pp. xii+114, figs. 26. Price 10s. "Modern Methods of Welding as applied to Workshop Practice," by J. H. Davies, pp. xviii+263, 132 figs. Price 21s. London: Constable & Co., Ltd.

"Science Abstracts, A. & B.," Vol. XXIV, No. 286, Part 10, October 31st, 1921. London: E. and F. N. Spon, Ltd. Price 2s. 6d. each net.

"Electric Clocks and Chimes—a Practical Handbook on their Design and Construction," pp. 159, 153 figs. London: Percival Marshall & Co. Price 3s. 6d. net.

Inquiry.—The makers of a device for arousing a sleeper and simultaneously starting a water heater ("The Sluggard's Comfort") are asked for.

Registration of Electrical Contractors in Australia.—The Electrical Contractors' Association of New South Wales has requested the State Government to introduce legislation licensing persons who control the industry.

At the annual dinner of the association, in September, Mr. G. Cann (Minister for Labour and Industry) said that he would promise, if the Government were spared, to place on the statute book a law in the direction indicated. As far as he was concerned he would do his level best to put through legislation on the basis of efficiency above all things. He was of opinion that certificates should be issued to the men, after a thorough examination, that they were competent to do the work. He had no time for the "go-slow" or sabotage policy. —*Sydney Morning Herald*.

Catalogues Wanted.—MESSRS. KYFFIN HUGHES, lighting and heating engineers, 4, The Foultry, Nottingham, who contemplate opening an electrical department, desire to receive catalogues of electrical specialities.

MESSRS. TRESDALE & JONES, electrical contractors, 17, North Street, Swindon, wish to receive catalogues and lists of electrical goods.

Social Event.—Mr. W. E. Hobbs, district manager, presided on Saturday at a "coming-of-age dinner," held at the Royal Hotel, Cardiff, in connection with the local branch of the General Electric Co., Ltd. Mr. M. J. Railing (director

and general manager), together with Mrs. and Miss Railing, was present, as also was Mr. H. N. Whitford, the branch representative at headquarters. The function was attended by about seventy members of the local staff. Mr. Hobbs said he considered that, after passing through a trying year, when everyone had been blaming the other fellow for being responsible for the slump, it was a good thing for the staff, management and directors, to meet together in that manner. Mr. Railing said he believed the reason why the General Electric Co. had not felt the depression as much as many other industrial concerns was because the staffs had realised hard, unpleasant facts, and were adjusting themselves more quickly.

The Trade Ship "British Industry."—The directors of the "British Trade Ship," of which Earl Grey is chairman, announce that provisional tenders are being obtained by the builders of the ship for the various parts and fittings. Exhibitors who are in a position to supply some part or fitting as an exhibit actually in use on board, quite apart from their display in the exhibition proper, are naturally anxious to have their products accepted for this purpose. At Wall-send-on-Tyne, where the ship will be built, and at the offices of the British Trade Ship, 12, Grosvenor Gardens, London, S.W. 1, the examination of specifications is taking place, and is of considerable interest as revealing the place of different cities in the construction and equipment of the "Trade Ship." Birmingham wants its bedsteads in the best cabins; Kidderminster its carpets; Bradford its textiles; Sheffield its cutlery; and so on with machinery, electrical goods, &c., and the directors of the "Trade Ship" are inundated with offers to provide exhibits which will be actual fittings of the ship. When arrangements have been completed the names of the chief firms responsible for the various component parts of the Trade Ship will be published.

Italian Companies.—There has been formed at Rome the Compagnia Italiana dei Cavi Telegrafici Sottomarini, with a capital of 1,000,000 lire, for the working of submarine cables joining Italy with Spain, Brazil, Uruguay, and Argentina.

At Turin has been embodied the Società Consorzio Impianti Trazione Elettrica to carry out the electrification of railway or tramway lines. Capital, 1,000,000 lire.

French Railway Work.—The French Thomson-Houston Co. is in negotiation with the Orleans Railway Co. for the supply of 200 electric locomotives, and an agreement is said to be on the point of being reached. At present the former is engaged on the manufacture of sub-station plant for the Southern Railway Co., and has in view the possible delivery of rolling stock for the Paris, Lyons, and Mediterranean Railway. The share capital of the electrical company is shortly to be raised from 200 to 250 millions of francs so as to provide for the extension of the industrial programme.

A French Amalgamation.—The directors of the Société d'Electro-Chimie et d'Electro-Metallurgie, and of the Compagnie des Forges et Acieries Electriques Paul Girod have decided to recommend their respective share-holders to agree to an amalgamation of the two undertakings by means of an interchange of shares on the basis of three shares of the former for five of the latter company.

The Gothenburg Exhibition.—A message from Gothenburg states that work has been begun on the erection of the large halls for the export section of the coming exhibition. The length of the halls is 230 and 200 metres respectively. These halls form only part of a space totalling 16,000 sq. m. allotted to the export section.—*Reuter's Trade Service* (Stockholm).

Strike at Dusseldorf.—Sixty thousand iron and steel workers have gone on strike in the Dusseldorf area for an increase of wages. In some cases a 100 per cent. increase was asked for. The masters replied by declaring a lock-out.—*Reuter's Trade Service*.

For Sale.—By order of the liquidators, Messrs. B. Norman & Son will sell by auction on November 30th, at 5, Little Britain, E.C., the machinery and fittings of Tele News (1914), Ltd., including motors, dynamos, generators, &c.; on December 1st at 62, South Eaton Place, S.W., instructed by the liquidator of T. B. L. Electric Construction Co., Ltd., Messrs. Leopold Farmer & Son will sell a quantity of electrical accessories and fittings, lamps, switches, &c.

Offers are invited for the lease, plant, and machinery, stock-in-trade, materials, &c., of the Victory Alarm Clock Co., Ltd. (in liquidation), of 274, Kentish Town Road, N.W.

Wigan Corporation Electricity Department has for disposal three reciprocating sets.

Assets Auctions Co., Ltd., will sell by auction on December 1st, at 119/121, Newington Causeway, S.E., remainders of various electrical stocks. (For full particulars see our advertisement pages to-day.)

E.D.A. Activities.—The British Electrical Development Association has issued a circular letter (E.D.A. 223) to managers of electricity supply undertakings, pointing out that the electric pastry oven is now a commercial success and a valuable addition to the station load. Accompanying the letter are extracts from testimonials of users of electric pastry ovens. These include restaurant and hotel proprietors, manufacturing confectioners, bakers, &c.

Local Electrical Exhibitions.—Messrs. Renton, Edinburgh, have a very complete exhibit of electric labour-saving appliances for the home, such as sweepers, cookers, toasters, heaters, irons and kettles at the Grocery Exhibition being held in Edinburgh. The "Gem" Labour-Saving Device Co. has also a few some novelties in the electric suction cleaner line. Computing and weighing machines worked by electricity are exhibited by Messrs. Parnall & Sons, Ltd., Birmingham.

An electrical exhibition at Blackburn, arranged by Mr. P. P. Wheelwright, borough electrical engineer, has proved a great success. There have been visitors from towns far and near, and the use of electrical devices is likely to be considerably encouraged.

Messrs. Stephenson, Ltd., hardware dealers, of Kirkgate, Wakefield, are making a special feature of domestic electrical appliances, and are giving demonstrations of electric labour-saving apparatus in the home for a fortnight. The equipment includes electric clothes washers and wringers of clothes, dish-washers, vacuum cleaners, sewing machines, irons, &c.

An exhibition arranged by Mr. J. Turner, superintendent of the Council's electrical department, was held recently at the Hoyalake and West Kirby Town Hall. The authorities were not in any way connected with the sale of the articles, but simply co-operated with firms of local electrical contractors, with a view to giving the numerous labour-saving exhibits an attractive display. Amongst the exhibits were electric cookers, fires, lamps, irons, and many other appliances.

Electrical Installations in Sydney.—The Sydney City Council recently resolved that, on and from a date to be fixed, all installations which it is intended to connect to the Council's mains must be installed by men who are certified by the secretary of the Electrical Trades Union of Australia, such men to be financial members of that organisation, and the consumers must produce a certificate to that effect before the Council will grant supply. Failure to produce such a certificate will render the consumer liable to a fine, and supply of current will be withheld until the fine is paid. It was intimated that notice to rescind the motion would be given.—*Sydney Morning Herald*.

Electrical Salesmanship.—The second of the series of lectures on salesmanship being arranged by the E.D.A. will take place at the building of the Chartered Institute of Patent Agents on December 16th, at 8 p.m. Mr. E. R. Morton will lecture on "Salesmanship in Relation to Electric Power-Driven Machinery in the Home." Mr. S. T. Allen will again occupy the chair.

Attracting the Consumer.—We have not lately seen an "all-electric" newspaper page, a form of collective advertising very popular in the United States, but last week we were gratified to see a whole page of the *Daily Mail* devoted to electricity. Among the advertisements of several prominent electrical apparatus and lamp makers, appeared a short talk on "Electricity the Perfect Servant," by the chairman of the Council of the E.D.A. (It was, of course, the E.D.A. which arranged the display.) The scheme is bound to prove advantageous to the industry as such a paper as the *Daily Mail* has a large circulation and reaches all classes, and the grouping of the advertisements gives each item an advantage not possessed by a similar advertisement surrounded by irrelevant matter.

Auxiliary Machinery for Diesel Engine Ships.—Messrs. W. H. ALLEN, SONS, & CO., LTD., have secured from Messrs. Harland & Wolff a licence for the manufacture of Diesel engines under Messrs. Burneister & Wain's patents. The engines will be made to jigs, tools and fixtures under a system of detailed inspection to secure accuracy, interchangeability, and rapid production, and this work will be carried out in special fitting and erecting shops. These, we understand, are fully equipped, and also have the latest appliances so that the engines may be tested as nearly as possible under actual working conditions. The engines will be made in sizes to conform with present-day requirements, and Messrs. Allen are specialising particularly in the supply of Diesel electric generating sets for auxiliary and emergency purposes on board ship. Messrs. Allen hope shortly to be in a position to supply auxiliary air compressors under the same licence, and they are laying themselves out to provide the other auxiliaries which go to form the complete equipment of a ship's Diesel engine room. The machinery that they are about to construct will comprise Diesel auxiliary engines, Diesel engine-driven generators, auxiliary air compressors, motors for driving compressors, motors for sanitary, ballast, bilge and cooling purposes, motors required in connection with refrigerating machinery, steering gear, hoists, and all descriptions of winches, and centrifugal pumps for all purposes.

Wage Reductions.—During October over 2,100,000 work-people were affected by reported changes in wage rates. Of these 1,700,000 sustained decreases, and 400,000 received increases. The net effect was a reduction in weekly full time wages of £430,000. The groups chiefly affected were miners, blast furnace workers, iron puddlers, and iron and steel mill-men, shipyard workers, foundrymen, hosiery workers, textile dyers, bleachers and workers in the heavy chemical and soap and candle trades.

It is estimated by the Amalgamated Engineering Union that a reduction of about £50,000,000 will be made in the annual wages cost as a result of the ballot decision of the members of the engineering and shipbuilding Unions to accept the withdrawal by instalments of the 12½ per cent. and 7½ per cent. Ministry of Munitions bonus. They express the hope "that the employers' anticipation of an early revival in trade will be realised, thus finding employment for the large number of unemployed workpeople."—*Morning Post*.

Electric Trucks.—Messrs. Roadcraft, Ltd., manufacturers of electric trucks have under consideration plans for an extensive factory. A consignment of six electric "Trojan" trucks has just been dispatched to the Continent. At their present factory work is proceeding on a new type of electric barrel lifting truck.

British Trade Mark Applications.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions associated with the electrical trades and industries:—

O.L.M. (lettering and design). No. 418,687. Class 13. Ignition plugs for explosive motors, &c. Officine per Lavorazioni Metallurgiche e Meccaniche, 4, Via Pestalozzi, Milan, Italy. October 20th, 1920.

Paralite. No. 413,747. Class 13. Vulcanite goods. The Tough Leather Co., Ltd., 447, Winculmlee, Kingston-upon-Hull. March 24th, 1921.

Crypto. No. 408,423. Class 6. Induction motors, rotary transformers, and motor generators, all being electrical machinery. The Crypto Electrical Co., Ltd., Acton Lane, Willesden Junction, N.W. October 7th, 1921.

Alternupoche. No. 415,751. Class 13. Pocket lamps (ordinary). Lucien Rosengart, 61, Boulevard Soult, Paris, France. May 31st, 1921.

Osglim. No. 416,399. All goods in Class 13. The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C. June 24th, 1921.

Autopet. No. 417,585. Class 16. Automatic electric generating plants. Petters, Ltd., Nautilus Works, Yeovil, Somerset. May 10th, 1921.

Win-Sun. No. 418,374. Class 18. Electric fire stoves. Tidd, Siday & Co., Ltd., 180, Drury Lane, London, W.C. September 7th, 1921.

A Derby Installation.—The Palais de Danse recently opened at Derby has been fitted throughout with electric light lanterns and shades of "Celastoid" in various colour effects and shapes. Celastoid is made of cellulose-acetate, by the British Cellulose and Chemical Manufacturing Co., Ltd., of London.

Telegraph Material in Russia.—It is reported from Moscow under the date of November 13th, that telegraph and telephone apparatus is beginning to arrive from Sweden, Germany and England.

Patent Application.—The Radio Communication Co. Ltd., has applied for the grant of a compulsory licence in respect of the following patents: No. 6,203 of 1907, "For improvements in electric signalling," granted to R. A. Fessenden; and No. 24,458, of 1913, "For improvements in the utilisation of oscillating current energy, particularly applicable for wireless telegraphy," granted to J. W. Lee and another.

German Trade with Japan.—Reports show that German machinery suppliers are steadily regaining the markets in Japan. Immediately after the war, it is said, Japanese machinery orders were placed with Germany only for special goods peculiar to German manufacturers. Subsequent trial orders, however, have proved that the machinery is equal to that produced prior to the war, and is offered at prices lower than British and American goods. Principally orders for scientific and chemical machinery used in laboratories, it is said, are reaching Germany from Japan.

Chinese Notes.—A Tientsin merchant has petitioned the Ministry of Agriculture and Commerce for approval to form a company for the construction of tramways between Peking and Tientsin. An electric plant will be installed at Hwailai, and power will be generated from the Yungting River. It is expected that electricity will also be supplied from this source to the factories en route. The permission of the Ministry has not yet been given.

The Ministry of Agriculture and Commerce has registered the revised regulations of the Chi Tsi Electric and Water-works Company of Hankow.

The Fu Sin Electric Co. of Shen Tseh, Kiangsu, and the Changsu Electric Co. of Changsu, Kiangsu, have been registered by the Ministry of Communications.

Hu Chung-shih and Wu Siao-peng are organising the Heio Yih Machine Manufacturing Co., with a capital of \$150,000, which will be situated at Men Tou Kou. The company will manufacture machines and nails.

Italian Trade Activity at Riga.—The Italian Foreign Trade Limited Liability Co. has opened a branch at Riga. The company represents 23 large Italian concerns, with 80,000 workmen and a capital of 500,000,000 lire. Among the Italian firms represented are Messrs. Pirelli (rubber, cable, telephone and telegraph works), and Messrs. Marcelli (electrical machinery).—*Reuter's Trade Service* (Riga).

The Situation in Chile.—Reports recently received from all parts of the country tend to confirm the opinion held by prominent business men in Santiago that the commercial outlook in Chile is brighter than it has been for many months.

The announcement is made that English and Chilean interests have completed financial arrangements for the construction of a railway between Los Andes, Santiago, and Valparaiso.

The Chilean Electric Tramway and Light Co. and the National Electric Power Co. have recently amalgamated with a combined capital of £12,000,000 sterling. The bulk of the capital is English.

Representatives of the Italian Government, who announced, in September, that direct cable communication between Italy and Latin-America would soon be established, now state that a cable between Italy and Brazil will be laid within two years. It is proposed later to extend the line to the Pacific Coast of South America. The cable will be exclusively Italian. —*Reuter's Trade Service* (Santiago).

Employment Exchanges.—Dr. MacNamara, Minister of Labour, stated in Parliament on November 10th, that he had been reviewing the question of employment exchanges, and by the end of the year would have closed 185 branch offices. How the needs of the population in industrial areas, particularly in the administration of the unemployment insurance benefit, could be met without the exchange system he could not understand. —*Daily Mail*.

Patent Restoration.—Messrs. W. Negus, A. Tony, J. Gueritte, N. Merz, and A. Reyrolle & Co., Ltd., have made application for the restoration of Patent No. 19,851 of 1910, "For improvements in electrical cut-outs," granted to A. C. Reyrolle and A. Reyrolle & Co., Ltd..

The Trade of Algeria.—Reporting on the trade situation in Algeria, the Acting British Consul-General at Algiers, says: "A limited market will be found for the products of certain branches of the iron and steel industry (e.g., tools, wire, mining requisites, anchors and chains), and of the machinery and electrical trades, and in leather belting."

LIGHTING AND POWER NOTES.

Accrington.—ELECTRICITY SUPPLY EXTENSIONS.—The Electricity Committee has received a letter from Blackburn Corporation stating the terms on which it will supply electricity or undertake a stand-by service to Accrington. The suggestion is that all electricity should be metered at Jubilee Street (Blackburn), and if a supply to Accrington proves necessary, to run the plant at Jubilee Street Station. At the recent inquiry by Mr. Robert Blackmore, technical adviser, and electrical engineer to the Stalybridge-Mossley Joint Station, he stated that by taking power from Blackburn, Accrington would lose £10,000 a year. The cost of cable-laying and equipment alone will be £9,000 per mile, giving a total cost for Whitebirk of from £40,000 to £45,000. Further steps are being taken to obtain the Electricity Commissioners' sanction to borrow £150,000 for extensions.

Australia.—ELECTRICAL DEVELOPMENTS.—The New South Wales Cabinet has agreed to issue the prospectus of a loan of £30,000 in order that the electricity undertaking on the Clarence River, known as the Nymboida hydro-electric scheme, may be carried out. The station will supply all the extreme north coast towns in the State with electric power.

Various municipal bodies in Northern Tasmania are asking for an official report on the possibility of generating electricity from the North Esk River. The estimated cost of connecting the coast with the Government scheme is £250,000; the annual charge would be £6.10 per h.p. It has been proposed that power could be obtained from the vicinity of Cradle Mountain. Devonport has agreed to take 2,000 h.p., Ulverstone, it is suggested, should be able to absorb 500 h.p., and Wynard 300 h.p.

The Pictou, (N.S.W.) Council is borrowing £7,000 in order to install an electrical service, and the Murray River town of Echuca is borrowing £16,000 for a similar purpose. —*Reuter's Trade Service* (Melbourne).

Axminster.—ELECTRICITY SUPPLY.—Steps are being taken to form a local company for the supply of electricity to the town.

Barnmouth.—ELECTRICITY SUPPLY.—With a view to finding work for the unemployed, the Urban Council is urging the continuance of the electricity supply scheme at Aber Artroo, upon which £22,000 has already been spent. The scheme, which is being promoted by Mrs. Frys Owen, of Llanbedr, who is defraying all expenses, has been held up for some months owing to the delay in obtaining a Special Order.

Beckenham.—LOAN.—The Electricity Committee has decided to apply to the Electricity Commissioners for sanction to the borrowing of £5,349 to cover the balance of the expense incurred by the installation of a new turbine.

Continental.—CZECHO-SLOVAKIA.—The Government has decided to introduce a tax on utilised water-power. Only plants of 2 h.p. or under will be exempt, and the tax will be levied according to the size of plant and hours of working.

DENMARK.—Mr. S. A. Faber, at a meeting of the Danish Association of Engineers, put forward a new scheme for the electrification of Denmark. The project is based upon the co-operation between all the big supply works in the matter of high pressure in connection with the supply of electricity from Norway via North Jutland. According to the scheme the pressure in the main conductors would be 50,000 volts, and the mains would proceed from Aalborg and be led over Randers, Aarhus, Horsens, Vejle and Fredericia to Strib and thence over the islands. Mr. Faber originally conceived the idea of the formation of a community of interests which would have absorbed the existing works in one way or another—under control of the State—but continued investigations showed that it would scarcely be possible to bring about such co-operation, and under the circumstances the question is now being considered whether the most appropriate method would not be for the State to take over and carry on such an important network of mains.

LATVIA.—As all coal supplies have to be imported from abroad and at the present low exchange rate of the rouble are very costly, Latvians have turned to local sources of power—water and peat. The chief source of water power would be the river Daugava, but the cost of development is beyond the means of local enterprise and will have to await the aid of foreign capital. In the meantime, several limited liability and co-operative societies have been formed with a view to utilising the water power of the smaller rivers. The generating plants are estimated to produce from 500 to 10,000 h.p. Already four such companies have been formed on the rivers Jugla, Brasla, Amata, Gauja, and in Livonia. Courland, being mostly flat country, has no rapid rivers, but there are extensive peat bogs in the vicinity of various towns. Several communities are planning the erection of peat-fired generating plants to be utilised for driving mills, and small factories and agricultural machinery, and for lighting. —*Reuter's Trade Service* (Riga).

RUSSIA.—According to reports from Petrograd, Allmaenn Svenska Elektriska Aktiebolaget has been granted a concession to build electricity works at Yaroslavl on the Upper Volga. —*Reuter's Trade Service* (Stockholm).

Darlington.—REDUCED CHARGES.—The Electricity Committee has decided to reduce the charges for electric lighting from 4½d. to 4d., and for power by 10 per cent.

Dundee.—CHEAP HOUSE WIRING.—The offer of a two-part tariff to electricity consumers as an alternative to the flat rate, a fixed charge based on floor area plus ½d. per unit, has not met with a very large response. As far as prospective consumers are concerned, this is thought to be due to the high cost of installation. The Corporation Electricity Department has therefore fitted up a seven roomed house in Broughty-Ferry, including the usual scullery, kitchen, and bathroom, in order to demonstrate the utility of electricity. Major H. Richardson, the engineer, explaining the method of wiring adopted, a simple surface one, points out that expensive ceiling fittings or electroliers are unnecessary, and that a complete installation for lighting, heating, and cooking, can be carried out quickly in houses at present using other methods without a great deal of preliminary work, and much more cheaply than any other system. It is also claimed that the present elaborate system of switching and fittings is done away with. Mr. Richardson also states that the new system obviates a great deal of damage which was caused through lights hanging from the roof, and the new wiring, while practically indiscernible, has a large current-carrying capacity, and fully provides for all the uses that electricity can be put to in the home.

Friern Barnet.—ELECTRICITY SUPPLY.—The surveyor to the District Council is preparing a report regarding the possible supply of electricity to the district by the North Metropolitan Supply Co., or the Hornsey Electricity Committee.

Gelligaer.—ELECTRICITY SUPPLY SCHEME.—A letter from the general manager of the Powell Duffryn Colliery Co., stating that, owing to the unreasonable attitude of the Council on other matters, he could not recommend his directors to consider the question of supplying electricity to Fochriw was read at a meeting of the Gelligaer Council on November 15th. It was stated that the communication would involve the Council in the expenditure of thousands of pounds. A deputation is to wait upon the company.

Llanfairfechan.—SCHEME REJECTED.—The Council has decided not to proceed with the electric light scheme which it was estimated would cost £10,000.

Lower Walton.—NEW SUBSTATION.—At a meeting of the Lower Walton Council, it was reported that the powers provisionally vested in the Mersey Power Co. had been transferred to the Warrington Corporation, and the plan of the sub-station to be erected in West Avenue by the latter authority was recommended for approval.

Lossiemouth.—**INCREASED CHARGES.**—The Town Council has decided to increase the charges for electric heating from 2d to 3d per unit and for power from 3d to 4d per unit.

Maidstone.—**ELECTRICITY SUPPLY TO HOSPITAL.**—The County Council has decided to expend £1,200 on a scheme for the supply of electricity to Ramming Heath Mental Hospital, by which it is estimated that there will be an annual saving of £1,500 on fuel and gas.

Middlesbrough.—**BREAKDOWN.**—A failure of the electricity supply at Middlesbrough on November 14th, held up the working of the Transporter Bridge which spans the Tees. Large numbers of workmen were stranded on each side of the bridge. In order to be able to keep the transporter car running in any future event of this nature, the Corporation is having separate generating machinery installed.

New Zealand.—**SOUTH ISLAND.**—The *New Zealand Times* reports that Mr. H. B. Hall, architect, of Timaru, has made an examination of Lake Tekapo as a source of electricity supply. He finds that a fall of 80 ft. can be obtained, which with a minimum lake discharge of 1,000 cuses would give 30,000 h.p. at the turbines. He proposes overhead transmission at 55,000 V. via Mackenzie Pass (fifteen miles), and then forty miles to Timaru. He estimates the cost of a tunnel, power house, and transmission line at £400,000 and distribution to every house in the district at £240,000, a total of £640 per h.p.—*Reuter's Trade Service* (Melbourne).

Shipley.—**NEW PLANT.**—On November 19th, the chairman of the Council started up a new 1,000-kW rotary converter. This machine was made by the English Electric Co., and is a good example of up-to-date practice. The chairman spoke of the steady progress of the electricity department, which now has over 1,500 customers, and prophesied that after the depression in trade had passed away the consumption of electricity would increase rapidly and consistently.

Skipton.—**ELECTRICITY SUPPLY.**—The District Council received and approved, last week, a report on negotiations with Keighley Corporation with a view to the supply of electricity to the town from Keighley. The provisional plans provide for an estimated capital cost of £15,000.

Worcester.—**PROPOSED PURCHASE OF PLANT.**—Subject to the receipt of the Electricity Commissioners' sanction, the City Council has decided to purchase some generating plant at Southampton from the Disposal Board. The estimated cost of purchase and installation is £55,850.

TRAMWAY AND RAILWAY NOTES.

Barrow-in-Furness.—**YEAR'S WORKING.**—The annual report of the tramway department for the year ended March 31st last shows a total revenue of £47,667. Working expenses amounted to £48,338. After deduction of capital charges, &c., there was a net deficit of £13,615.

NEW CARS.—Two of the twelve new trams ordered by the Corporation have been delivered, and delivery of the remainder is expected within six weeks. The cars will cost £2,227 each. The bodies and trucks are being built by the Brush Electrical Engineering Co., of Loughborough, and the electrical equipment installed by the English Electric Co., of Preston. The cars are single-deckers, seating 32 passengers. A saving of £6,000 to £7,000 per year is anticipated when the twelve cars are in service.

Canada.—**MONTREAL.**—According to the *Electric Railway and Tramway Journal*, the plan and route for an underground railway have been outlined by Mr. F. S. Williamson, a prominent engineer. It is estimated that a subway system would cost about 25,000,000 dols., and that in the course of a year the Montreal tramways, which would operate the scheme, could carry 300,000,000 passengers.

Carnarvon.—**LIGHT RAILWAY.**—The Town Council has decided, subject to the consent of the Ministry of Transport, to commence the scheme for the extension of the North Wales Narrow Gauge Railway from Dinas to Portmadoc, and the estimated cost of £200,000 has already been spent on this line, and it is estimated that an additional £120,000 is required to complete it. The scheme will provide work for 830 men.

Glasgow.—**NEW ROUTE.**—The general manager of the tramway department has been asked to prepare a report regarding the possibility of laying a track between Clydebank and Dunoon.

L. B. & S. C. Railway.—**PROJECTED ELECTRIFICATION.**—The last issue of *Modern Transport* gave particulars of the electrification schemes projected by the London, Brighton & South Coast Railway Co. It is proposed to proceed at the earliest favourable opportunity with the electrification of the lines from London to Brighton, Worthing, Seaford, and Eastbourne. The system used will be high-pressure, single-phase

current with overhead collection. In addition to the speeding-up and augmentation of services, the change will bring substantial financial gains, as the company's experience in the past has proved.

London.—**LOWER FARES.**—The London United Tramways announce that owing to the success of the cheap return fares on their Tooting and Hampton Court route, the facility was extended on November 16th to the Richmond Bridge and Kingston route.

New Zealand.—**WELLINGTON.**—The annual report of the general manager of the tramways undertaking (Mr. W. H. Morton), shows a total revenue of £347,695. Working expenses amounted to £289,320, leaving a gross profit of £58,375. After deduction of capital charges there was a net profit of £3,232.

Preston.—**CHRISTMAS HOLIDAY.**—The Tramways Committee has resolved not to run cars on Christmas Day.

Reading.—**EXTENSION OF TIME.**—The Ministry of Transport has extended the time of the Reading Corporation Act, 1914, for the completion of tramways, until July, 1923.

TELEGRAPH AND TELEPHONE NOTES.

Austrian Succession States.—**TELEGRAPH AND TELEPHONE AGREEMENT.**—At its plenary sitting on November 17th, the Porto Rosa Conference definitely approved the text of the agreements between the Austrian Succession States in the matter of postal, telegraph, and telephone services, and the agreements will be signed in the course of a few days. The telegraph and telephone agreement provides for the re-establishment of several telegraph and telephone lines between the Succession States. A number of clauses deal with the payment of telegraph dues between the various administrations.—*Reuter's Trade Service* (Porto Rosa).

Costa Rica.—**NEW CABLE.**—A contract entered into between the Government of Costa Rica and the "All America Cables Incorporated Co." for the establishment, within a period of 18 months, of a direct cable service between Costa Rica and foreign countries, was finally approved on October 9th. The direct cable service, it is understood, will connect Port Limon with the company's cables serving the Isthmus of Panama. A translation of the contract from the *Costa Rica Official Gazette* can be seen at the Department of Overseas Trade, says the *Financial News*.

Germany.—**TELEGRAPH CHARGES.**—Owing to the depreciation in the mark, the rates for telegrams to foreign countries from Germany were to be increased by 170 per cent. as from November 20th.—*Reuter's Trade Service* (Berlin).

Imperial Wireless.—The Postmaster-General announces that the statement which appeared in a daily paper to the effect that the scheme for the Imperial Wireless Chain had collapsed is devoid of foundation. This scheme was approved by the Government, and was endorsed by a Committee of the Imperial Conference over which Mr. Churchill presided, and by the Conference itself.

The scheme was accepted by the Prime Minister of the Commonwealth subject to giving full freedom of action to Australia to decide the method in which she would co-operate. No change in the policy of the Government has since taken place. The first two stations in the Imperial Chain—those at Leith and Cairo—will be working by the end of this year, and the report of a Commission of experts which has been engaged in designing the remaining stations is expected within a few weeks. On its receipt the construction of the stations will be proceeded with as quickly as possible.

Italy.—**TELEPHONE AND TELEGRAPH EXTENSIONS.**—The Italian Parliament has sanctioned an outlay of 150,000,000 lire for urgent works and purchases needed for the systematisation of the urban and inter-urban telephone system and the telegraph network. This sum is to be disbursed as follows: 25,000,000 lire in the financial year 1921-22; 50,000,000 lire in 1922-23; 50,000,000 lire in 1923-24; and 25,000,000 lire in 1924-25. The choice of firms to undertake the several works and furnish the supplies will be made by the Government with the co-operation of the Minister of Posts and Telegraphs, the Public Works Department, and the Council of State. The granting of a concession to a national company for the installation and working of a submarine cable for direct communication with Spain, Brazil, Argentina and Greece is likewise authorised. A Government subsidy for ten years will be contingent upon the realisation of a minimum of words exchanged by each cable. Other help afforded is in the shape of relief from certain taxes to the extent of 6 per cent. of the paid-up capital of the several companies.

A decree dated August 20th sanctions the outlay of 16,000,000 lire for the installation of telegraph and telephone lines along the course of the sections of railway now being electrified, namely, Turin-Susa, Turin-Chieri, Turin Ronco, and the approaches to Voghera. The disbursements will

be made in two equal amounts in the financial years 1921-2 and 1922-3 through the medium of the Deposits and Loans Fund, which is duly authorised to make the advances.

The Telegraph Service.—RATE REDUCTION.—The Postmaster-General announces that the telegraph rate of 5½d. a word has been reduced to 4½d. for Estonia, 4d. for Latvia, and 3½d. for Lithuania. The rate to Russia is 5½d. a word, both by the Government-owned Anglo-Russian cable and by the Great Northern telegraph routes via Finland and via Latvia. Telegrams for Russia by any route are still only accepted at the sender's risk.

The Telephone Service.—Speaking at Bedford on November 10th, the Postmaster-General said the extensive programme for laying telegraph and telephone cables underground was employing a considerable amount of skilled and unskilled labour in different parts of the country. It was not relief work, as it was generally understood, but it had the great advantage of being revenue earning and of reducing the expenditure of the Post Office on maintenance and repairs.

The Post Office was also putting in hand a large number of new telephone exchanges and extensions to existing exchanges. During the next six months 23 new exchanges would be completed and 47 existing exchanges extended. During the year ended October 31st, 26 new exchanges had been completed and extensions had been made to 15 exchanges. The total number of stations in use at the end of September was 964,479, or an increase of 3,447 over the total at the end of August. New orders were coming in at a satisfactory rate, and the number of people giving up the telephone was slightly below the normal. They were fast overtaking arrears of work, and the telephone traffic showed a slight tendency to improve, especially in London, where the average calling rate had shown a steady increase each week since the end of August up to and including the last week in October.

These facts, he thought, were evidence of a revival in trade. Telephone traffic was peculiarly susceptible to trade conditions, and the fact that telephone traffic showed an increase was an encouraging sign.—*The Times*.

SHEFFIELD'S NEW EXCHANGE.—A start was made on November 21st on Sheffield's new telephone exchange, which is to be erected in Bow Street, in the centre of the city. It is estimated that it will take four years to build the exchange. Coinciding with the installation of the new exchange the postal authorities are laying underground telephone wires.—*Daily Telegraph*.

Wireless Telegraphy.—STATIONS CLOSED.—The wireless stations on the aerodromes at Castle Bromwich (Birmingham) and Didsbury (Manchester), the Air Ministry says, will from November 16th until further notice be temporarily closed for traffic, and the meteorological reports hitherto transmitted to the Air Ministry by them will be discontinued.

VINGA STATION.—The radio service at Vinga station will begin on November 22nd to give bearings to ships on demand for the purpose of facilitating entrance into Gothenburg harbour and passing Skagen Point. The range of the radio station is over 100 nautical miles.—*Reuter's Trade Service* (Stockholm).

Wireless Telephony.—The wireless telephone on the Bar Lightship, which was licensed by the Post Office early this year for communication with the Mersey Docks and Harbour Board at Liverpool, is now equipped with the new Marconi ringing-up device, which dispenses with the necessity for a continuous watch. The utility of this addition was clearly demonstrated last week, when a tug equipped with wireless despatched an urgent telegraphic message which the Bar Lightship received and communicated to the Harbour Board. The telephonic message reached Liverpool some time before that received through telegraphic channels.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Australia.—MELBOURNE.—January 4th. Victorian Government Railways. One set pyrometer equipment (cont. 34,705), electric equipment for cargo shifter (cont. 34,723), electric rivet heater and accessories (cont. 34,735).

Five electric road trucks.—*Reuter's Trade Service* (Melbourne).

January 25th. Ten coasting recorders or, alternatively, 10 coasting and service recorders for the trains (cont. 34,736).

January 4th and 11th. Postmaster-General's Department. Telegraph instruments and telephone apparatus and material (schedule 1,718 and 694). (November 18th.)

February 22nd. N.S.W. Government Railways and Tramways Department. One 5,000-kW, 50-cycle turbo-alternator, with condenser and accessories, for the Newcastle power house.*

BRISBANE.—February 10th. City Electric Light Co., Ltd. Six miles of 3-core, 0.15 sq. in., paper-insulated cable.*

Bulgaria.—January 10th. Direction of Posts and Telephones. Sixty 50 line telephone exchanges, fifteen, machine outfit. (November 11th.)

Chorley.—November 30th. Board of Guardians. Storage battery (125 cells—capacity 300 Ah) and booster for the institution, Eaves Lane. (November 18th.)

Dublin.—December 12th. Dublin United Tramways Co. (1896), Ltd. General stores, including electric supplies for six months. (See this issue.)

Egypt.—ALEXANDRIA.—December 21st. Port and Light-house Administration. Stores, including electric lamps, for six months.*

Farnworth.—December 7th. Urban District Council Electricity Department. L.p. cables, distribution pillars, transformer, h.p. and l.p. switches. (See this issue.)

France.—December 6th. Sarre Postal Authorities. 43 tons of copper cable, 3, 4 and 5 mm. dia., and 16 tons of bronze cable, 1, 2 and 5 mm. dia. Particulars from La Direction Supérieure des Postes, Sarrebruck.

Glasgow.—November 28th. Health Department. Works (including electric lighting) in connection with the erection of doctors' and workmen's houses at Robroyston Hospital. Office of Public Works, 64, Cochrane Street, Glasgow.

November 30th. Gas Department. Two electric locomotives to haul 30 tons. (November 11th.)

Italy.—December 15th. Italian State Railway Authorities, Rome (14, Via Le Policlinico). Electrification of the Bologna-Milan line.

Liverpool.—December 28th. West Derby Board of Guardians. Engineering work, including electric power installation, electric lift, telephone installation, boilers, stokers, &c. (November 18th.)

London.—FULHAM.—November 29th. Electricity Supply Department. 11,000 yards -2 sq. in. h.p. (3,000 V) concentric paper-insulated lead-covered cable. (November 18th.)

Manchester.—December 2nd. Electricity Committee. Hand-operated overhead travelling cranes. Barton power station, Oldham Road, and Stuart Street sub-stations. (November 18th.)

December 9th. Heating plant and hot-water service apparatus for offices, and self-sustaining electric hoist, Barton power station. (November 18th.)

New Zealand.—WELLINGTON.—January 31st. Public Works Tender Board. Two sets 3-phase, 6,600-V automatic oil circuit breakers, four sets disconnect switches, and one 66,000-V air-break, lever-operated switch for main transformer switches, for Lake Coleridge power house.*

March 6th. Public Works Tender Board. Waikato power scheme. Two 2,500-kVA alternators, two 3,100-h.p. water turbines, two exciter sets.*

Shipley.—November 28th. Education Department. Electric light and power installation at the Technical School. Director of Education, Education Office, Saltaire Road.

Spain.—November 30th. The *Diario Oficial del Ministerio de la Guerra* publishes the basis of a competition for the supply of wireless material for the 1st Regiment of Telegraphists and Wireless Battalion, and for the choice of models of regulation stations. The date of opening the tenders is November 30th.

Warrington.—November 28th. Electricity and Tramways Committee. Sub-station ironclad switchgear, high and medium pressure lead-covered cables. (November 18th.)

Wexford.—December 8th. Corporation. Overhead l.p. distribution mains, street lanterns, &c. (November 11th.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—MELBOURNE.—Victorian Electricity Commissioners. (Accepted):—

Complete steam-raising plant at the Morwell powerhouse (£282,000). J. Thompson, Vicksburg; £137,000 to be expended locally. Supply of steelwork for pit (£115,000). Redpath, Brown & Co.—*Reuter's Trade Service* (Melbourne).

Birmingham.—The Scholey Construction Co., Ltd., has received a contract from the Corporation Tramways Department to carry out the Lincoln process of welding the fishplates to the rails at the joints.

Government Contracts.—The following Government contracts were placed during October, 1921:—

ARMY AND AIR FORCE SUPPLY DEPARTMENT.

Battery boxes.—Lawson & Co.
Cells. General Electric Co., Ltd.; Siemens Bros. & Co., Ltd.
Electric light installation.—G. E. Taylor & Co., Ltd.
Electric forging cranes.—Sir W. Arrol & Co., Ltd.
Electric lifts.—Wadsworth & Son.
Electrodes.—Quasi-Arc Co., Ltd.
Sheet mica.—R. & S. Baxter & Co., Ltd.
Valves for wireless telegraphy.—General Electric Co., Ltd.

WAR OFFICE.

Electric carbons.—General Electric Co., Ltd.
Electric lamps.—English Electric & Siemens Supplies, Ltd.
Valves for wireless telegraphy.—A. C. Cossor, Ltd.; General Electric Co., Ltd.

Boilers, *See* **Engines**
 Electric storage, *See* **Batteries**
 Fire pumps, *See* **Pumps**
 Ignition, *See* **Engines**
 Locomotives, *See* **Engines**

[illegible]

Motor generators.—Liverpool H.P.O. Sub-station: British Thomson-Houston Co., Ltd.
 Telephone exchange equipment. Hull Post-Office Telephone Works, Ltd., Birmingham (Victoria); Western Electric Co., Ltd., Bournemouth; Western Electric Co., Ltd., St. Albans; Western Electric Co., Ltd. Sub-contractors: Chloride Electric Storage Co., Ltd., for batteries. Romford: The British L.M. Ericsson Manufacturing Co., Ltd.
 Transformers.—Liverpool H.P.O. Sub-station: Metropolitan-Vickers Electrical Co., Ltd.

Testing, protective apparatus, &c.—E. Turner.
Telephone apparatus.—Phoenix Telephone & Electric Works, Ltd.; Sterling
Telephone & Electric Co., Ltd.
Telegraph and telephone cable.—Enfield Edison Cable Works, Ltd.;
Hickbridge Cable Co., Ltd., Pirelli-General Cable Works, Ltd.
Union Cable Co., Ltd.
Switchboard plugs.—E. Turner.

Cable, &c.—W. T. Henley's Telegraph Works, Co., Ltd.
Copper wire.—F. Smith & Co.
Insulators.—Taylor, Tuncliffe & Co., Ltd.
Switchboards.—Gent & Co., Ltd.
Switchboards, &c.—Western Electric Co., Ltd.
Telegraph material.—Siemens Bros. & Co., Ltd.
Telegraph instruments.—Tyler & Co.
Telephone materials.—British I. M. Ericsson Manufacturing Co., Ltd.
Train lighting equipment.—J. Stone & Co., Ltd.
Tramway materials.—R. Hudson, Ltd.

Motor alternator.—Lancashire Dynamo & Motor Co., Ltd.
Baudot apparatus.—Elliott Bros. (London), Ltd.
Cable.—General Electric Co., Ltd.
Milking booster sets.—Crompton & Co., Ltd.
Motors.—Lancashire Dynamo & Motor Co., Ltd.
X-ray tubes.—British Thomson-Houston Co., Ltd., Newton & Wright, Ltd.

Engineering services—Acton: Electric wiring. M.J. Manufacturing Co.

London.—L.C.C. Highways Committee. (Accepted):
Centre for rapid depot completion of superstructure (491,574). P. & W.
Anderson, Ltd.

STEPNEY.—Electricity Supply Committee.
50 tons moulded pitch (£211).—J. Smart & Son. (Accepted.)
Lighting and heating plant. £190. W. Jones & Co. Ltd. (Recommended.)
Electricity meter for the new installation No. 6 turbine (£109).
W. H. Jones & Sons, Ltd. (Accepted.)

Institution of Electrical Engineers.—Thursday, December 1st. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Cyc-Arc Process of Automatic Electric Welding," by Mr. L. J. Steele and Mr. H. Martin. Informal Dinner at the Engineers' Club.
Friday, December 2nd. At 5 p.m. Special general meeting.

(North Midland Centre).—Tuesday, November 29th. At the Hotel Metropole, Leeds. At 7 p.m. Ordinary meeting.

(North-Eastern Centre).—Monday, November 28th. At the Armstrong College, Newcastle. At 7.15 p.m. Paper on "Single and 3-phase Commutator Motors with Shunt and Series Characteristics," by Dr. S. P. Smith.

(North-Western Centre).—Tuesday, November 29th. At the Engineers' Club, Manchester. At 7 p.m. Paper on "Induction Type Synchronous Motors," by Mr. L. H. A. Carr.

(London Students' Section).—Friday, December 2nd. At the Institution, Victoria Embankment. At 7 p.m. Paper on "Automatic and Semi-automatic Railway Signalling," by Mr. H. S. Petch.

Chelmsford Engineering Society.—Thursday, December 1st. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Small Public Electric Supply Undertakings," by Mr. I. N. Houlton.

Institute of Marine Engineers. Friday, December 2nd. At the Hotel Cecil
At 7 p.m. Annual dinner.

Ships' Electrical Auxiliaries.—Sir Owen Phillips, M.P., chairman of Elder, Dempster & Co., Ltd., on November 14th, received on board the vessel at Liverpool guests invited to inspect the *Abu*, a new Belfast-built ship intended for the company's service between British, Continental, and African ports. The vessel is a motor-ship. Her twin propellers are driven by Diesel oil engines. All the engine-room auxiliaries are driven by independent electric motors, with the exception of a small emergency steam-driven air compressor. Deck machinery and the steering-gear also are electrically driven. The *Abu* is 450 feet long and of a gross register of about 8,000 tons.—*Westminster Gazette*.

German Professor of Kinematography.—A chair has been established in the Berlin Technical High School for kinematograph technology, and Prof. Karl Foerch is to be the first professor; he will lecture twice weekly.

Cheap Supply and Good Lighting.—Speaking recently at the Dublin Rotary Club, Mr. Ernest C. Handcock, M.I.C.E., said that electricity was not so expensive as was commonly believed, and demonstrated that, at the Dublin rate, a 5 lb. joint of beef could be cooked in an electric oven for 2d., while a 6 lb. joint lost but one ounce in electric cooking, against 25 to 30 per cent. by other methods. In Dublin he claimed that they had some of the best lighting of shops by electricity in the whole of the United Kingdom. The lighting in some spots, as in Grafton Street, was superior to that of London. He regretted that many unqualified men undertook electrical contracts, but rejoiced that now, as the result of the charter granted to the Institution, only chartered electrical engineers would be recognised as qualified and competent.

Finsbury Technical College Old Students' Association Dinner.—On November 12th over 80 members of the Old Students' Association sat down to the tenth annual dinner which was held at the Engineers' Club, under the presidency of Dr. G. T. Morgan, Professor of Chemistry at Birmingham University. He was supported by a number of Past Presidents, including Messrs. Tennant and Raworth, Dr. Forster, and Capt. Wallis-Jones; and amongst the guests were Professors Donnan, Eccles, Hale, Philpot, and Mr. Sebastian After "The King," Prof. Donnan proposed "The College" in a humorous speech which appealed to all present. His statement that Finsbury had proved its system of making students search for information in text books and laboratories to be correct by the very large number of its old students holding high positions in every part of the globe, was received with cheers.

Prof. Eccles, the present Dean of the College, in his reply said that, thanks to the generosity of the L.C.C. and others who had worked for the good cause, his speech this year need not be likened to a funeral oration, such as that of last year.

In proposing the Old Students' Association, Dr. Forster explained that the authorities were giving forfence an education which cost ninpence, and gave some figures to show the real generosity of the City and Guilds, which established the College in 1878. This statement was applauded by all present, and in conclusion he wished the Association continued strength and prosperity.

Dr. Morgan, in reply, acknowledged how much the City and Guilds had done, and remarked how pleased all must feel that Mr. L. B. Sebastian, the Chairman of the College Delegacy, was present as their guest.

Finally Mr. W. E. Head proposed "The Guests," and Prof. Philpot's reply was brief and to the point, but extremely optimistic on the future of Emsbury.

A musical programme (under the direction of Mr. Clark) was interspersed between speeches.

A smoking concert has been arranged for January 27th, to be held at the Engineers' Club, where, on the occasion of the dinner, the catering, service, and accommodation were all that could be desired.

Electrical Power Engineers' Association (Southern Division).—President, J. H. McFarland, Jr., 2000 N. 1st St., St. Petersburg, Fla. 33704; Vice President, H. W. Westmeyer, 3400 W. 10th St., Fort Lauderdale, Fla. 33309; Secretary, R. H. B. Brown, 1000 N. W. 10th St., Ft. Lauderdale, Fla. 33309.

Physical Society of London.—Friday, November 25th. At the Imperial College School of Science, Kensington S.W.7. Time 8 p.m.—Discussion

Junior Institution of Engineers.—Friday, November 25th. At Caxton Hall, 12, Bedford Square, W. 1. Lecture, "The Problems in Design and Construction," by Mr. G. F. Shuter.

Institution of Production Engineers—Friday, November 25th. At the In-

Institution of Production Engineers.—Friday, November 25th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 7.30 p.m.

Liverpool Engineering Society.—Wednesday, November 30th. At the Royal

Manchester Wireless Society. Lectures by Mr. A. H. Jones, M.A., at the Albert Hall, Manchester, on Tuesday, November 10th, 8 p.m.

Radio Technical and Engineering Association—Saturday, December 2nd

Salford Technical and Engineering Association.—Saturday, December 3rd
A. H. R. L. ...

An Electrical Suction Dredger.—A 20-in. suction dredger in use on the Sumas River in Washington was recently converted from steam to electrical operation by the Marsh Construction Co. As now arranged the dredger has a total connected load of 1,322.5 h.p. with motors ranging up to 1,000 h.p. Power is used at both 2,300 and 440 V. a cable and reel maintaining connection with the shore as the vessel moves forward. Power is taken from the 34,000-V transmission line that parallels the line of operation of the dredger, leads running from it to a bank of three 500 kVA transformers mounted on a scow moored to the bank of the river. This scow and the dredger are connected by a 1,000 ft. length of submarine cable carried by a reel mounted on a small scow lashed to the dredger. This cable is paid out automatically as the dredger moves ahead until all the cable has been reeled out. The transformer scow is then cast adrift and moved ahead, the slack in the submarine cable is coiled up on the reel, and a new connection is made between the transmission line and the transformer bank in its new position. The two largest power units on the dredger are the 1,000 h.p. motor that drives the main pump at the rate of 300 r.p.m., and the 150 h.p. motor that operates the cutter through a set of reduction gears. After the dredger had been in operation for a few weeks material was being handled at the rate of approximately 600 cubic yards an hour at a cost for power of from 1 to 1½ cents per yard. Under normal operating conditions the dredger requires from 900 to 1,000 k.W.—*Times Engineering Supplement*.

A Silent Electrical Tribute.—During the funeral of Lady Beck in Toronto, Canada, all the electric power supplied by the Ontario Hydro-Electric Commission, with which Sir Adam Beck has been associated since its inception in 1907, was cut off for one minute in 275 municipalities, over an area nearly as large as that of England.—*The Times*.

Fog and its Dispersion.—The difficulties attendant on the use of aerodromes by aeroplanes when a fog enshrouds the ground, are amongst the most troublesome of those with which aviation in this country has to deal. The possible means of dispersing fog, form the subject of a report, No. 727 (M.N.2), April, 1921, by the Aeronautical Research Committee, and may be summarised under three heads: (1) electrical, by subjecting the air of the aerodrome to a very strong electric field, or, if possible, a brush discharge. The theory of the method is discussed in an appendix (R.A.E. Report No. H. 550, presented by the director of research). An electrical discharge from a point does not spread over any appreciable volume of air, and the free paths of the normal small fog particles are very great in comparison with their size, so that electrical methods do not at present give much hope for a solution of the problem. All methods for discharging large quantities of electricity into the atmosphere fall largely on account of the small volume of air affected, and the committee has no reason to suppose that an experiment on the very large scale necessary for clearing an aerodrome would succeed if one on a smaller scale were not sure of success. (2) Mechanical, by propelling fog-free air downwards from above, or, alternatively, drawing it downwards by suction from beneath. This aspect of the problem is dealt with by the director of the Meteorological Office in a second appendix, and he concludes that "the dissipation of fog by such means is entirely outside the range of possibility." (3) Thermal, by artificially warming the air of the aerodrome sufficiently to evaporate the fog which drifts over it. Sir Napier Shaw's remarks on the latter method are as follows: "The problem is about the same as trying to raise by a few degrees the temperature of the top two inches of the Thames between the Lot's Road power station and Battersea Bridge when the tide has begun to ebb. . . . I do not know how much coal they burn in an hour at Lot's Road, but if the experiment is to be tried it had better be on a small brook first."

International Conference of Electrical Engineers.—An International Conference of Electrical Engineers was opened in Paris on November 21st, under the auspices of the International Electro-technical Commission. The conference was presided over by M. Le Trocquer, Minister of Public Works, and was attended by forty delegates from twelve countries; the British delegates included Messrs. P. V. Hunter, E. B. Wedmore, and W. B. Woodhouse. Canada is among the nations sending delegates. The object of the conference is to study the construction and standardisation of equipment for the interconnection of high-power transmission stations. Thursday's sitting was to be held at the Sorbonne, and was to be presided over by M. Millerand, the President of the Republic.—*Reuter's Trade Service* (Paris).

The Electrical Gasification of Coal.—Mr. Edwin, of the A.S. Norsk Staal, has presented a report before the Norwegian Association of Engineers, concerning his experiments in the direction of the electrical gasification of coal. He is reported to have stated that he had solved this problem, that his method would permit of the coal consumption at an iron-works being reduced to 14 to 15 per cent. of what is reckoned with blast furnace working, and that the gas could be transmitted over long distances equally as cheap as electrical energy.

Educational.—WIRELESS CLASSES.—"Wireless" classes are now being held every Tuesday and Thursday evening at the premises of Messrs. Cunningham, Ltd., 169-171, Edgware Road, W.2. The fee is 1s. 6d. per lesson, and is under the

direction of their expert Mr. C. J. Close, late of the Government service and Marconi's. Further particulars can be had on application to the firm.

Electric Ship Propulsion.—The steamship *San Benito*, the largest electrically-propelled cargo ship built and equipped outside the U.S.A., docked on October 24th in America, says the *Journal of Commerce & Commercial Bulletin*, after a stormy but successful voyage from Almeria, Spain. For twenty-four consecutive hours she was in a cyclone, the worst weather Captain J. C. Jackson said he had experienced in his twenty-nine years at sea, but she reached port in perfect condition, so far as her equipment was concerned.

"Ordinarily under such conditions we would have had all sorts of trouble with our propeller racing, but with this electric drive we did not experience any such trouble," said Captain Jackson. "I have never been on a ship that acted so well under all conditions, there was not the slightest evidence of any racing. Another feature which impressed me, was the absence of vibration. Truly, this is the finest ship I have been on in my many years at sea." Chief Engineer B. Crumley was just as enthusiastic.

Among the twenty-eight passengers on the *San Benito* were Mr. McClelland, director of electrical engineering, of the British Admiralty, and his deputy, Mr. S. D. Constable. Both were elated at the success of the trip. "Never saw anything more reliable in my life than this electric drive," said Mr. McClelland, "and in my report to the Admiralty I certainly shall praise this type of propulsion."

The *San Benito* is a new ship, and this was her maiden voyage. She was built by Workman, Clark & Co., of Belfast, for the United Fruit Line, as announced in our pages recently. She has a tonnage of 5,500, is 336 feet long, has a beam of 45 feet, and was designed for a speed of 12.5 knots. Her electrical equipment, built and installed by the British Thomson-Houston Co., Ltd., consists of a 2,040-kilowatt Curtis turbo-generator, driving a 3,000-horse-power synchronous motor in the stern of the ship attached to the propeller. This feature eliminates the shaft alley and shafting and adds considerably to its cargo space.

Her circulating pumps, forced air draught and ventilating systems are also electrically operated. On her trip she maintained an average speed of 10.5 knots, considered remarkably good for the weather encountered, and made a maximum speed of 15.1 knots. She left the shipyards at Belfast, September 28th, and cleared Almeria with a cargo of onions and grapes on October 10th. After a week in New York, she will be sent to Boston, where she will be placed in service between that port and Central America, in conjunction with her three sister ships, the steamers *San Blas*, *San Gill*, and *San Bruno*, all of which are equipped with reciprocating engine drive.

Selenium Substitute.—The crystal found in Japan and Borneo, and known as antimonite, is said to hold out hopes of being used as a substitute for selenium. The great drawback to the use of the latter is its fatigue, but antimonite can be produced synthetically and is reported to be capable of responding to variations in light with wonderful rapidity.

Transmission of X-rays.—A remarkable property of X-rays, in virtue of which they can be conducted like an electric current through a metallic tape, has, it is claimed, been discovered by Mr. Henry J. Monson, a radiographer and X-ray specialist.

"Hitherto we have had to place the patient quite near the X-rays tube with the risk of producing inflammation of the skin," said Mr. Monson to the *Daily Mail*. "By means of this simple appliance, the X-rays can be carried a long distance, even into another room, and applied to the patient without the danger of skin burning."

The apparatus consists of an insulated copper plate which is placed over the X-rays tube and is separated from it by a thickness of wood. Electrodes are attached to the plate, and from them the rays can be carried to the patient at a distance. According to the paper, the X-rays appear to accumulate in the copper plate, and from that they pass along the conductor much in the same way as electricity.

Effect of Lighting on Output.—In the course of a paper on the work of the Industrial Fatigue Research Board and its application to industry which Mr. D. R. Wilson, M.A., secretary to the Board, read before members of the Royal Society of Arts, in November, the author points out that the effects of lighting on production have been studied by Elton, in silk weaving, a fine process specially susceptible to variations in illumination, and presents a table showing the distribution of output (corrected for certain variables) from 56 looms during a week in December, 1919. The working day commenced at 7.30 a.m. and ended at 5.15 p.m.; the use of artificial light was confined to the first and last periods, and he remarks that to this must be attributed in a great part the heavy drop in output observed, since at a later season, when artificial lighting was no longer used, the reduction in output at the beginning and end of the period of employment, though still present, was much less marked. Elton concludes that under artificial illumination production falls, even if electric light of sufficient intensity is provided, and that the magnitude of the fall is of the order of 10 per cent. of the daylight value of the rate of output.

Appointments Vacant.—Engineer (£300+war bonus=£528), for H.M. Mining School, Portsmouth, plumber-jointer, for Nelson Corporation Electricity Works; assistant distribution engineer (£252), for the Woolwich Corporation Electricity Department, 252, Whitechapel, in electrical engineering, for the Gloucestershire Electric Co., New Cross, S.E., plumber-jointer, for the Salford Corporation Electricity Department; junior engineer as electrical laboratory assistant (£83+war bonus=£195), for H.M. Mining School, Portsmouth; plumber-jointer, for the Walthamstow Urban District Council Electricity Department. (See our advertisement pages to-day.)

Tidal Power in Italy.—The movement to utilise the tides has now spread to Italy, where Signor Cattaneo, of Genoa, has just set up a plant. He had previously experimented with a small plant to light his dwelling at Voltri. A visit paid to the latter by the Minister of the Italian Marine has resulted, it is said, in a contract being signed with Signor Cattaneo for the construction of a first station of 500 h.p. capacity at the Arsenal of Spezia. An Italo-American syndicate, it is furthermore stated, has formed an Italian company with a capital of 50,000,000 lire to work an Italian patent for similar installations.

L.E.E. Anti-Aircraft Dinner.—On Saturday, November 12th, a re-union dinner took place at the Holborn Restaurant of members of the 7th Anti-Aircraft Searchlight Section, London Electrical Engineers. Owing to the energies of Mr. Collins the following were present: Messrs. F. Childs, E. Moore, R. Collins, H. Verey, G. Keen, E. Collings, E. McCarthy, R. Bennett, J. Palmer, S. Smith, H. Thomas, and H. Payne, but it was not possible to obtain the addresses of several others, including two former commanding officers. Several toasts were proposed, and it was suggested that the dinner be made an annual affair. If this notice should catch the eyes of any members who were not present they are invited to send a note of their addresses to Mr. R. Collins, 43, Brick Street, Piccadilly, W.1.

Cancer Hospital's New X-ray Plant.—The latest addition to the X-ray and electro-therapeutic department of the Cancer Hospital is a twin induction coil installation of British manufacture, designed to give a pressure of from 250,000 to 300,000 volts. The apparatus will be used to test the value of the new technique for the treatment of deep-seated cancer, and a new apparatus for localising the radiation at any depth in the body will be used. The apparatus is the combined work of the staff at the Cancer Hospital, and one of the chief features of the therapeutic room is the method employed for the protection of the operator.—*The Times*.

The Cost of Ventilating Tunnels.—Mr. Hutton, Inspector of Mines, Germiston, has made a comparison of the cost of ventilating a long tunnel by means of electric fan, compressed air fan, and compressed air direct. A typical case is taken; this is 2,000 ft. in length, with a cross section of 50 square feet, and the calculation is made for the whole of the ventilation from the commencement to the completion of the tunnel, a period of 25 months. The fan ventilation allows for capital cost of fans, of which two will be worn out if they are compressed air fans, for maintenance, cost of 16 in. piping, for power, or compressed air, and incidentals. Compressed air cost is taken at the prices charged by the Victoria Falls Power Co., probably the lowest at which compressed air is obtainable on the Witwatersrand. The comparison is as follows:—

Method.	Total air. Cub. ft.	Cost per	
		Total	1,000
Electric fan	1,872,000.000	£638	0.082d.
Compressed air fan ...	1,053,000.000	£978	0.233d.
Compressed air direct ...	224,125.000	£1,077	1.154d.

It will be seen that although the amount of air which is supplied by fan ventilation is many times larger than with compressed air supplied direct, the cost is considerably less.—*S. A. Mining and Engineering Journal*.

INSTITUTION NOTES.

Institution of Electrical Engineers.—EAST MIDLANDS SUB-CENTRE. The following meetings have been arranged: December 1st, paper on "The Whirling of Shafts," by Prof. C. H. Bulleid; January 3rd, 1922, Address by Mr. R. A. Chattock; January 24th, paper on "The Loughborough Electricity Undertaking and Extensions in Hand," by Mr. R. B. Leach; February 14th, to be announced later; March 7th, paper on "The X-ray Examination of Materials," by Mr. J. F. Driver; March 28th, paper on "The Future Aspect of Power Generation," by Mr. A. Hugh Seabrook; April 18th, paper on "Electric Vehicles," by Mr. R. J. Mitchell; May 9th, Annual General Meeting.

North-East London Centre. A series of joint meetings has been arranged between the Associates and Students of the Centre, the North of England Institute of Mining and Mechanical Engineers, and the North-East Coast Institution of Engineers and Shipbuilders. The first meeting was held on November 17th, when Professor George Lewis, D.Sc., gave an address upon "The History of Iron and Steel Manufacture." Another meeting was held on November 19th, when a paper was read

by Mr. John T. Pringle upon "The Installation of a Ward-Leonard Winding Plant at the Cowpen Coal Co.'s Isabella Colliery."

THE ROYAL CHARTER.—On November 17th an extraordinary general meeting of the Institution was held at which a resolution was passed authorising the voluntary liquidation of the Institution as a limited company, with Sir James Devonshire and Mr. P. F. Rowell as liquidators, this being a necessary formality in view of the Institution being granted a Royal Charter. A meeting will be held on December 2nd to confirm the resolution.

NORTH-WESTERN CENTRE.—*Liverpool Sub-Centre.*—Mr. E. S. Byng read his paper on "Telephone Line Work in the U.S.A." before the Sub-Centre on November 21st. Mr. Eames opened the discussion, and was followed by Messrs. Bolton, Pratt, Morton, Cowburn, Holthum, Brookes, Mercer and Adams. The discussion centred round a criticism of American practice as compared with English.

INFORMAL MEETING.—On Monday last at an informal meeting held at the Institution building, Mr. J. F. Avila presiding, a discussion on "Hydro-electric Power" took place. Mr. A. J. Hainsworth opened the discussion with a brief account of a large installation in New Zealand, illustrated with diagrams.

An interesting discussion followed, in which many speakers took part. The attendance was very large, the whole of the seating accommodation being fully utilised.

Chelmsford Engineering Society.—On November 17th a paper was read by Mr. C. W. Boyle, A.M.I.C.E., on the "Poulsen Arc as applied to Wireless Telegraphy." The President (Mr. G. F. Barrett) was in the chair. The design of the arc generator for high-frequency currents was gone into very thoroughly. The author said that the shape of the pole tips of the magnets was important; the gap between them was fixed by the power of the arc or size of the electrodes. The pole cores were round, and should be of diameter equal to approximately four times the length of the gap, and the best shape of pole tips was conical, with the tips cut off square, the angle of slope being 55 degs. to the face, and the face diameter approximately 0.433 of the diameter of the pole cores. This ensured a concentrated magnetic field in the gap. The efficiency of the arc was usually about 40 per cent., the theoretical maximum being 50 per cent.

National Union of Scientific Workers.—The annual general meeting was held in London on November 12th, when Professor Leonard Bairstow, F.R.S., the retiring president, delivered his address. Prof. Bairstow deplored the continued inadequacy of the rewards received by inventors and scientists, and stated that the "Geddes" Economy Committee clearly failed to realise the importance of the part played by the scientific worker. The negotiations for the amalgamation of the Union with the British Association of Chemists promised well, and brought them nearer the desired goal of proper recognition. Dr. A. A. Griffith was elected president for the ensuing year; Prof. J. Stanley Gardiner and Dr. Harold Jeffreys were appointed president and secretary respectively of the Research Council.

The annual dinner followed the meeting, Sir Frank Baines, H.M. Office of Works, being the principal guest.

The Optical Society.—A series of meetings has been arranged which will be devoted to subjects dealing with the evolution and development of various types of optical instruments. The first meeting was held at the Imperial College on November 24th. The subject was "Polarising Apparatus." Professor F. J. Cheshire, C.B.E., was to give a demonstration.

Nottingham Society of Engineers.—At a meeting held on November 23rd, Mr. A. D. Phillips, M.I.E.E., read a paper on "The Economics of Power Transmission and Distribution." The author compared the efficiencies of large and small stations, discussed the most economical voltages for certain applications, and also dealt with e.h.p. direct-current transmission.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Mr. W. E. BURNAND, the new chairman of the North-Midland Section of the Institution of Electrical Engineers, who delivered his inaugural address on November 15th, is in business as W. E. Burnand & Co. (electrical power engineers and wholesale dealers in electrical supplies) at Chippinghouse Works, Lowfields, Sheffield. He has no partner in the ordinary sense of the term, the word "company" in the firm's name really standing for the workmen. Mr. Burnand is justified in the cultivation of a spirit of comradeship between himself and his employees by a 25 years' record without labour troubles. He was born in 1875, and apprenticed to the Sheffield Telephone Exchange and Electric Light Co., Ltd., the predecessors of the present extensive municipal electricity supply undertak-

ing. He entered the Sheffield company's service—1892-1896 was the period of his apprenticeship—when the generating plant comprised 50-kW and 200-kW single-phase alternators and three Thomson-Houston arc lighters, and when three-fourths of the units generated came from the 50-kW machine. For some time Burnand had charge of the plant, and having a good deal of time to spare for experimental work he profitably employed it in designing and experimenting with motors and transformers, in developing and patenting an arc lamp with



Ethel Eadon]

[Sheffield.

MR. W. E. BURNAND,
Chairman of the North-Midland Centre of the Institution of
Electrical Engineers.

inclined carbons, regulating mechanism, and with a reflector over the arc. Meter work also occupied his attention. In 1896 his desires for greater activity in such directions led him, in spite of the fact that he had little money at his command, to start in business on his own account in the manufacture of transformers and arc lamps. He started on a very small scale, but the one-man business has now grown to be a large one, with extensive works at Sheffield. The manufacture of arc lamps was abandoned and that of induction motors was taken up. In this branch of work steady progress has been made, and the motors are in use for all purposes, from driving a chaff cutter to running a steel rolling mill. Mr. Burnand in recent years has developed a "super" slide rule, chiefly for transformer calculations. He has designed many power plant lay-outs, also special machine tools, and has assisted in the development of special tools for the local trades, applying electrical methods that have converted apparent failures into commercially successful machines, and apart from appliances for the local trades, has designed transformers for wireless and welding and many non-standard motors for special work, in addition to the usual standard requirements which are in extensive use in the Navy and elsewhere.

Mr. J. N. ROBERTSON, Assistant Sub-Station Superintendent of the Glasgow Corporation Electricity Department, has accepted an appointment as an outside representative of The British Electric Transformer Co., Ltd., Hayes, Middlesex. Mr. Robertson has been associated with the power stations and sub-stations of the Glasgow Corporation for the past fourteen years. Shortly after his return from the army in 1919 (in which he held a commission) Mr. Robertson was appointed assistant sub-station superintendent. On the eve of his departure for London he was presented with an attaché case and a set of silver-mounted brushes from the staff and employees of the electricity department.

Mr. JAS. D. DOW, who was for many years the sales manager of the old Armorduct Manufacturing Co., Ltd., has now been appointed manager of the cable department of Magie Appliances, Ltd., who are supplying the H.B. (Armorduct) cables.

Mr. J. ROLAND GOTT, assistant under Mr. C. I. Baker, Blackpool Tramways Traffic Superintendent, leaves England next

month to take up an appointment as general assistant to the traffic manager of Calcutta tramways.

Mr. JOHN HORNE is leaving the Metropolitan-Vickers Export Co. at the end of this month to take up an important position on the London staff of the A.C.E.C. (Ateliers de Constructions Electriques de Charleroi). Mr. Horne has been associated with the British Westinghouse and Metropolitan-Vickers companies for nearly 15 years.

On the occasion of the opening of the Blackburn Meadows Power Station by H.R.H. the Duke of York, on November 4th, a cinematograph record was taken, which was subsequently exhibited for a week in the Sheffield picture theatres. Thus, we understand, Mr. S. E. FEDDEN (City Electrical Engineer and Manager) made his *débüt* as a film actor. It would be interesting to know whether any other central station engineer has anticipated Mr. Fedden in this respect.

According to the *Electrical News* (Canada), Mr. F. JOHN BELL recently resigned the position of president and general manager of the Canada Wire & Cable Co., Toronto. He has also resigned as president and general manager of Leaside Engineering Co., which corporation controls the cable company and other firms, including the Leaside Munitions Co.

Mr. W. HARTLEY, of the Rochdale Corporation Electricity Works, who has resigned his post of mains superintendent through ill-health, has been connected with the department for over 12 years.

Mr. H. GUY WOOD has resigned his position with the City of Birmingham Electric Supply Department, to take up an appointment with the Calcutta Electric Supply Corporation, Ltd. as station engineer. On leaving Birmingham he was presented with a silver cigarette case by the members of the generated staff. As lieutenant in the R.E. (T.), he was recently transferred from the 2nd N. Mid. Field Co., 46th Divisional Engineers, Corps of Royal Engineers (T.A.), to the Territorial Army Reserve.

Mr. CHAS. S. ATKINSON, A.M.I.E.E., for the past 17 years on the staff of the Newcastle-upon-Tyne Electric Supply Co., Ltd., and its associated company, the Cleveland & Durham Electric Power Co., has resigned his appointment to enter into partnership with Mr. P. Nutter (who was also for many years on the staff of the former company), in the business of Messrs. P. Nutter & Son, 41, Side, Newcastle-on-Tyne, engineers and merchants.

Mr. G. W. SOMERVILLE, A.M.I.E.E., has been appointed manager of the electrical department of Messrs. Joseph Walton & Son, of Nelson.

Prof. BRANLY, the inventor of the coherer, has refused a grant of £800 per annum by the French Chamber of Deputies, declaring that he is not worthy to rank with such men as Pasteur and Lamartine, to whom such grants were made.

Obituary.—MR. W. H. BOOTH.—The death of William Henry Booth has deprived the engineering world of one of its most original and daring thinkers, the technical Press of a much appreciated contributor, and the editors of the *ELECTRICAL REVIEW* of a highly esteemed friend, with whom they



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[London.

THE LATE MR. W. H. BOOTH.

had had pleasant relationships during more than thirty years. Mr. Booth, who was a man of wide practical experience, left Lancashire (he was born at Rochdale and educated there and at Owens College, Manchester) in 1877 to seek advancement in New Zealand and Australia. After his return to England in 1880, he spent some years in boiler construction work and in technical journalism. In the latter sphere he was associated with the *Mechanical World* and the *Practical Engineer*; of the

last named he was one of the founders. He came to London in 1889 and was associated with others in promoting a Bill for a shallow electric railway across the West End of London, but the Bill was not carried. Later he held an appointment with the G. & S. Electric, and subsequently entered into various engineering partnerships in London, carried out artisan well sinkings and public water supply undertakings, joined the engineering staff of the British Electric Traction Co., with whom he remained for several years, and in many other capacities enjoyed a very full life of engineering activity. To the pages of the *ELECTRICAL REVIEW* and other technical journals he was all through the period covered by these pursuits an ever-ready and profuse contributor possessed with original and critical ideas, able to express himself in the strongest language in condemnation of anything fallacious or fraudulent. He was deserving of greater credit than it was his lot to receive in various connections; for example, having a keen insight into the processes of combustion, he perceived the defects of the earlier types of water-tube boilers, and lost no opportunity of declaiming against the inadequate space allowed above the grate for the combustion of the hot gases, strenuously maintaining that these should never be permitted to come into contact with water-cooled surfaces until combustion was complete. These principles he propounded in numerous articles in our pages at the commencement of this century, and there is no doubt that his influence was largely effective in bringing about the reformed practice in this respect which is now regarded as standard. As a geological expert also he took high rank, particularly in connection with the provision of water supply to factories and townships. Mr. Booth frequently lectured on liquid fuel, smoke abatement, and other subjects, and he also wrote several well-known books. During the war he "did his bit" as an engineer in Government service in connection with the manufacture of gauges, and for a number of years at the Slough motor depot in connection with the water supply, and we believe was the last official to leave, early in the present year. For some months past he had been in failing health, but he continued with his heart in his engineering work. He wrote his first article for the *ELECTRICAL REVIEW* (in conjunction with his old friend, Frank B. Lea, also a frequent writer to these pages) on the subject of "Steam Boilers" in September, 1891, and his last, by coincidence, appeared in the same issue in which it was our sad duty to announce his death. His spirit of daring and enterprise demonstrated itself in comparatively recent years when, a year or two before the war, he went on an exploring expedition to Venezuela, covering what was previously practically untrudged country, crossing swollen rivers by primitive means, and so forth, on behalf of certain City of London financial interests. He had been a member of the American Society of Civil Engineers since 1888, and a Fellow of the Geological Society. He was not a man to shrink from hardihood, and he fought against many difficulties at various stages of his career. In the interest of engineering pursuits and in solicitude for the well-being of his family he never spared himself. He was a man of very determined resolution, of strong convictions, jealous for his personal liberty of thought; he was a rising unsettled man, not an unnatural or altogether undesirable disposition for a man of his profession, for the British engineer claims the whole world as his field of operations, and it is just as well. Latterly Mr. Booth had appeared to desire to settle down and be at rest. At the age of 67 years it has now been so ordained, for he passed away on November 12th at Worthing.

Mr. W. R. KENNEDY.—The death is announced of Mr. W. R. Kennedy, a director of the Coleraine (Co. Derry) Foundry and inventor of the "Express" turbine and the "Challenge" turbine and water-wheel.

Mr. W. McHUGH.—The death has occurred after a very brief illness of Mr. Wm. McHugh, secretary of the Dublin United (Electric) Tramways Co. He had been 35 years in the service of the company, and was appointed secretary on the death of Mr. Tressilian, about six years ago.

Mr. F. G. HART.—We regret to record the death of Mr. Francis George Hart, M.I.E.E., which occurred at Epping, Suffolk, on November 21st at the age of 43 years.

Delstar Engineering Co., Ltd. (177,810).—Private company. Registered November 14th. Capital, £1,000 in £1 shares. To carry on the business of mechanical and electrical engineers, motor manufacturers, manufacturers and sellers of electric and other motors, motor accessories, switchboards, transformers, generators, and all kinds of electrical gear and appliances, &c. The permanent directors are: H. Creighton, 46, Eila Street, Leeds; A. Blair, 12, Temple Crescent, Beeston Hill, Leeds. Qualification, 100 shares. Secretary, Emma Creighton. Registered office, 100, Woodhouse Street, Leeds.

R. F. Payne Gallwey & Co., Ltd. (177,892).—Private company. Registered November 12th. Capital, £100 in 100 shares. To carry on the business of merchants, warehousemen, manufacturers' agents, manufacturers' importers and exporters, wholesale dealers in electric lamps, fittings and bells, bell installations and fittings, electric motors and switchgear, manufacturers of, and dealers in, tinware, copper, iron, brass and hardware goods of all kinds, mechanical, electrical and general engineers, merchants and factors for the supply to collieries and other manufacturing works of machinery and equipment, &c. The permanent directors are: Sir John F. Payne Gallwey, Bart. (chairman), 7, Draxton Place, S.W. 1; director of Sir J. F. Payne Gallwey, Brown & Co., Ltd., R. F. Payne Gallwey (managing director), 11b, St. James's Square, Holland Park, W.; C. F. Sturdy (assistant managing director), 11b, St. James's Square, Holland Park, W. Qualification, five shares. Registered office, 58, Victoria Street, Westminster, S.W. 1.

Symondsburg Electric Lighting Co., Ltd. (177,885).—Private company. Registered November 17th. Capital, £2,000 in £5 shares. To provide electric light and power in Symondsburg, Bridport. The permanent directors are: Rev. C. F. L. Sweet, The Rectory, Symondsburg; T. A. Walker, The Manor House, Symondsburg; E. J. Donville, Shutes, Symondsburg. The directors' borrowing powers are restricted to £100. Qualification of permanent directors, 100 shares. Secretary: E. J. Donville. Registered office: Symondsburg, Bridport, Dorset.

Carlton Lamp Co., Ltd. (177,827).—Private company. Registered November 15th. Capital, £500 in £1 shares. To carry on the business of manufacturers and vendors of electric lamps, fittings, and other appliances and apparatus for use in connection with electricity. The permanent directors are: G. A. Sawyer, 58a, Pall Mall, S.W. 1; director: A. B. F. Roberts, 58a, Pall Mall, S.W. 1. Qualification, 50 shares. Remuneration, as fixed by the company. Registered office: 58a, Pall Mall, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Kalgoorlie Electric Power & Lighting Corporation, Ltd. (91,219).—Return dated June 23rd, 1921. Capital, £225,000 in 175,000 preference shares of £1 each and 100,000 ordinary shares of 10s each. 150,000 preference and 100,000 ordinary shares taken up. 10s. per share called up on seven ordinary, £3 10s. paid, £199,390 10s. considered as paid on 150,000 preference and 50,000 ordinary. Mortgages and charges, £57,450.

Electric Supply Co. of Victoria, Ltd. (66,069).—Return dated October 27th, 1921. Capital, £325,000 in 175,000 preference and 150,000 ordinary shares of £1 each, 175,000 preference and 125,000 ordinary shares taken up. £200,067 paid. £249,993 considered as paid. Mortgages and charges, £109,713.

Direct West India Cable Co., Ltd. (53,956).—Return dated October 6th, 1921. Capital, £120,000 in £5 shares. 12,000 shares taken up. £400,000 paid. Mortgages and charges: Nil.

L. J. Healing & Co., Ltd. (97,137).—Return dated June 8th (filed October 7th, 1921). Capital, £100,000 in £10 shares (5,000 preferred, 5,000 deferred). 1,301 preferred and 5,000 deferred shares taken up. £13,010 paid. £50,000 considered as paid. Mortgages and charges: Nil.

British Electric Traction Co., Ltd. (49,855).—Return dated July 9th, 1921 (filed October 14th, 1921). Capital, £2,398,397 15s. £712,744 5s. 6 p. cent. cum. pref. stock and £1,326,265 15s. ord. stock taken up, and paid for in full. Mortgages and charges, £1,734,133.

Hong Kong Tramway Co., Ltd.—Charge on certain lands, &c., dated May 30th, 1921, created under the United Kingdom (supplemental to charge dated May 31st, 1919, securing £700,000). Holders: Hongkong & Shanghai Banking Corporation.

A. and A. Electrical Co., Ltd.—Satisfaction in full on September 18th, 1919, of charge dated November 30th, 1913, securing £250. (Notice filed November 15th, 1921.)

Spittdorf Electrical Co. of London, Ltd.—Satisfaction in full on August 29th, 1921, of debenture dated October 9th, 1919, securing £5,000.

C. F. Ellwell, Ltd.—Mortgage debenture dated October 29th, 1921, to secure £3,000 charged on the company's property, present and future, including uncolled capital. Holders: Radio Communication Co., Ltd.

Lancashire Electric Light and Power Co., Ltd.—Trust deed dated October 20th, 1921 (supplemental to trust deed dated April 7th, 1911, securing £700,000 prior lien debenture stock). Charged on debenture stock and shares in Lancashire Power Co. and the company's undertaking and property, present and future, including uncolled capital. Holders: N. Spens, 7, Union Court, E.C. 4, and G. Collis, 2, Finch Lane, E.C.

Winscombe Electric Light and Power Co., Ltd.—Issue on November 9th, 1921, of £250 debentures, part of a series already registered.

Sevenoaks and District Electricity Co., Ltd.—Particulars of £15,000 debentures authorised October 14th, 1921. Present issue £100, charged on the company's undertaking and property, present and future, including uncolled capital.

Harris Electro Metal Co., Ltd.—Particulars of £2,000 debentures, authorised November 8th, 1921, to secure £2,000 charged on the company's undertaking and property, present and future, including uncolled capital.

NEW COMPANIES REGISTERED.

Power House Components, Ltd. (177,881).—Private company. Registered November 17th. Capital, £2,000 in £1 shares. To carry on the business of manufacturing and selling all kinds of apparatus, components, and accessories for power stations, including but not limited to, valves, pumps, and other machinery, &c. The permanent directors are: M. J. E. Ashlea, 20, Ashlea Road, West Bridgford, Notts, articles clerk. Solicitor: J. C. Ashlea, 20, Ashlea Road, West Bridgford, Notts.

Advance Lamp Co., Ltd. (177,868).—Private company. Registered November 17th. Capital, £1,000 in £1 shares. To carry on the business of manufacturing and selling all kinds of apparatus, components, and accessories for power stations, including but not limited to, valves, pumps, and other machinery, &c. The permanent directors are: M. J. E. Ashlea, 20, Ashlea Road, West Bridgford, Notts, articles clerk. Solicitor: J. C. Ashlea, 20, Ashlea Road, West Bridgford, Notts.

CITY NOTES.

The report for 1920, which is to be submitted at the meeting on November 29th, states that the revenue was £4,381,556, less £1,629,057 for ordinary expenses, and £1,359,726 for maintenance of cables, income and war taxes payable abroad, share of contribution to pension and superannuation funds, towards depreciation of investments, payments to staff and other expenses incidental to the war, special grant on formation of staff widows' fund, and sundry differences in exchange, leaving a balance of £1,303,072. After providing for income tax, corporation

profits tax, and E.P.D. payable in England, interest on mortgage debenture stock, and dividends on the preference stock, which all absorb £474,015, the balance is £913,058, plus £416,083 brought forward, making £1,339,149 available. £500,000 has been placed to general reserve, and £100,000 to Maintenance of Ships' Fund. The total distribution on the ordinary shares has been 10 per cent. free of income tax, and a dividend free of income tax has been paid on the new ordinary shares amounting to £18,662. There remains £316,479 to be carried forward. During the year £1,476,088 was expended in respect of new cables. In accordance with the purpose for which the new ordinary shares were issued £1,000,000 has been charged to capital expenditure, the balance of £476,088 being charged against general reserve fund. This fund has been debited with £901,022 for partial renewal of main line cables, £57,650 for loss on sale of investments, and £250,000 as a further provision on account of investment fluctuations. The balance to the credit of the fund is £2,217,380.

German Companies.

The A.E.G.-Unternehmungen A.G., of Berlin, reports net profits of 641,000 marks for 1920-21, as compared with 652,000 marks, and the dividend is at the rate of 6 per cent., as in the previous year.

The directors of the *Telephonfabrik vorm. J. Berliner*, of Hanover, recommend a dividend at the rate of 20 per cent. for 1920-21, as compared with 15 per cent. in the previous year, and an increase in the share capital from 20,000,000 to 40,000,000 marks.

The A.G. *für Licht und Kraft*, of Munich, after making provision for depreciation, reports net profits of 1,591,000 marks for 1920-21, comparing with 452,000 marks in the previous year. A dividend at the rate of 10 per cent. has been declared, as against 8 per cent. in 1919-20. It was mentioned at the recent meeting that all departments were fully occupied.

The *Berlin Elevated and Underground Railway Co.* has decided to increase the share capital by 30,000,000 to 110,000,000 marks, so as to provide funds for new installations and extensions of working. An augmentation from 75,000,000 to 150,000,000 marks is proposed by the Berlin Electrical Undertakings Co. for meeting the requirements of associated concerns which are to carry out extensions of the generating stations, &c.

The directors have issued the accounts for the 11 months ended August 31st, 1921, to meet the requirements of Part I of the Second Schedule of the Finance Act, 1921. They show, after providing for doubtful debts and E.P.D. refund, a net loss of

£445,461. The balance of profit brought forward from the previous year was £142,418. From this is deducted £11,458, the eleven-twelfths of dividend on preference shares, paid in January and July, leaving £130,960. To this is added £350,000 transferred from the reserve fund, making £480,960. Deducting from this the loss mentioned above (£445,461) there is to be carried forward £35,498. The report mentions that, of the net loss shown on the profit and loss account, a very large proportion is due to depreciation in the value of stock as at August 31st, 1921, compared with September 30th, 1920. The remainder of the loss is the result of the disastrous effects of the coal strike, the shorter hours of work, labour difficulties, the unsettled state of markets, and the great reduction of turnover due to the competition of dumped foreign goods and surplus stocks arising out of world-wide over production, these together have reduced the turnover by about one-half. To cover the loss on the eleven months' work the directors have withdrawn £350,000 (as mentioned) from the reserve fund, leaving £215,792 to the credit of that fund. The board regret that the payment of a dividend on the ordinary shares is impossible, but with a return to more normal conditions they feel confident that the company will once more be put on a dividend-paying basis. The warrants for the half-yearly dividend on the preference shares will be payable on January 2nd, 1922. Mons. H. E. P. Delajoux, manager of the company's works at Person-Béaumont, has been appointed an extraordinary director. The meeting is to be held on November 30th at 106, Cannon Street, E.C.4.

Switzerland.—The balance sheet of the *Société des Usines Electriques de la Lonza*, of Basle, for the last financial year shows a loss of 3,200,000 francs, as contrasted with a profit of 485,673 francs in the preceding 12 months.

British Electric Traction Co., Ltd.—Interim dividend of 3 per cent. on the six per cent. cumulative participating preference stock.

Isle of Thanet Electric Tramways & Lighting Co., Ltd.—Dividend of 24 per cent., less tax, on preference shares for half-year ended July, 1908.—*Financial Times*.

The Ever-Ready Co. (Great Britain), Ltd.—Dividend at the rate of 7 per cent. per annum on preference shares for the half-year ended September 30th.

France.—The report of the *Société Frençonne d'Énergie Electrique*, of Toulouse, for the last financial year shows a profit of 800,641 francs, as compared with only 548,685 francs in the preceding 12 months.

Prospectus.—*The British Thomson-Houston Co., Ltd.*—As briefly announced by us last week, this company has this week been offering for public subscription an issue of £1,500,000 seven per cent. mortgage debenture stock at 92½ per cent. The stock forms part of a total authorised issue of £3,000,000 stock, and will be repaid on or before May, 1922, by the payment of a cumulative sinking fund beginning next year. The redeemable price between 1921 and 1922 is 102½ per cent. of at least at any interest date thereafter if the company exercises its right to redeem at these dates. The unissued balance of £1,500,000 will be available for redemption of the 4½ per cent. first mortgage debenture stock, for redemption of notes which fall due in 1925, or for the general purposes of the company. The prospectus contains a certificate by Messrs. Price, Waterhouse & Co., showing the profits for the last six years. The average of the last four years, after deducting reserves made for contingencies, amounted to £318,000, or about three times the annual amount required to provide interest and sinking fund on the present issue. The orders on hand at October 31st, 1921, were over £3,250,000. The objects of the present issue are to retire temporary loans and to provide for completion of extensions of the company's buildings and plant and further working capital.

The subscription list was closed on Monday afternoon. Country applications received the following morning by first post were considered.

The A.E.G. Dividend.—The directors of the A.E.G., after having set aside 100,000,000 marks as a first instalment towards the provision of a works' maintenance fund, report net profits amounting to 82,388,000 marks for 1920-21, as compared with 45,707,000 marks in the preceding year. The dividend proposed is at the rate of 16 per cent., as against 14 per cent. in 1919-20, and 10 per cent. in 1918-19. The shareholders will be asked at the forthcoming meeting to sanction a further increase of 250,000,000 marks in the ordinary share capital, to be issued at an appropriate time in the coming year.

Companies to be Struck off the Register.—The following are to be struck off the Register within three months, unless cause is shown to the contrary:—

Baith's Economisers, Ltd.
E. B. Magnes, Ltd.
India Railways Traction Co., Ltd.
Kable Electrical Co., Ltd.
Technical News, Ltd.
Wallace Griffin Electrical Co., Ltd.
Accessories Manufacturing Co., Ltd. (registered November 7th, 1910).
Yates-Colonial Engineering Co., Ltd.
Engineers' Standardised Publications' Association, Ltd.
General Engineering Accessories, Ltd.

The French Cable Co.—The shareholders in the *Compagnie Française des Câbles Télégraphiques* have now sanctioned the proposed increase in the share capital from 16,000,000 to 24,000,000 fr., so as to permit of payment being made for the participation taken up in the *Radio-Française*. It is not expected that the emission will be offered for subscription before January at the earliest.

Callender's Share & Investment Trust, Ltd.—For the year ended August 31st the total revenue was £18,760, and after paying debenture interest, &c., £10,364 remains, plus £6,218 brought forward. £500 is put to reserve and £700 to corporation tax. A final dividend of 4 per cent., less tax, is recommended, making 8 per cent. for the year, and carrying forward £6,619.

New Issue.—According to *The Times*, public subscriptions will next week be invited for an issue of £400,000 7½ per cent. mortgage debenture stock of the *Midland Counties Electric Supply Co.* at 96.

Power Gas Corporation, Ltd.—Dividend at the rate of 6 per cent. per annum, less tax, for the year ended September.

STOCKS AND SHARES.

TUESDAY EVENING.

The two principal factors in the Stock Exchange markets at the present time are Ireland and naval disarmament. The first is certainly the more serious of the two. Possibly the City has taken a hyper-cautious view of the disarmament proposal, for there seems to be no great enthusiasm for the idea, except on the part of those who look some way ahead, and who regard the possible lightning of taxation as being more than compensation for whatever risks may be run by scaling-down the naval strength of the country. Armament shares are dullish, although showing recovery from the worst. The outstanding feature in the markets as a whole is the continued strength of the purely investment stocks.

Several tables which have been given here lately in connection with investment stocks and shares appear to have proved useful to readers who are on the lookout for suggestions, and to others who like to compare their own securities with what is offering in the markets. Accordingly, the following eight examples of what is obtainable, at the present time, may be of service as well as interest. This group is concerned with debenture stocks and debentures:—

Description.	No.	Yield.		Interest payable.	Redemption.
		Interest only.	Including redm.		
Anglo-Arc Trans. 4s. Deb.	624	6 8 0	6 12 0	J. & J.	1928 (by cum. sinking fund) at 102 or by purchase.
Cable & Electric Co. 7½ 1st Mort.	674	5 2 6 net	—	J. & J.	Tax free. Repay- able by cum. sinking fund of 2% by drawings at 102 or by purchase. Right to convert into ord. shares at 10s. deb. for £500,000 between June, 1921, & June, 1925, inclusive.
Convert. Reg. Deb.		7 6 0 net	—		1924 cum. sinking fund at 105%.
English Elec. & P. Co. 6 1st Secured Notes Reg.	26	8 7 0	9 11 0	J. & J.	1953 at par by annual drawings by means of a cum. sinking fund of 1%.
General Elec. Co. 7½ Mort. Deb.	884	7 1 6	7 2 0	M. & S.	Also after 1931 at par.
Lancashire Elec. Light and Power 7½ Prior Lien Deb. (issued at 95)	1614	7 7 0	7 7 6	A. & O. (part int. April)	By 1948 at 105 by means of a 2% cum. sinking fund. By drawings at 105 or by purchase.
Merser Power Co. 7½ Mort. Deb. (issued at 97)	103	7 10 0	7 10 0	M. & S. (21 2 6 March)	By 1948 at 105 or earlier by means of an an- nuity cum. sinking fund. Guaranteed as to both prin. and int. by the Salt Union, Ltd.
Newcastle upon Tyne Elec. Sup. 5½ 2nd Mort. Deb.	75	6 13 0	7 2 0	M. & S.	1947 at 110 or after 19.2 at 102.
Surrey, Here, and Staffs. Elec. Power 7½ 10- year guar. conv. Deb. (issued at 97)	994	7 10 0	7 13 0	J. & J. (part int. January)	1931 at par. Guaranteed as to both prin. and int. by the British Elec- tric Traction Co., Ltd. Convertible at any time at the holders' option into £1.0 of 8% "A" ord. shs. and £2.0 of "B" ord. shs. for each £100 stock.

The market for cable stocks and shares is inclined to sag. Eastern Extensions and Globes are down to 16½, and Eastern Telegraph ordinary stock is not much better than 163. No change worth mentioning has occurred in Westerns, but the group as a whole has lost part of its usual buoyancy. Some people are asking whether this is due to the probable competition of wireless, having regard to the recent extension of the Radio Corporation's activities in the United States. Rumours, very vague and nebulous, are afloat concerning a remarkable development in connection with wireless telegraphy, said to be on the point of announcement from Germany.

Proprietors of cable stocks can afford to regard these factors with equanimity. Such considerations have played their part in depressing prices of the cable companies' stocks and shares in the past, but experience has hitherto proved that there is plenty of room, in the business world, for submarine as well as for overhead work. It is fair to assume that cable companies have suffered in the same way as most other industrial undertakings from the world-wide depression in trade, but the Stock Exchange, at any rate, entertains no apprehension as to the probability of dividends being reduced from the 10 per cent. at present paid on the ordinary stocks of the Eastern group. There is, of course, always the chance of companies which declare their dividends free of tax making such an alteration as would involve payment of the dividends less tax, though this, in the case of the cable concerns, is highly improbable.

The wireless shares are none too strong, the shares of the parent company being 1/16 easier at 3 1/3, the preference having shaded off to the same price. Radio Corporation common are 9s. 9d. and the preferred 9s. 3d.

Electrical manufacturing shares are going quietly. There is not much change in the prices this week. Electric Constructions are unaffected by the declaration of an interim dividend at the rate of 6 per cent. Last year the dividend for the full 12 months was 10 per cent. General Electric "B" preference are better at 17s. 6d., while the ordinary remain steady at this same price. British Aluminums have hardened to 13s. 6d. from 13s. 3d. up at 13s. 3d., but the first debenture shed 2 points to 65, and the preference at 13s. 6d. are lower on the week.

The British Electric Cable and Telegraph Works Co., in its report for the eleven months to August 31st last, shows a net loss of £445,000. By transferring £100,000 from reserve and adding the amount brought in from share issues, a credit balance of £35,000 is realised to set off the loss. The directors state that a very large proportion of the loss is due to the depreciation in the value of stock, and that the remainder is the result of the depreciation of the cost of the strike, shorter hours of work, labour disputes, and other such causes. No dividend is, of course, to be paid on the ordinary shares in respect of the accounts now published. The price of the shares is nominally 12s. 6d., though actually it is not as

good as this, and the melancholy figures have had no effect upon other companies' shares.

The British Thomson-Houston Co. has made an issue of £1,500,000 7 per cent. mortgage debenture stock at 92½, brief particulars of which were given here last week. The subscription lists could have been kept open until Thursday, but they were shut on Monday, there being a rush for the stock. A capitalised dividend, out of capital reserves account, of 10 per cent. was paid on the ordinary shares in July, 1920. Previously to that, nothing had been paid on the ordinary for 17 years. The shareholders received 4 per cent. per annum for nine months of 1902-3. The preference dividends fell into arrears from 1904 to 1919, but this was satisfied in full, in July, 1920, by the allotment of 210,000 fully-paid 4½ ordinary shares, a sum of £210,000 out of capital reserve account having been capitalised for this purpose.

Electricity supply shares hold their prices, and Kensingtons are better at 42.

Underground stocks have moved up a little after their recent reaction, although the Income Bonds of the Underground Electric Railways are again a point down. The company's £10 shares, however, have risen to 35s. Brazilian Tractions at 30 are one higher, and Mexican Light and Power 1st mortgage bonds at 53½ have equally improved. Mexican Government bonds have been going up by points at a time this week, the buying being traced to New York sources. Up to the present, however, the Utility companies have not participated in this attention. The rubber share market continues firm, with rubber itself still a trifle under a shilling per lb. Engineering shares keep steady, with Babcock & Wilcox 23 1/8. The armament group is a little shaky, though Vickers, after a dip to 9s., rallied to 9s. 6d. Siemens ordinary at 21s. 3d. have recovered the 1s. net dividend deducted a week ago, and the preference shares at 25s. 6d. are higher on the week.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend.	Price		Yield	
		Nov. 22.	Rise or fall.		
Brompton Ordinary ..	12 12	182	—	29 10 0	
Charing Cross Ordinary ..	7 8	44	—	8 17 10	
do. do. 4½ Pref. ..	4½ 4½	14	—	7 4 4	
Chelsea ..	6 6	32	—	9 4 8	
City of London ..	13 14	26 9	—	10 9 6	
do. do. 6 per cent. Pref. ..	6 6	17 6	—	6 17 2	
County of London ..	8 8	82	—	10 4 4	
do. do. 5 per cent. Pref. ..	5 5	42	—	7 10 0	
Kensington Ordinary ..	7 9	42	+ ½	9 9 6	
London Electric ..	5½ 2½	1	—	7 10	
do. do. 6 per cent. Pref. ..	6 6	32	—	10 0 0	
Metropolitan ..	5 7	39	—	9 6 8	
do. do. 4½ per cent. Pref. ..	4½ 4½	22 2	—	7 13 2	
St. James' and Pall Mall ..	12 12	62	—	8 17 10	
South London ..	6 7	28	—	10 13 2	
South Metropolitan Pref. ..	7 7	16 0	—	8 13 4	
Westminster Ordinary ..	10 10	52	—	8 13 10	

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref. ..	6 6	82½	—	7 5 7	
do. Def. ..	1½ 1½	17	—	4 16 6	
Chile Telephone ..	6 6	57	—	5 17 2	
Cuba Sub. Ord. ..	6 6	57	—	10 0 0	
Eastern Extension ..	10 10	162	—	6 2 2	
Eastern Tel. Ord. ..	10 10	163½	—	6 2 4	
Globe Tel. and T. Ord. ..	10 10	163	—	6 2 4	
do. do. Pref. ..	10 10	62	—	6 0 0	
Great Northern Tel. ..	22 24	25	—	9 12 0	
Indo-European ..	10 10	30	—	8 6 8	
Marconi ..	15 15	15	—	9 12 0	
Oriental Telephone Ord. ..	12 12	2	—	7 6 0	
United R. Plate Tel. ..	8 8	6½	+ ½	7 0 8	
West India and Panama ..	Nil Nil	5½	—	Nil	
Western Telegraph ..	10 10	169	—	6 1 6	

HOME RAILWAYS.

Central London Ord. Assented ..	4 4	494	—	8 1 8	
Metropolitan ..	1½ 1½	284	—	6 7 8	
do. District ..	Nil Nil	16	—	Nil	
Underground Electric Ordinary ..	Nil Nil	12	+ 2	Nil	
do. do. "A" ..	Nil Nil	67	—	Nil	
do. do. Income ..	4 4	65½	—	4 13 0	

FOREIGN TRAMS, &c.

Anglo-Arg. Trams, First Pref. ..	5½ 5½	28	—	10 9 6	
do. do. 2nd Pref. ..	Nil 5½	22½	—	10 4 8	
do. do. 5 per cent. Deb. ..	5 5	60	—	7 15 0	
Brazil Tramways ..	Nil Nil	0	+ 1	Nil	
British Columbia Elec. Ry. Pref. ..	5 5	58	—	8 12 4	
do. do. Preferred ..	5 5	58½	—	7 5 0	
do. do. Deferred ..	5 5	58	—	7 13 10	
do. do. Deb. ..	4½ 4½	64	—	7 4	
Mexico Trams, 5 per cent. Bonds ..	Nil Nil	52	—	Nil	
do. do. 6 per cent. Bonds ..	Nil Nil	56	—	Nil	
Mexican Light Company ..	Nil Nil	10	—	Nil	
do. 1st Bonds ..	Nil 5	58½	+ 1	9 7 0	

MANUFACTURING COMPANIES.

Babcock & Wilcox ..	15 16	2	—	6 18 6	
British Aluminium Ord. ..	10 10	14½	+ 9d.	10 0 0	
British I. Sulphated Ord. ..	15 15	12	—	10 18 2	
Callenders ..	15 15	12	—	6 18 8	
do. Pref. ..	6½ 6½	14½	—	13 15 10	
Crompton Ord. ..	10 10	18 0	—	13 15 10	
Edwin Swan ..	10	5 9	—	7 9 1	
do. do. 5 per cent. Deb. ..	5 5	65	—	11 8 6	
Electric Construction ..	10 10	17½	+ 6d.	16 0 0	
English Electric ..	8 8	107	—	8 14 8	
do. do. Pref. ..	8 8	130	—	7 18 0	
Gen. Elec. Pref. ..	6½ 6½	107	—	11 8 6	
do. Ord. ..	10 10	17 6	—	10 0 0	
Honley ..	15 15	14	—	6 8 8	
do. 4½ Pref. ..	4½ 4½	38	—	8 14 8	
India Rubber ..	10	2	—	5 11 9	
Mess. Vickers Pref. ..	8 8	91½	—	8 14 8	
Siemens Ord. ..	10 10	21	—	8 14 8	
Telegraph Con. ..	20 20	21	—	8 14 8	

* Dividends paid free of Income Tax.

POWER FACTOR.—III.

By E. W. DOREY, A.M.I.E.E.

CAPITAL outlay is not the only item influenced by low power factor, there being the important question of increased running costs due to increased losses in the generating plant and distribution system, and also bad voltage regulation.

The following table shows the value of current in a circuit with varying power factor:—

Power factor	1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.3
Total current	100	111	125	143	167	200	250	333
Idle current	—	11	25	43	67	100	150	233

At 70 per cent. power factor all current-carrying plant, viz., generators, transformers, switchgear, and cables, must be 43 per cent. greater than would be necessary at unity p.f., or in other words, 30 per cent. of the total current in the mains is idle (so called wattless), but heats up all current-carrying plant.

The fuel costs of an electricity supply undertaking may be as much as 80 per cent. of the total running costs. Considerable capital expenditure will often be incurred in the installation of more efficient plant in the power station to reduce the generation cost per unit sent out by, say, 5 per cent., as thereby, with 80 per cent. fuel costs, the overall generator costs could be reduced by 4 per cent. of the total. Supposing the number of units sent out is 20,000,000 and cost per unit sent out .8d., then 4 per cent. saving is the equivalent of approximately £2,660 per annum capitalised at 10 per cent.; this equals, say, £26,600.

The revenue of an undertaking is derived from the units sold and metered on the consumers' premises, and therefore the losses in the distribution system play an important part in fixing the rate charged per unit. Low power factor means increased losses both inside and outside the generating station, and under otherwise equivalent conditions a system with an average power factor of 60 per cent. must charge more per unit than one with, say, 90 per cent. power factor, as the current flowing is as 167 to 111 (see table above); low power factor is therefore as vitally the concern of the consumer as of the supply undertaking.

A consideration of the following points shows how the losses, and therefore the fuel costs per unit sold, are affected by low power factor.

Steam Turbines (or other prime movers).—If the driven alternator is designed for 80 per cent. p.f. and the station p.f. is 60 per cent., it follows that the set cannot be run at more than 75 per cent. of full kW load, owing to kVA limitation of the alternator; this means greater steam consumption per unit, and possibly running, say, three sets where with high p.f. two would do. The losses may quite easily be increased, in such circumstances by 2-4 per cent.

Alternators.—The following table shows the approximate percentage increase in excitation of modern alternators due to low power factor:—

Power factor	1.0	0.9	0.8	0.7
Per cent. excitation	100	106	110	112

With the excitation value about 1 per cent. of the kW output of the machine, this item is not very considerable, but it all adds to the losses.

Mains Losses.—The increase in the mains losses with low power factor is usually the greatest factor of all, as the losses vary directly as the square of the current. Therefore, with 70 per cent. power factor, the losses are approximately double those at unity p.f.

Taking as an example, a single high-pressure feeder between two points with unity power factor and a current of, say, 100 amps., the I^2R losses are found to be approximately 30 kW, or 30 units per hour; then with 60 per cent. power factor the current will rise to 167 amps., and the losses will increase as $100^2 : 167^2$, i.e., the losses would be $30 \text{ kW} \times 167^2/100^2 = 84 \text{ kW}$, an increase in the mains losses of not less than 180 per cent. The difference of 54 kW, say, for eight hours a

day and 300 days a year, equals approximately 130,000 units, which, at 1d. per unit, equals £540, or capitalised at 10 per cent., £5,400. An investigation of the reductions of mains losses possible by improvement of power factor is well worthy of the closest consideration.

Transformer Losses.—Transformer losses are a very considerable item in the total losses of the distribution system, and there are two points to consider:—

1. The increased losses due to the necessity for bringing into circuit additional transformers to meet increased kVA demand with low power factor.

2. The increased losses in the transformer itself due to low power factor.

Thus, a load of 1,000 kW at unity p.f. could be dealt with by two 500-kVA transformers, and the losses would be about 1.6 per cent. of the kW output, i.e., 16 units per hour. At 70 per cent. p.f., 1,430 kW, a third 500-kVA transformer would be switched in, thus increasing the losses to a total of about 2.35 per cent. of the kW output, i.e., 23.5 units per hour. The increased losses are therefore approximately 7.5 units per hour, and in a year would be perhaps as much as 25,000 units. By the judicious installation of plant for the improvement of power factor, it should be possible, in the majority of cases, to reduce the losses in both generation and transmission by a considerable percentage. A reduction of these losses must result in a lower price per unit sold. The important bearing of power factor, not only on capital expenditure but on the losses in the generation and supply of electrical energy, is receiving, and must continue to receive, increasing attention on the part of supply engineers.

Is it conceivable that any supply undertaking (and there are such) can continue to operate on sound commercial lines with an overall power factor of 60 per cent., when of every 167 kVA in the mains 67 kVA is idle? The consumer is to blame for low power factor, and the consumer must be made to pay for it.

ELECTRICAL EXPORTS OF THE UNITED STATES.

BELOW are given the values (and quantities where available) of electrical machinery and appliances exported from the United States of America during 1920, showing the principal countries of destination. For purposes of comparison the figures for 1919 are added, and notes of increases or decreases are made.

		1919	1920	Inc. or Dec.
		Dol.	Dol.	Dol.
<i>Dynamos or generators.</i> —				
Total		5,800,000	7,796,000	+ 1,996,000
To France	...	782,000	615,000	— 167,000
„ Italy	...	344,000	245,000	— 99,000
„ Norway	...	141,000	161,000	+ 20,000
„ Great Britain	...	92,000	152,000	+ 60,000
„ Canada	...	775,000	700,000	— 75,000
„ Mexico	...	135,000	209,000	+ 74,000
„ Cuba	...	368,000	637,000	+ 269,000
„ Argentina	...	111,000	71,000	— 40,000
„ Brazil	...	157,000	193,000	+ 36,000
„ Chile	...	66,000	315,000	+ 249,000
„ Uruguay	...	131,000	70,000	— 61,000
„ China	...	314,000	714,000	+ 400,000
„ Hong Kong	...	91,000	104,000	+ 13,000
„ India	...	146,000	798,000	+ 652,000
„ Japan	...	1,054,000	1,403,000	+ 349,000
„ Australia	...	156,000	167,000	+ 11,000
„ British South Africa	...	22,000	70,000	+ 48,000
<i>Carbons.</i> —				
Total		1,392,000	1,478,000	+ 86,000
To Italy	...	45,000	63,000	+ 18,000
„ Norway	...	101,000	16,000	— 85,000
„ Great Britain	...	83,000	74,000	— 9,000
„ Canada	...	759,000	938,000	+ 179,000
„ Japan	...	73,000	132,000	+ 59,000

Batteries.—		1919	1920	Inc. or Dec.
		Dol.	Dol.	Dol.
Total	...	5,998,000	6,634,000	+ 636,000
To Norway	...	212,000	79,000	- 133,000
.. Great Britain	...	525,000	469,000	- 57,000
.. Canada	...	1,780,000	1,834,000	+ 54,000
.. Cuba	...	276,000	406,000	+ 130,000
.. Argentina	...	377,000	448,000	+ 71,000
.. China	...	153,000	117,000	- 6,000
.. Australia	...	112,000	365,000	+ 47,000
.. New Zealand	...	224,000	227,000	+ 2,000
.. British South Africa	...	311,000	251,000	- 60,000
.. British India	...	145,000	230,000	+ 85,000
.. Brazil	...	163,000	190,000	+ 27,000
.. Mexico	...	175,000	302,000	+ 127,000
.. Spain	...	62,000	206,000	+ 144,000
.. France	...	84,000	114,000	+ 30,000

Fees		1919	1920	Inc. or Dec.
		No.	No.	No.
Total	...	76,500	72,200	- 4,300
To Canada, No.	...	1,421,000	1,365,000	- 56,000
.. Argentina, No.	...	22,000	11,000	- 11,000
.. China, No.	...	289,000	116,000	- 173,000
.. British India, No.	...	5,000	6,000	+ 1,000
.. Cuba, No.	...	91,000	138,000	+ 47,000
.. Mexico, No.	...	12,000	4,000	- 8,000
.. Japan, No.	...	278,000	83,000	- 195,000
.. New Zealand, No.	...	12,000	16,000	+ 3,400
.. British South Africa, No.	...	322,000	344,000	+ 22,000
.. British India, No.	...	2,500	10,000	+ 7,500
.. France, No.	...	49,000	192,000	+ 143,000

Heating and cooking apparatus—		1919	1920	Inc. or Dec.
		Total	Total	Total
Total	...	1,580,000	1,801,000	+ 221,000
To Norway	...	274,000	198,000	- 76,000
.. Great Britain	...	107,000	152,000	+ 45,000
.. Canada	...	311,000	346,000	+ 35,000
.. Argentina	...	95,000	108,000	+ 13,000
.. Japan	...	96,000	79,000	- 17,000
.. Australia	...	79,000	139,000	+ 60,000
.. Mexico	...	65,000	112,000	+ 47,000

Insulated wire and cables.—		1919	1920	Inc. or Dec.
		Total	Total	Total
Total	...	8,815,000	8,209,000	- 606,000
To Belgium	...	116,000	73,000	- 43,000
.. Denmark	...	230,000	58,000	- 172,000
.. France	...	135,000	102,000	- 33,000
.. Netherlands	...	475,000	298,000	- 177,000
.. Norway	...	1,671,000	592,000	- 1,079,000
.. Portugal	...	110,000	38,000	- 72,000
.. Spain	...	107,000	78,000	- 29,000
.. Sweden	...	139,000	125,000	- 14,000
.. Great Britain	...	258,000	450,000	+ 192,000
.. Canada	...	198,000	271,000	+ 73,000
.. Mexico	...	340,000	556,000	+ 216,000
.. Cuba	...	550,000	944,000	+ 394,000
.. Argentina	...	691,000	465,000	- 226,000
.. Brazil	...	979,000	1,267,000	+ 288,000
.. Chile	...	300,000	136,000	- 164,000
.. Colombia	...	53,000	98,000	+ 45,000
.. Peru	...	144,000	165,000	+ 21,000
.. Uruguay	...	278,000	55,000	- 223,000
.. China	...	311,000	562,000	+ 251,000
.. Japan	...	72,000	49,000	- 23,000
.. British India	...	192,000	186,000	- 6,000
.. Dutch East Indies	...	292,000	112,000	- 180,000
.. Australia	...	128,000	55,000	- 73,000
.. New Zealand	...	25,000	80,000	+ 55,000
.. Philippine Islands	...	291,000	431,000	+ 140,000
.. British South Africa	...	233,000	34,000	- 199,000

Interior wiring supplies and fixtures.—		1919	1920	Inc. or Dec.
		Total	Total	Total
Total	...	2,319,000	3,386,000	+ 1,067,000
To Norway	...	107,000	45,000	- 64,000
.. Canada	...	493,000	957,000	+ 464,000
.. Mexico	...	153,000	209,000	+ 56,000
.. Cuba	...	221,000	379,000	+ 158,000
.. Argentina	...	154,000	163,000	+ 9,000
.. Brazil	...	247,000	252,000	+ 5,000

Metal filament lamps.—		1919	1920	Inc. or Dec.
		Total No.	Total No.	Total No.
Total	...	17,072,000	16,143,000	- 929,000
To Italy, No.	...	4,674,000	4,052,000	- 622,000
.. Canada	...	583,000	330,000	- 253,000
.. Mexico	...	138,000	81,000	- 57,000
.. Brazil	...	3,061,000	3,907,000	+ 846,000
.. Argentina	...	902,000	974,000	+ 72,000
.. China	...	1,562,000	1,146,000	- 416,000
.. Japan	...	572,000	317,000	- 255,000
.. Australia	...	984,000	2,074,000	+ 1,090,000
.. New Zealand	...	310,000	606,000	+ 296,000
.. British India	...	1,424,000	683,000	- 741,000
.. British South Africa	...	146,000	153,000	+ 7,000
.. France	...	2,467,000	2,249,000	- 218,000
.. Germany	...	1,000	465,000	+ 464,000
.. Australia, No.	...	100,000	479,000	+ 379,000
.. Canada, No.	...	200,000	117,000	- 83,000
.. British South Africa, No.	...	100,000	245,000	+ 145,000
.. France, No.	...	227,000	69,000	- 158,000
.. Germany, No.	...	17,000	25,000	+ 8,000
.. carbon filament	...	203,000	115,000	- 88,000

Magnets, sparking plugs, &c.—		1919	1920	Inc. or Dec.
		Dol.	Dol.	Dol.
Total	...	3,035,000	3,601,000	+ 566,000
To Italy	...	525,000	444,000	- 81,000
.. Great Britain	...	195,000	365,000	+ 170,000
.. Canada	...	633,000	1,030,000	+ 397,000
.. Argentina	...	128,000	186,000	+ 58,000
.. India	...	101,000	210,000	+ 109,000
.. Japan	...	180,000	126,000	- 54,000
.. Australia	...	278,000	161,000	- 117,000
.. New Zealand	...	89,000	119,000	+ 30,000
.. British South Africa	...	83,000	108,000	+ 25,000

Meters and measuring instruments.—		1919	1920	Inc. or Dec.
		Total	Total	Total
Total	...	2,891,000	2,677,000	- 214,000
To Canada	...	492,000	483,000	- 9,000
.. Argentina	...	208,000	66,000	- 142,000
.. Brazil	...	327,000	132,000	- 195,000
.. China	...	136,000	138,000	+ 2,000
.. Japan	...	639,000	441,000	- 198,000
.. Italy	...	99,000	102,000	+ 3,000
.. Australia	...	218,000	111,000	- 107,000

Motors.—		1919	1920	Inc. or Dec.
		Total	Total	Total
Total	...	10,635,000	13,422,000	+ 2,787,000
To France	...	591,000	701,000	+ 110,000
.. Great Britain	...	877,000	1,240,000	+ 363,000
.. Canada	...	1,611,000	2,304,000	+ 793,000
.. Mexico	...	425,000	398,000	- 27,000
.. Cuba	...	505,000	972,000	+ 467,000
.. Brazil	...	544,000	449,000	- 95,000
.. China	...	443,000	557,000	+ 114,000
.. India	...	572,000	477,000	- 95,000
.. Japan	...	1,068,000	1,486,000	+ 418,000
.. Belgium	...	153,000	704,000	+ 551,000
.. Italy	...	143,000	406,000	+ 263,000
.. Spain	...	344,000	426,000	+ 82,000
.. Argentina	...	317,000	318,000	+ 1,000
.. Australia	...	760,000	660,000	- 100,000

Rheostats and controllers.—		1919	1920	Inc. or Dec.
		Total	Total	Total
Total	...	515,000	708,000	+ 193,000

Switches and accessories.—		1919	1920	Inc. or Dec.
		Total	Total	Total
Total	...	3,565,000	4,439,000	+ 874,000

Telegraph apparatus.—		1919	1920	Inc. or Dec.
		Total	Total	Total
Total	...	831,000	714,000	- 117,000
To Great Britain	...	200,000	66,000	- 134,000
.. Canada	...	198,000	84,000	- 114,000
.. Japan	...	97,000	73,000	- 24,000

Telephones.—		1919	1920	Inc. or Dec.
		Total	Total	Total
Total	...	3,783,000	3,899,000	+ 116,000
To France	...	197,000	27,000	- 170,000
.. Italy	...	204,000	132,000	- 72,000
.. Netherlands	...	157,000	10,000	- 147,000
.. Norway	...	189,000	20,000	- 169,000
.. Spain	...	167,000	129,000	- 38,000
.. Great Britain	...	233,000	276,000	+ 43,000
.. Canada	...	678,000	810,000	+ 132,000
.. Brazil	...	380,000	408,000	+ 28,000
.. China	...	158,000	234,000	+ 76,000
.. Japan	...	120,000	76,000	- 44,000
.. Dutch East Indies	...	66,000	143,000	+ 77,000
.. Australia	...	182,000	188,000	+ 6,000
.. New Zealand	...	132,000	77,000	- 55,000

Transformers.—		1919	1920	Inc. or Dec.
		Total	Total	Total
Total	...	3,788,000	4,803,000	+ 1,015,000
To France	...	194,000	125,000	- 69,000
.. Italy	...	224,000	30,000	- 194,000
.. Netherlands	...	144,000	18,000	- 126,000
.. Spain	...	230,000	331,000	+ 101,000
.. Mexico	...	235,000	214,000	- 21,000
.. Brazil	...	538,000	565,000	+ 27,000
.. Chile	...	241,000	60,000	- 181,000
.. China	...	193,000	330,000	+ 147,000
.. Japan	...	366,000	455,000	+ 89,000
.. Australia	...	273,000	254,000	- 19,000
.. Canada	...	132,000	167,000	+ 35,000
.. India	...	116,000	748,000	+ 632,000

All other electrical machinery and appliances (except locomotives) —		1919	1920	Inc. or Dec.
		Total	Total	Total
Total	...	27,827,000	32,868,000	+ 5,041,000

Grand total of electrical machinery and appliances (except locomotives) —		1919	1920	Inc. or Dec.
		Total	Total	Total
Total	...	89,090,000	102,000,000	+ 12,910,000

Locomotives, electric.—		1919	1920	Inc. or Dec.
		Total	Total	Total
Total	...	836,000	880,000	+ 44,000

New Cable Armouring.—*Daggers Nipster* learns that the Siemens-Schuckert group has bought the patent rights for Germany of the new alloy for cable armouring invented by M. Stenquist, an engineer in the service of the Swedish State Telephone Office.—*Reuter's Trade Service* (Stockholm).

CHINA'S INDUSTRIAL FUTURE.

A Promising Market for Machinery.

THE report on the trade situation in China*, to which reference is made in a leaderette appearing in this issue, shows that China is beginning to utilise her own raw materials by manufacturing for herself many of the goods which she has previously had to import from abroad. The standard of living is rising. The people have overcome to a large extent their traditional dislike and suspicion of foreigners and foreign ways, and are rapidly assimilating Western customs and Western modes of living; consequently foreign style goods are ceasing to be luxurious and becoming necessities.

In Mr. Fox's opinion these tendencies will redound to the advantage of British trade, for the Chinese while relying more and more on their own industries to supply the wants that intercourse with foreign nations has created, will purchase, far more freely than they have done in the past, the better class of goods that they cannot produce at home. In the process of this industrial development there will be a demand for every description of foreign machinery and mechanical appliances which should keep British manufacturers busy for many years to come.

Railway Schemes.

The report mentions a number of railway schemes in progress or in contemplation, that which is most urgently needed being probably the completion of the Hankow-Canton line, work on which has long been interrupted owing to financial difficulties and disturbed political conditions in the southern provinces. There is still a gap of about 270 miles between the railheads at Chu Chou in Hunan and Hsiu Chow in Kuangtung, and, owing to the hostility existing between the governments of the respective provinces, attempts to continue constructional work have hitherto proved unsuccessful. It is reported, however, that a definite arrangement has now been arrived at for financing the continuation of the Hunan section to Hanchow, funds to a total amount of \$400,000 being set aside each month from the revenues of the Peking-Hankow, Tientsin-Pukow, Peking-Mukden, and Peking-Suiyuan railways, and that work will be started immediately.

It may be mentioned that valuable work was accomplished last year by a commission of railway experts, appointed by the Ministry of Communications. The Commission, which had the assistance of six foreign advisers, collected much useful information with regard to China's railway system, having particularly in view the need for devising means to standardise railway equipment.

Coal and Iron Production.

The coal mining industry has made considerable strides during the past two years; the reserves of iron ore are reckoned at about 1,000 million tons. Under contracts with Japanese smelters, the latter hold options on the output of many of the mines in China up to a total of approximately 1,000,000 tons per annum, but owing to the industrial depression in Japan since the war these options have not been fully exercised during the past few years. With a business revival in Japan, however, the export of ore to that country will probably increase rapidly. At the same time the development of the smelting industry in China is also growing, and a much larger production of ore is anticipated in the near future. The following is a list of iron works already in operation or to be erected within the next few years:—

Name.	Approx. capacity in tons.	Date of opening.
Hanyang ...	150,000 ...	In operation.
Tayeh ...	240,000 ...	End of 1921.
Penchih ...	80,000 ...	In operation.
Anshanhan ...	100,000 ...	Partly in operation.
Lungyen ...	80,000 ...	End of 1921.
Yangtse Engineering ...	20,000 ...	In operation.
Kungsh'angling ...	30,000 ...	1922 (?).
Chinwantao ...	80,000 ...	1922 (?).

Manufacturing Enterprises.

After referring to the hindrances which have occurred to development during the past two years, particularly the disturbed condition of the country and the difficulty of obtaining machinery, the report points out that China's industries have by no means stopped growing, and a journey through the country by rail or river reveals the transformation that is everywhere taking place in her cities, which are rapidly losing their mediæval appearance and changing into busy hives of modern industry. Shanghai, Hankow, Tientsin and Canton lead the way, but in almost every provincial capital and considerable commercial centre throughout the land, modern mills and factories are springing up which are turning out in ever increasing quantities articles which China has in past years been obliged to import from foreign countries. The hindrances to development above referred to, though still existent, are less serious than they were. Communications

are slowly improving, that the Chinese have at least come to realise the importance of roads and road-building is noticeable in the neighbourhood of every large town—attempts, spasmodic but of hopeful augury, are being made in the cotton and silk-producing districts to improve the quality of these valuable products, and the successful working of some of China's newest mills and factories compels the admission that the Chinese are at last beginning to understand the value of efficient organisation and honest management.

Among the more important industrial enterprises may here be mentioned:—Cotton spinning and weaving mills, flour, bean and oil mills, iron and steel works, shipbuilding and engineering works, cement works and paper mills.

The Industries of Shanghai.

During the last decade Shanghai has become a manufacturing centre of considerable importance, its local industries now including 25 cotton mills, 16 flour mills, 15 silk mills, paper, oil, and timber mills, cigarette, soap, and candle factories, abrewery and several aerated water factories, and five shipbuilding yards. The report contains statistical and other data regarding the success of the electrical undertaking, taken from reports of the Chief Electrical Engineer.

The Import of Machinery.

Bearing in mind what has been said about the growth of manufacturing industries, it is not surprising to find that imports of machinery rose from 4.6 million Haikwan taels in 1913 to 22.3 million Haikwan taels in 1920. Practically every class of machinery is now in demand, and it may be said that China's orders are only restricted by the limited ability of Great Britain and America to supply her wants. The following list of some of the principal lines imported last year give some indication of the requirements of this market:—Machinery for cotton mills, cigarette factories, flour mills and oil mills, boilers and engines, knitting and sewing machines, hand and machine tools, railway materials (rails, sleepers, rolling stock and locomotives), telegraph and telephone materials, electric power plants (including cables, insulated wire, motors and meters, switches and transformers), motor-cars, motor cycles, motor trucks and motor-car accessories.

The increased sale of electrical materials is especially interesting, imports having risen from 2.3 million taels in 1913 to 6.3 millions in 1920. Nearly every large city in China is either provided with an electric installation for light and power purposes or is in treaty for one, and private power stations and small electric power plants for household use are becoming increasingly popular. Japan still has the bulk of the business in the cheaper kinds of electrical accessories, although the competition of Chinese lamp factories in Shanghai and elsewhere is beginning to make itself felt. British manufacturers of electrical materials are now well represented in China, and would secure a large share of the business offering if they could rely on prompt shipments. As it is they have some difficulty in meeting American competition.

Reference is made to the keen competition of the Americans in the engineering trade, which is especially serious in the matter of the supply of locomotives and rolling stock to Chinese Government railways. It is reported that contracts have been signed by American firms which, while guaranteeing delivery in from six to nine months under penalty, provide for payment being extended over a period of five and even as much as seven years. It is obvious that no British manufacturer or merchant house could afford to grant such liberal terms without some strong financial backing, and the question arises whether the time has not come to consider the establishment of an Anglo-Chinese Industrial Bank which would assist our manufacturers in financing large contracts involving deferred payments. It may be noted that similar banks have been formed by the Japanese, French, Italians, and quite recently by the Americans.

It is very satisfactory to note that British manufacturers are taking an active and intelligent interest in the China market, and that the reputation of their goods is second to none.

The Henley Wiring System.—In view of the discussion in connection with the use of lead-covered wiring systems which has been going on for some time in our "Correspondence" columns, the arrival of a booklet issued by Messrs. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., is very opportune. Faults which have been reported by correspondents were practically all due to faulty erection, and this booklet is designed to educate or assist contractors on this important point. Bonding and earthing are particularly emphasised in an opening "warning." Such details as fixing to various surfaces, stripping, and jointing, are fully dealt with, and, in addition, numerous wiring diagrams for ordinary and peculiar circuits are included.

* "Situation of China." Department of Overseas Trade. H.M. Stationery Office. 1s. 9d.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Small Kinema Projector.

Continued the sales journal of the Westinghouse Electric and Manufacturing Co., gives particulars of a kinema projector made by Withington-Hunting, Inc., of New York City, and fitted with a Westinghouse motor. The "Beacon" projector (fig. 1) is made in two models for standard or safety standard films, and it will project a picture the size of a poster from a distance of two feet, or the usual kinema

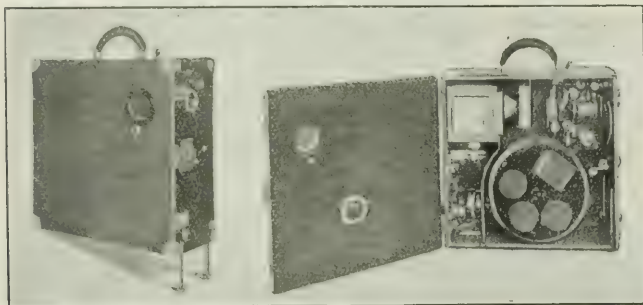


FIG. 1. THE "BEACON" KINEMA PROJECTOR.

theatre size from a distance of ninety feet. The film may be stopped at any time, and a stationary picture projected for an indefinite period without danger of fire or other injury to the film or machine. Such a projector can be used to advantage in the windows of stores to show a continuous motion picture on a screen of ground glass hung in the window.

A Combined Coal and Electric Range.

The *Electrical Review* (Chicago) recently published details of a new American cooking range designed for both coal and electricity. The complete appliance is about 5 ft. in height, 46 in. long, and 35 in. wide. As will be seen from the illustration (fig. 2), the electric oven is mounted on the top of the range; this oven is 19 in. wide, 15 in. deep, and 13 in. high. It is lined with "rustless" sheet metal, and has light aluminium-plated racks and two heating elements. There are also two cooking or boiling rings in the top of the coal-fired stove.

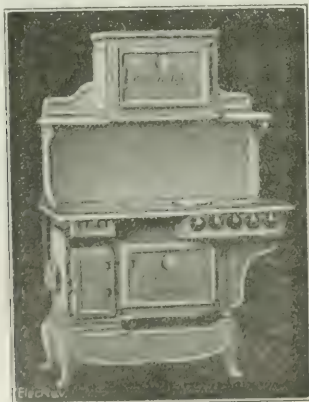


FIG. 2. THE MODEL "ELECTICOAL" RANGE.

Each of the elements is connected to a three-heat switch. These are controlled by a knob on the front of the appliance, and the switch is fitted with a temperature indicator. The fuel is controlled by a knob on the side. The range is manufactured by the Model Electricoal Co. of Boston, and is known as the "Electicoal" range.

An Adaptable Hot-Plate.

THE FERRIS Electric Co. of Cleveland, Ohio, has introduced an electric hot-plate adaptable to the top of practically any stove. This is a conical cast-iron piece tapering from 9.5 in. dia. at the top to 6 in. dia. at the bottom. A circular heating element is fitted in the top of this casting, and the leads from this may be taken to a wall plug.

A Reavell Air Compressor.

The old "crescent type" of rotary air compressor had a drum or rotor with radial sliding blades rotating eccentrically in a stationary casing. The principal fault of this design was that any attempt to use high speeds resulted in excessive wear of the casing and, consequently, low speeds were employed.

Messrs. REAVELL & Co., LTD., Ranelagh Works, Ipswich, have overcome this objection in the following way.

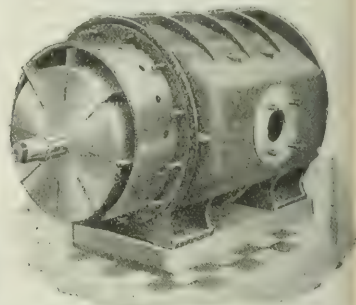


FIG. 3. THE REAVELL ROTARY AIR COMPRESSOR.

While the rotor and stationary casing are retained, the blades of the former are not in contact with the interior of the latter. A rotary drum is fitted between the two. This is mounted on roller bearings in the fixed end covers of the casing and rotates freely inside the casing with a very fine clearance. As shown in fig. 3, the drum is perforated and the air passes freely through these holes. When the rotor begins to revolve, the blades are pressed against the inner surface of the drum by centrifugal force, and the drum is carried round by this pressure. Owing to the possibility of running this compressor at a high speed it can be direct coupled to an electric motor or a high-speed engine.

The Phoenix Lighting Set.

Yet another addition has been made to the list of small British lighting and power sets. This is the "Phoenix" plant (fig. 4) made by the PHOENIX IRONWORKS CO., Littleborough, near Manchester. The engine is of the horizontal type, arranged to run on paraffin at a speed of 650 r.p.m., and developing from $1\frac{1}{2}$ to 2 h.p. Two heavy balanced flywheels and an efficient governing system maintain even running. The cylinder is fitted with a removable liner which can be replaced when worn or scored at a comparatively low cost. The fuel tank is in the base, and paraffin is supplied to the mixer

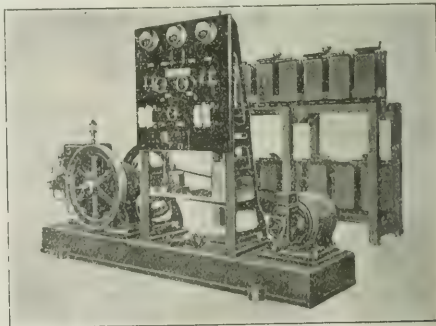


FIG. 4. THE "PHOENIX" LIGHTING SET.

or carburettor by a small plunger pump. Magneto ignition is employed. The dynamo, which is belt-driven, has an output of 1 kW at a speed of 1,400 r.p.m. It is fitted with a large commutator and ring oiler bearings. Current is generated at a pressure of from 25 to 35 V. The switchboard is an enamelled slate panel 2 ft. square and 1 in. thick. It bears charge and discharge ammeters, a voltmeter, two 20-A. d.p. knife switches, four s.p. handle-type fuses, an automatic cut-out, an 8-point shunt-regulating switch and resistance, a 4-way battery switch, and a 2-way voltmeter switch. The set is completed by a "D.P." battery. The engine and dynamo are mounted on a heavy cast-iron bed 6 ft. long, 18 in. wide, and 6 in. deep, and the switchboard is also erected upon this, supported by two cast-iron brackets.

TELEPHONE LINE WORK IN THE UNITED STATES.

By E. S. BYNG, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS)

IN view of the difference between the methods of telephone line construction adopted in England and the U.S.A., a description of the essential features of the present-day practice in America should be of interest to British telephone engineers. Mr. Byng's object is to place before members of the

The American Telephone and Telegraph Co. and its associated and connecting companies (commonly known as the Bell system) control approximately 12,600,000 telephone stations. In addition, there are about 900,000 stations owned by independent companies, not connected in any way with



5-ton Tank-type Tractor hauling cable drums over mountainous country.



Pulling winch 3,600 ft. away, note signaller on pole. Open wires to be superseded, arm temporarily lowered to avoid contacts.

AERIAL CABLE TRANSPORT AND INSTALLATION.

Institution observations he made during a trip to the U.S.A. upon some of the practices adopted in line construction work. The treatment is mainly descriptive, and, in general, no attempt is made to estimate the advantages or disadvantages of American methods in comparison with those adopted in other countries.

The author points out that America now contains about 70 per cent. of the telephones of the world, and the engineers concerned have, therefore, enjoyed a better opportunity of developing and improving their plant methods than has been offered elsewhere. Their work has been carried on in com-

the Bell system, but competing directly with it in certain territories. The entire country is covered by these associated companies. In describing American engineering and constructional methods, it is explained that, in general, an underground conduit system is adopted in all main thoroughfares and business streets; in the outskirts of a city and for distribution work, aerial cables are used extensively. At one time such cable was considered to be a transition stage between open wire and underground construction, but it is now settled policy, where local conditions permit, to run all long-distance cables aerially. The advantages and disadvantages of aerial cable, as compared with underground cable, are fully discussed by the author, who points out that many of the past weaknesses of this type of cable have been eliminated, and that the last few years have demonstrated that where only cables are carried, the route is practically immune from storm damage.

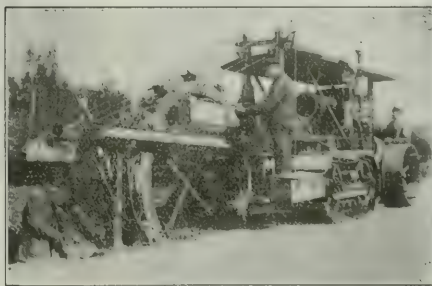
The methods of constructing underground conduit and of laying underground cable are explained, and it is remarked that American engineers consider that no kind of lubricant forms an effective preservative against chemical or electrolytic action on the lead sheath of cable. The advantages of the American "block" system are briefly mentioned to show that the system is an exceedingly flexible one, and that, after completion of the main scheme, telephone service can be readily supplied to any house in the block at a small cost. Motor transport is much more largely used on telephone work



Long span, with three pick-ups from auxiliary suspension strand. Open wires temporarily moved (to be superseded by cable).

SPECIAL OVERHEAD CONSTRUCTION.

paratively new cities which were growing rapidly, and among people who regarded the telephone not as a luxury, but as a necessity of business and social life. The field, moreover, was left open to commercial enterprise. Telephone development in America was thus stimulated to a degree to which no other country affords a parallel.



Trench Excavation Machine, showing digging prongs on perspective of 6 ft. wheel.

"DITCHING" MACHINE.

in the U.S.A. than in England because it is cheaper. The New York Telephone Co., for instance, has a fleet of over 1,000 vehicles of various descriptions and a staff of 250 engaged on maintenance and repairs. Nevertheless, the companies are satisfied that the expense is fully justified by the resulting improvement in efficiency. The high rates of pay

in America have necessitated the use of many labour-saving appliances, amongst which are excavating machines for trench work; a modified farmer's plough for filling in trenches; concrete mixers; tamping machines; pole hole excavators; pole erectors; pumps; air-driven drills; trucks carrying derricks or shear legs; and trucks to carry cable drums and power winches for drawing in cables.

With regard to maintenance, the author says that throughout the associated companies in America there appears to be a keen spirit of "service first," so that the public shall have

practice of boiling-out all cable joints tends to delay a complete cable breakdown from any other cause than mechanical injury.

As a rule the provision of spare conduits is on a liberal scale, and a small stock of each size of cable is usually available in the vicinity of the main routes. The construction gangs are thus able to introduce a new length of cable into a duct adjacent to the one containing the faulty cable and change over the circuits within a few hours of a warning being given.

There is one feature which might be emphasised in con-



Lighting and power wires are carried on the upper arm, 48 in. above the telephone cable. COVERED "DROPPING" DISTRIBUTION FROM AERIAL CABLES ON "JOINT-USE" POLES.

no legitimate ground for complaint. Under pre-war conditions the time taken for clearing faults in large cities was reduced to an average of about two hours per fault. This was made possible by the concentration of all testing and localising apparatus in one central office. When a fault is reported the test clerk at the exchange concerned telephones the details to the central test-office and connects the faulty line to a junction between the two offices. Necessary instructions are conveyed by means of loud-speaking telephones fitted at several parts of the apparatus floor of the exchange concerned. If a fault is outside the exchange, details are passed on to the fault-distribution officer, who is in telephonic communication with all the linesmen. Each large building, block, or group of blocks, is considered for maintenance purposes as a unit under the control of one man. The distribution officer has a largescale map of the territory on the wall, with a small hook placed in the centre of each maintenance section. A ticket showing details of each current fault in this section is placed on the hook so that the necessary instructions can be given to the responsible linesman. Instrument faults which cannot be quickly remedied on site are dealt with by changing the instrument, the defective one being handed over to mechanics for repair.

Linesmen are provided with motor cycles or even small cars, when their use can be justified, to enable them to deal with long-distance subscribers' line faults. The section linesmen are also furnished with an exchange telephone at their private residences, so that they may be called out at any time in case of emergency.

Breakdowns of telephone line plant due to heavy sleet storms are now being considerably reduced by the more extensive use of cable instead of open wire. As a result of this, there is little danger of any overhead route being brought down when carrying cable only.

As a result of this, it is expected that the maintenance of underground cables suffers in consequence. In practice this is not the case. In the central testing-offices careful records of all faults in underground cables are kept, and, if more than two or three pairs have to be changed over in the same cable for the purpose of clearing faults, suspicion is aroused and the necessary localisation tests are at once made with a view to determining the cause of the trouble. In this way incipient faults are generally detected and remedied. The universal

connection with telephone construction work in the States. When the speed at which the work is carried out was first realised, it was imagined that the quality of the work would necessarily suffer. However, this was not the case. There are several reasons for this unexpected combination of high quality and rapid output. The ready acceptance of machinery and labour-saving devices by the working man, and the fact that they have been used to their full capacity, have been conducive to high efficiency. Trade unionism exists to some extent, but there is no desire to hamper output. The men readily accept any suggestion for speeding up the work, as they believe it will be to their advantage to reduce costs; in consequence it has been possible to place the majority of tele-



Motor Transport for Overhead Construction Gangs. (The Bell System.)

phone workmen on the staff of the various companies rather than on an hourly basis. They receive a good weekly wage and enjoy privileges with regard to holidays, sickness, pensions, &c., which attract a good class of man. Another important point is the prospect of promotion to the higher grades for all ranks. It is a fact that any position in the Bell system is open to anyone who becomes qualified for it. Amongst the joiners are men who have graduated in a university; they have started at the bottom but are not content to remain

there. The actual hours worked are not long, but while the men are on duty they work hard and well.

Amongst the instances of rapid work quoted by the author are the following:—

Four miles of full-size cable, contained on 44 drums, drawn into a duct by 20 men, who performed the complete work of installation in 10 hours.

On a subscribers' cable the more experienced men can joint 150 pairs an hour, completing a 600-pair 10-lb. cable joint in an eight-hour day. Over 100 pairs an hour is usual.

The "ditching machine" can cut a trench 19 to 24 in. wide in a country road at the rate of 7 ft. per minute.

Major BROWN, referring to the waxing of cable ends, said that it was the standard practice of the Post Office, but contractors were allowed to dispense with it if the standard insulation was obtained. Four large cable contractors did not boil out the joints, and did not use wax; the use of wax was attended with certain dangers from fumes and fire risk, and delayed the work. The Post Office had found wax useless for testing plumbed joints.

Mr. A. MOM referred to the value of subways for cables under streets; they were used in Paris, and in the newer London streets, and should always be provided when streets were being rebuilt.



Two men (driver and operator) with 3-ton truck, boring pole-hole.

POLE-HOLE EXCAVATING MACHINE.

The tamping machine delivers 30 blows a minute (159 lb. dropped 4 ft.) whilst traveling at 3 ft. per minute, and does the work of 10 men.

A pole-hole 6 ft. deep and 18 to 24 in. in diameter can be excavated in three to five minutes by the mechanical auger. The author saw three men erect 45-ft. poles in a back-alley, boring the hole in 4½ minutes and planting the pole ready for tamping in 6½ minutes. When the holes have been excavated and the poles laid out in advance, 25-ft. poles can be erected at the rate of 40 per hour. The record is 300 poles in an 8-hour day by nine men with one 3-ton truck.

Cable is normally drawn in at 50 ft. per minute.

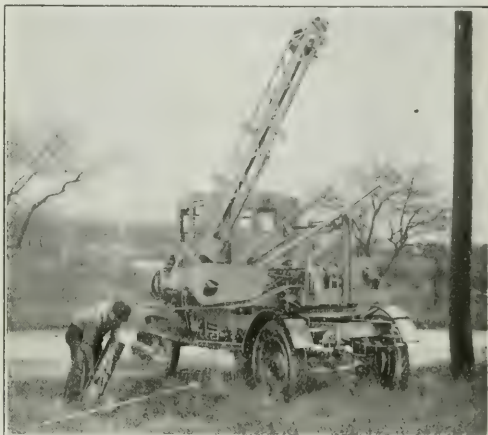
DISCUSSION IN LONDON.

Sir ANDREW OGILVIE said that the organisation of the American Associated Companies at headquarters was unparalleled elsewhere in the world; some 1,200 men were employed in research work. Glass insulators and wooden pins were not suitable for this country, where the climate was far more adverse to telephone work than that of the United States; and it would be difficult to install loading coils on overhead lines here. The labour-saving devices shown by the author should prove useful here also, and the use of overhead cable also appealed to him.

Mr. A. GIBSON, discussing practical details, said that vitrified clay conduits were embedded in concrete as an insurance against external injury; self-aligning ducts had been laid here successfully without concrete. He showed some views of work on a line of 56 ducts at Ludgate Hill, illustrating the difficulties met with owing to the presence of numerous pipes, &c.

Mr. J. M. SHACKLETON said that in British practice earth wires were not now used on pole arms, and they might perhaps be dispensed with altogether. Poles were not planted here at the rate attained in the United States. He pointed out that single-way ducts enabled the formation of a nest of ducts to be varied to avoid obstructions. A satisfactory leading-in cable had not yet been devised.

Mr. FRANK GILL said that glass insulators were used all over North America and in other parts of the world; in some parts of the United States the climate was as bad as in this country. American glass insulators worked well in France during the war, and were worth studying for use here. Aerial cables must have a suitable sheathing—not pure lead.



Auger tilted for boring stay-hole, note "never-sleep" anchor plate and rod.

Sir WILLIAM NOBLE considered that the paper would have valuable effects if the companies that laid cables would adopt the labour-saving devices described by the author. He was inclined to doubt some of the figures given for the rate of jointing and erecting poles. The use of large overhead cables in the United States was noteworthy, but there the engineers had runs of many miles without trees or other obstructions; here the roadsides were frequently bordered with trees, and many towns and villages were traversed, so that it was better and more economical practice to lay the cables underground. Labour-saving machines had been tried here, but gave disappointing results; a gang of labourers could do the work more cheaply.

Mr. J. E. KINGSBURY, referring to the statement that the American Telephone & Telegraph Co. controlled about 12,600,000 telephone stations, explained that so far as concerned



Motor truck with Derrick, lowering 45-ft. pole into hole.

POLE ERECTION.



Hole excavated by chain tractor in sandy soil, and fleet of transport vehicles.

HOLE EXCAVATION.

the associated companies, the "control" was technical not financial. Obviously it was impossible to connect up other companies' systems unless their lines and equipment were maintained at the same standard of efficiency as those of the company.

Mr. BYNG, in reply to the discussion, insisted on the accuracy of the figures given for the rate of work, which he had per-

inally verified. The high speed was due partly to the efficient training of the joiners' mates. He had timed a "pair" jointed in 20 seconds; 150 joints were made in an hour, and 175 could be attained. It was found impossible to reach such high speeds in this country, though if it could be done the same wages could gladly be paid (an American joiner was



CABLE VAULT AT EXCHANGE, SHOWING RACKS FOR SUPPORTING CABLES.

paid \$1 an hour, say, 6s.). He had seen a hole bored by the machine in four minutes, and the pole erected in two minutes.

The use of unsightly poles in the United States was due to the low cost of local timber. Here the poles had to be imported, at considerable cost, which enabled them to stipulate for straight and knot-free poles.

THE ART OF SALESMANSHIP.

THE first of the series of lectures organised by the British Electrical Development Association, for the discussion of the various phases of electrical salesmanship, was held at the rooms of the Chartered Institute of Patent Agents, London, on October 18th. Mr. S. T. ALLEN (the president of the I.M.E.A.) occupied the chair.

THE CHAIRMAN, opening the proceedings, pointed out that the meetings were to be quite informal. The conferences, he said, had for their object the bringing together of persons interested in the sale of electricity or electrical material and appliances, and the promotion of discussions dealing with the various aspects of load building and salesmanship. It was not intended that the conferences should in any way replace the work of existing organisations for discussing the technique of the business, but that they should concentrate on methods of popularising the use of electricity, and presenting the advantages of electrification to the consuming public.

A paper was then read by Mr. E. H. FREEMAN on "Salesmanship in Wiring and Installation Work," in which he gave some valuable information and hints to those engaged in the solicitation of orders for this work. He limited his remarks to the case of the smaller user, i.e., the occupant of the villa with a rent of from £50 to £100 per annum. To-day, said the author, no one seriously disputed the pre-eminence of electric lighting; the only effective objections raised were the first cost of the installation, and, less frequently, and less definitely, the highest running cost. Canvassers should be able to meet these objections, and should not be discouraged because they exist. Most of the larger houses were probably already converted to electric lighting, but in the case of the smaller houses a further consideration must be taken, because so many of them were not owned by the occupants. An endeavour should be made to ascertain where the tenants had become the owners, and then to approach them with regard to wiring. Architects were concerned with the question of electric lighting, and therefore the arguments which might be used with the owner would be equally effective with the architect, who would usually be the medium for presenting them to the owner of a new house. The author classified the usual objections to electric lighting installations under three heads, namely: (1) capital cost; (2) in the case of older houses, the anticipated damage to decorations and the consequent objection; and (3) the supposed higher running cost. The first was undoubtedly the most important and most difficult, but it was desirable to persuade the owner to look at the matter from other points of view

than that of the cost. Electric lighting installations would probably not involve an extra expenditure of more than 2 or 3 per cent. of the cost of the house. The canvasser should have sufficient knowledge of the value of the house under consideration, and of the approximate cost of the wiring, and another point to which attention might be given was that of labour saving. Once the possibility had been considered by the house owner further arguments could be introduced, such as that of the saving which would be effected on re-decorating. If the canvasser could collect actual examples in his own neighbourhood he should certainly do so. In one example, with which he was familiar, it was found that the whole cost of the wiring was more than covered within three or four years by the saving effected in re-decorating. One such example, with actual figures, would carry more weight than an hour's general talking. There were other arguments, such as that of general convenience. The ability to switch on a light without fumbling for matches was always deserving of mention, particularly if the more extensive use of two-way switch controls were put forward. The use of a gas by-pass might be mentioned as a counter argument, but this entailed an appreciable consumption of gas in a year. The absence of dirt and smell, and the fact that electrical apparatus could be used in any room required should be emphasised. By this time the prospective consumer should be getting sufficiently interested to want more definite details of cost, and in this connection it was a great mistake to suggest too low a cost. The canvasser should consider how much he could possibly persuade the consumer to buy, and include everything he thought ought to go in. He should include two-way switch controls for the staircases and the hall, and possibly for bedrooms; recommend extra plugs, &c. Such items could be cut out later if the cost was really prohibitive, but first the canvasser should try to get them considered. It was much better to let the purchaser cut them out if he insisted than to let him adopt a cheap, and possibly incomplete, scheme, and then add the extra items one by one. He would in the long run be better satisfied with a scheme that might cost £50, and was ultimately cut down to £45, than he would with one quoted at £20, eventually running up to £40. As to damage to decorations, the author had found a short sample of surface wiring material in his pocket to be a great help in some cases. A foot length of wood casing or twin lead wire neatly painted white, which could be placed against a door frame, or along a skirting board, so that its inconspicuousness could be demonstrated, was often a very convincing argument. Other samples, such as a sunk switch recessed into a wood block for the more important rooms, also had their value. The owner's convenience was also to be considered when carrying out the installation work. The objection with regard to supposed heavier running costs was, except in a very few districts, a futile objection, and most canvassers could easily obtain a few examples of costs of lighting by gas and electricity, which should convince any prospective customer. Having met the usual objections raised, other arguments included the reduced risk of fire; the entire removal of all possibility of explosion; general convenience; comparative economy and simplicity of maintaining lamps instead of mantles, and their longer life. As soon as a telling argument was found for the particular customer emphasis should be given to it and kindred points. Although the canvasser need not have any intimate knowledge of actual wiring work he should have a general knowledge of the subject. The relative advantages of tubing, casing, and lead-covered wiring; the amount of light required for a room; the points for and against lighting by pendants, brackets or portable lamps, were all matters he should study. Finally, the author pointed out that the canvasser's job was not finished when the order was booked, or even when the installation was complete. Periodical visits should be made to ensure that everything was satisfactory, and, if possible, a maintenance contract could be fixed up for a yearly test and examination. Even if only a nominal charge were made for this, which did not in itself pay, it was good business, as further orders could be booked.

In the discussion which followed a great deal was said with regard to the relations between wiring contractors and supply authorities, and a number of speakers testified to the friendly relations which existed between the two as a rule, although appeals were made for more co-operation and sympathy. With regard to canvassing householders in new roads, the difficulty of obtaining a sufficient number of consumers to justify the laying of supply mains was referred to. Whilst some contractors asked for more help from the supply authorities in this connection, the representatives of supply authorities pointed to the financial position, reminding the contractors that unless they were able to foresee that a reasonable number of householders would take electricity it was not feasible. The Chairman himself pointed out that canvassers should make themselves acquainted with the position of existing mains, and with the methods of the supply authorities. Another speaker said that too much must not be left to the contractors with regard to new roads, because whereas they would get a comparatively small profit from wiring premises, the supply authorities were getting a greater benefit, in that there would be a perpetual income.

A point raised by Mr. H. T. Young, a contractor, was that when a prospective customer had been given an estimate for wiring he would go to other contractors and get a lower estimate. The result was that the job would be done cheaply, the

house probably wired with flexible cord, and there was risk of fires. This led him to draw attention to the methods of insurance companies, which passed jobs that were really dangerous. The only real way to get over the difficulty was to register contractors, or to make the rules of the Institution of Electrical Engineers compulsory, and he asked that something might be done in this direction.

A speaker suggested that there might be two or three standard grades of wiring. With the cheaper grades the contractors who did the wiring should follow it up and see that it did not get so worn as to be dangerous.

The suggestion with regard to getting a prospective customer to consider as much apparatus as possible, and then cut it down if necessary, was questioned by one speaker, whose experience was that if a man were willing to have two or three lights in his drawing room, and make provision for further lights, that gave the canvasser a right to see him again, and gradually build up a load. If, on the other hand, the canvasser wanted to install too much, the customer would become suspicious.

Many schemes which had been adopted by canvassers were recounted. For instance, a representative from a borough near London said that the whole borough was divided into three sections, each section having its own representative. They concentrated at first on increasing the number of consumers on existing mains. The literature prepared by the E.D.A. was used, and each prospective consumer periodically received a pamphlet. Each house had a card, which contained information as to the method of lighting used, the approximate cost of that method of lighting, &c. It was useless to go from door to door without first creating interest by sending out suitable literature.

Mr. W. A. GILLOTT (Jackson Electric Stove Co.) described how he had furnished a house, had it wired, and fitted up with electrical apparatus, and given a practical demonstration of what electricity could do. It was necessary to let a man handle the class of goods one wished him to get familiar with. It was shown that a successful canvasser must be technical, have a keen commercial sense, and a good knowledge of general economics. He must not tell a householder that a certain apparatus would cost a certain sum for so many hours; he must talk in averages, and give the customer an idea as to how much it would cost per week. He must have regard to his competitors, and, if possible, learn their methods.

One suggestion which met with general approval was that of organised advertising on behalf of the industry as a whole through the E.D.A. If the Association were supported it could carry on a publicity campaign in the daily Press, and insert large advertisements periodically. The opinion was expressed by one or two speakers that circularising did not pay, and in one case a showroom had been opened, but had to be closed down for the same reason. The business did not come to the contractors in the same way as in other industries. As to the literature issued by the E.D.A., which was regarded as valuable, representatives were advised to read it and memorise it, as well as sending it out to prospective customers, so that they would always be up-to-date.

At the close of the discussion Mr. J. W. BEAUCHAMP said the Association had been selling a great deal of literature, and he would be pleased to send samples from stock to any applicant. He also wanted the literature to be looked upon as a sort of guide to canvassers.

THE PACIFIC CABLE BOARD.

ANNUAL REPORT.

The report of the Board for the year ended March 31st, 1921, shows that the surplus receipts have been employed in strengthening the reserve and renewal fund, and in improving staff superannuation arrangements. The receipts amounted to £633,343; the net traffic receipts (£620,051) fell short by £22,896 of those of the previous year, but the decrease was not so considerable as was anticipated, due mainly to the fact that the cable facilities by other routes were curtailed for several long periods during which the Board's route carried the whole or the major portion of the Australasian business. There was, however, towards the end of the year, a pronounced falling off in the total volume of traffic. In consequence a sufficient margin of carrying capacity was created to enable the Board to reinstate the cheap week-end service.

The expenditure, £543,171 (excluding special appropriations), exceeded that of the preceding year by £33,314, and the gross assets of the reserve fund on March 31st, 1921, amounted to £1,487,338.

The Sydney-Auckland cable was out of commission for a day, and the cable between Bamfield and Victoria was interrupted from November 27th to December 19th, 1921.

Neither interruption had any serious effect upon the traffic, since alternative routes were in each case available.

One of the Board's senior electricians, Mr. K. C. Cox, has spent much time in perfecting several important inventions. The Board pays royalties for the use of Mr. Cox's patents, and in addition recently granted him a gratuity.

For several reasons the Board considers that the duplication of the Pacific Cable has become a matter of urgency.

Various projects for carrying out the desired duplication

have been examined by the Board. Definite proposals were made which could be carried into effect without any financial assistance from the Partner Governments as the Board's reserve fund is now capable of providing the necessary resources. The scheme has received the approval of some of the Partner Governments, and the Board hopes that their unanimous assent may be obtained at an early date.

The landlines in Canada leased by the Board from the Canadian Pacific Railway Co. worked well during the year. Leases of the lines between Montreal and Bamfield and between Vancouver City and Victoria, have been renewed for a further period of 10 years without any material alteration in the general terms. Through working between Halifax and Bamfield for traffic served by the Imperial Cable has continued throughout the year with complete success.

The service on the landline between Melbourne and Sydney, which is operated by the Board's staff, was generally satisfactory throughout the year.

An extensive building programme has been undertaken on Fanning Island, the cost of which is estimated at £12,000.

The new offices at Sydney were expected to be available for the Board's occupation in October, 1921.

The Board's cable maintenance vessel *Iris* was not called upon to undertake any repair operations on the Board's system during the year, but she was commissioned on four occasions under charter to other Administrations.

During the year under review the Hon. Sir Thomas Mackenzie, G.C.M.G., who had been a member of the Board since October 1912, and the Right Hon. Andrew Fisher, P.C., whose association with the Board dated back to February 1916, retired from their respective offices of High Commissioners for the Dominion of New Zealand, and the Commonwealth of Australia, and their places on the Board were taken by Colonel the Hon. Sir James Allen, K.C.B., and Mr. M. L. Shepherd, I.S.O., respectively.

During the year over 7,700,000 paying words of International traffic (i.e., traffic other than local traffic between Australia, New Zealand and the Pacific Islands) were handled. This was approximately 1,350,000 words less than the total during the previous year, when more than 9,000,000 words were carried. In addition to the international traffic, approximately 2,600,000 paying words were carried during the year between Australia and New Zealand and between those Dominions and the Pacific Islands. This was approximately 280,000 words in excess of the 1919-20 figure. The ordinary international traffic showed a decrease of more than 500,000 words, while the deferred ordinary and the Press traffic each showed an increase of more than 300,000 words. There was a diminution of nearly 1,200,000 words in the Government traffic, the total handled being less than half that transmitted during the previous year.

The service of week-end telegrams between the United Kingdom and Canada on the one hand and Australia and New Zealand on the other was reinstated early in 1921. This class of traffic is carried across the Atlantic by the Imperial Cable only, the other Atlantic cable systems not having re-introduced the service yet. The only pre-war services which had not been reinstated at the end of the year were:—The deferred ordinary service between the United States and Australia and New Zealand, and the deferred Press service between the United Kingdom and Canada on the one hand and Australia and New Zealand on the other.

The Board made arrangements to reinstate the deferred Press service from August 1st, 1921, and it hopes in the near future to be able to re-introduce the deferred ordinary service with the United States.

The tariffs by the Board's system for traffic exchanged between the principal Continental countries and Australasia have been assimilated to those by other routes. Previously the Board's rates were generally higher.

"A Tug of War." A correspondent writes:—"I was recently present at a perfectly delightful verbal contest. The two principals were local scrap-metal merchants, one a Jew, the other a Welshman. A large Government factory was being sold piecemeal, and some of the 'lots' were valuable electric cables that traversed underground conduits connecting various parts of the factory. By mischance the ends of one length, about 300 ft., had been marked with different lot numbers. After bidding savagely against one another the Jew became the possessor of one end, whilst the other was knocked down to the Welshman. The rivals now turned their attention to the task of extracting the cable by attaching wire ropes to the ends and hauling on a winch; intervening buildings obscured the view of the parties. A tug of war was soon in progress, and both parties strained at their winches, but, naturally, the cable would not budge. Then the Welshman's wire rope parted, and a new one had to be fitted.

The Jew, delighted at the sudden release, spurred his men to fresh efforts, and the cable was out in no time. Meanwhile the Welshman had fitted the new rope and prepared to fasten it to his end of the cable, but lo! it had vanished! Fifteen seconds later he had found it. The verbal contest was thrilling."

(NOT YET PUBLISHED.)

27,579. "Commutators of electric ignition systems." A. H. Caley and P. S. Taylor. November 7th.
27,580. "Electric ignitions for electric conductors." W. D. Owen and R. Lybelle & Co., Ltd. November 7th.
27,587. "Means for magnifying effects of small efforts for telegraphy, &c." A. Orling. November 7th.
27,614. "Lamp-light." L. Lorrain and R. Vinetto Lorrain. November 7th.

¹ Figures in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1919.

- 12,834 "Traction systems for elevated cable ways," R. E. Phillips (S. A. Regeuse, September, 30th, 1920, (170,602))

1920.

- A. 204. "Radio-telephony signalling systems." W. J. McKersie-Jackson. (A. Taylor, April 22nd, 1920. (70.603).
11,277. Telephone sets." Dictograph Products Corporation. August 21st, 1919. (122,123).
11,843. "Electric switch fuses." W. A. Legge. April 29th, 1920. (70.612).
12,263. "Electrodes for electric batteries and accumulators." A. Pouchain May 3rd, 1920. (70.614).
12,264. "Negative electrode for electric accumulators." A. Pouchain. May 3rd, 1920. (70.615).
12,947. "Electric glow discharge lamps." H. Filippo, D. Lely, jun., and N. Amazez. Vernechtung Philips. Gloeampatentfabrik. June 20th, 1919. (145,400).
13,000. "Electric accumulators." A. Pouchain. May 27th, 1920. (70.618).
13,030. "Electrical power transmission systems." A. M. Taylor. June 12th, 1920. (Patent of addition not granted. Cognate applications 17,490, 20, 22, 617, 28, 923, 29, 31, 150, 20 and 32/1. (70.619).
13,140. "Vacuum discharge apparatus for heating an incandescent filament." Siemens & Halske Akt. Ges. (Patent of addition 1910. (145,421).
16,912. "Construction of commutators." R. Bosch Akt. Ges. April 29th, 1919. (145,328).
17,350. "Method of and apparatus for directive sound transmission." Steward-Davitt and Equipment Corporation. June 25th, 1919. (146,183).
17,357. "Devices for detecting and determining the direction of sounds." Steward-Davitt and Equipment Corporation. June 25th, 1919. (146,190).
17,358. "Method of sounding and determining distances." Steward-Davitt and Equipment Corporation. June 25th, 1919. (146,191).
17,360. "Directive reception of sound or other wave energy." Steward-Davitt and Equipment Corporation. June 25th, 1919. (146,193).
18,234. "Arrangement for the excitation of continuous current generators in the Leonard systems." F. Krupp Akt. Ges. January 6th, 1915. (146,311).
18,402. "Telephone exchange systems." Western Electric Co., Ltd. December 29th, 1916. (146,425).
19,000. "Apparatus for the determination of wave energy direction." Steward-Davitt and Equipment Corporation. June 25th, 1919. (147,669).
20,237. "Vehicle stations for wireless telegraphy." Dr. E. F. Huth Ges. December 4th, 1914. (148,323).
20,358. "Sending or receiving device for subaqueous sound waves." Signal Corps. September 17th, 1917. (Addition to 147,935, modified by 148,411. (148,413).
20,360. "Electro-magnetic subaqueous sound producer or receiver." Signal Corps. 11th, 1918. (Addition to 147,935, modified by 148,411 and 148,413. (148,414).
20,505. "Bow collectors for electric vehicles." C. Conrady (firm of). June 17th, 1918. (148,528).
20,508. "Bow collectors for electric railways in which the slip-piece is attached to a train upon its longitudinal axis." C. Conrady (firm of). April 28th, 1919. (148,531).
20,784. "Insulation and support of thermionic valve electrodes between which a high potential difference exists." A. K. Macrorie, H. Morris-Airey, G. Stirling, and J. A. Munro. July 22nd, 1920. (70.634).
22,032. "Reception of wireless signals." Marconi's Wireless Telegraph Co., Ltd. July 28th, 1919. (149,282).
21,873. "Electric welding apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). June 21st, 1920. (70.643).
21,918. "Electric battery." Alber. July 26th, 1919. (149,351).
22,007. "Wireless telegraphy and telephony." Marconi's Wireless Telegraph Co., Ltd. (A. N. Goldsmith). July 22nd, 1920. (70.656).
22,058. "Automatic controlling means for the ignition timing in internal-combustion engines." C. R. K. Bessy, D. E. Batty, and Associated Equipment Co., Ltd. July 23rd, 1920. (70.658).
22,131. "Dynamo-electric machine group." R. L. Cleaver. July 24th, 1920. (70.663).
22,132. "Transmission of power in and to the electrical equipment of motor vehicles, aircraft, and the like." F. H. Bowman and R. L. Aspden. August 6th, 1920. (70.692).
23,480. "Means for charging portable electric accumulators." A. H. Railton and A. E. Angus. August 13th, 1920. (70.701).
24,731. "Electric switches." F. Zuckschwerdt. August 30th, 1920. (70.724).
24,425. "Method and apparatus for the measurement of the temperature of electric cables." E. Fawcett. September 30th, 1920. (70.728).
25,994. "Amplifying systems for electric currents." British Thomson-Houston Co., Ltd. (General Electric Co.). August 23rd, 1920. (70.730).
25,760. "Telephone desk sets." P. C. Burns. September 7th, 1920. (70.735).
26,075. "Construction and regulation of electric arc." F. von Schlegel. September 10th, 1920. (70.738).
26,887. "Electrical resistances." J. I. Leslie. September 22nd, 1919. (151,699).
27,994. "Electric switch devices." T. W. Rogers (Krupp Akt. Ges. F.) September 21st, 1920. (70.745).
26,999. "Regulating systems for alternating current circuits." British Thomson-Houston Co., Ltd. (General Electric Co.). September 22nd, 1920. (70.746).
27,496. "Storage battery testers." J. L. Thompson. September 27th, 1920. (70.748).
27,796. "Casings, mountings and connections for electrical instruments, and transformers." R. Amberson. September 30th, 1920. (70.751).
28,511. "Electric junction box." R. Crust. October 8th, 1920. (70.756).
28,853. "Suspension insulators for electric wires and cables." F. Rohde. October 12th, 1920. (Convention date not granted). (152,345).
28,574. "Junction boxes for electric cables." H. G. Cruden and Callender. October 12th, 1920. (70.759).
28,575. "Junction boxes for electric cables." H. G. Cruden and Callender. October 12th, 1920. (70.784).

1921.

609. "Construction of conductors for electrical machines." Bergmann
Elektricitäts Werke Akt. Ges. November 26th, 1917. (156,673.)
958. "Frames for the windings of electric resistances or heating elements."
Widerstand Akt. Ges. für Elektro Waerre-Technik. September 12th, 1918
(160,363.)
9180. "Electric oscillation generator." L. Levy. March 29th, 1920
(160,799.)
10,701. "Control of alternating-current electric motors." Metropolitan
Edison & Farnham Co., Ltd. July 19th, 1920. (166,878.)
17,600. "Secret magnetic locks for the electric battery lamps, more particu-
larly for use in mines." H. Turquand. January 23rd, 1920. (Divided
application on 17,677, 1920. 170,809.)

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"HANDS OFF" THE ELECTRICAL INDUSTRY.

Just over seven years ago the British electrical engineering industry was threatened by Teutonic competition and scheming policies of penetration. Since then much has happened in connection with the industry that we represent, so to improve its resources, efficiency, output capacity, and organisation, as to make it more competent to withstand the assaults of the enemy, assuming that it is not unduly troubled by unsettlement in industrial relations and is not betrayed by those who, in the common interest, should render it protection.

To-day it may be—indeed it is, if the impression on some minds be correct—that the British electrical industry stands in an even more dangerous position in respect of Teutonic penetration than it occupied in pre-war days. The suggestion has been thrown out by Sir Peter Rylands personally—though it was uttered at a meeting of the Federation of which he was for two years president, we believe it in no way represents the view of that organisation or of any special section of it—that Germany shall be allowed to erect and equip our super-power stations; the bait is that they shall be constructed free of capital cost, and thereby allow a cheaper and more abundant supply of electricity to be available for the cheapening of manufacturing production in various classes of trade.

May Heaven save us from so colossal a blunder—traitorous to the dead by whom we live, robbing the living of their means of livelihood, and unmindful of the interests of those unborn for whom the manufacturing industries of Britain must be preserved and strengthened.

In a recent speech, the Premier included among the favourable symptoms of the trade situation, the liquidation of the great glut of products which followed the 1920 boom. Such liquidation would necessarily enable the manufacturing of such products to return to more reasonable activity. He expressed the view that the world needed goods and British goods, and that it would get them.

Since these utterances were made there have been various speeches delivered and articles written in the newspaper Press on the subject of German reparations. Among the suggestions advanced are some such as we have mentioned which appear to be in direct opposition to the Premier's thoughts on the need for the revival of British manufacturing. Those who are advocating that Germany should be allowed to construct super-power stations in British industrial districts are actually proposing that one of the great manufacturing industries of the United Kingdom should be sacrificed in order that our late enemies may be assisted to their feet. Such suggestions do not emanate from British manufacturing circles representative of our electrical interests, of course. Those who desire to see the electrical and allied engineering industries of the United Kingdom in full and profitable employment, are not so foolish as to imagine that such a scheme could possibly redound to the advantage of those industries. They, indeed, know only too well that nothing would give German electro-technical organisations greater delight than the prospect of weakening British electrical industry and gaining a strong Teutonic hold thereon. Germany will find it hard work to regain its favoured pre-war position there by fair methods in competitive trading. How can anybody acquainted with the past suggest that the future of a vital British industry should be imperilled, as it certainly would be imperilled, by our national legislators approv-

ing of the erection of German electrical engineering exhibits in the United Kingdom? Surely only those can do so who know nothing of British electrical engineering and its ability to-day to fulfil any plant or equipment contract that the world has to offer. Our manufacturers are justified in expecting that new power station work to be executed in the United Kingdom shall be carried out by British labour. British workpeople are justified in looking to such contracts to afford them a means of livelihood for years to come. They know that they will be in sorry plight if those in authority betray them by wrongly using the power that they have given them, to assist German industries, already reported to be very busily engaged, with large contracts for manufactures which we ourselves can make.

The construction of large electric power stations is the most important branch of electrical engineering, as may be gathered from the fact that the cost of a station of 100,000 kW would be of the order of £5,000,000, at present prices; moreover, the key to export trade is construction for home requirements—if we do not build our own power stations, we shall not have the chance of building them for other nations. The designers of machinery must have the opportunity of studying the performance of their productions close at hand, and the manufacturers must have the means for conducting experimental research with a view to improving their products and keeping ahead of their competitors; but above all is the question of loss of employment, in connection not only with the super-power station plant manufactured in Germany for presentation to this country, but also with the orders for plant from foreign countries which would be diverted to Germany. In 1918 the Board of Trade Committee on the Electrical Trades remarked in its report: "The policy of German manufacturers has been studiously directed not only to secure orders in this country under the open competition permitted by our fiscal system, but also to the effective destruction of British industry." The policy advocated by Sir Peter Rylands would play directly into their hands.

We were not surprised to see the disclaimer of the Federation which followed on the heels of the speech in the Press the day after it was published.

Let us reprint Sir Peter's statement as reported and the official disclaimer:

As to the cheapening of our own costs of production, he might refer by way of illustration to the electrical industry. It would be to the interest of this country for the Government to lay down in every industrial centre in this country the best super-power stations at the complete expense of Germany and with an absolutely zero capital cost to this country. The question of the Channel Tunnel also deserved consideration, as he was disposed to believe that the Channel Tunnel would be of great value if it did not cost anything. (Cheerful.) He made these suggestions by way of contribution to the question of alternatives to the terrors of an uncontrolled liquidation of the indemnity. (Cheers.)

He also stated that in the speech made by Sir Peter Rylands on the German Reparations, the suggestions he put forward, both regarding electrical power stations and the construction of the Channel Tunnel at the expense of Germany, were not mentioned in the provisional reports of the Sub-Committee, and were put forward by Sir Peter Rylands as his own personal views as illustrations of the character of the proposals. (The speaker's example of the suggestions of the Reparations Sub-Committee.)

We are glad that this statement was promptly issued. If it had not been forthcoming we can imagine that there would have been a pretty considerable stir in the electrical branch of the Federation. Indeed, we can even imagine the electrical firms having no further use for the organisation, which would have been a pity, for the strengthening, and not the weakening, of the F.B.I. is what is needed.

In an interview that a *Times* representative had with him on Tuesday, Colonel O. C. Armstrong, who is now President of the Federation, said that Sir Peter Rylands introduced super-power station and Channel Tunnel ideas as types of the various forms of payment in kind which Germany could make because, in developing the idea of construction by Germany of works in different

countries "he had to search for striking examples to illustrate his meaning, among ideal projects which were not likely to be proceeded with in the ordinary course of development in this country for many years to come." Colonel Armstrong himself regrets that public attention has become centred on these two illustrations to the neglect of what he regards as the more important suggestions which had previously been discussed.

Even Sir Peter would surely desire that these German super-power stations should be erected as far distant as possible from those sacred memorials wherewith we pay public tribute to our immortal heroes who at so great a cost prevented the *Huns* from gaining the Victory after their unforgettably foul deeds. Shall we, after all, allow the Economic Crown to pass to those who proved so grossly unworthy in the eyes of civilisation? Shall we assist to strengthen those very industries which Rathenau organised for purposes of war—the war that came "a year too soon"?

The Germans, by force of arms, designed to rule the world with might. They still design to conquer the world, or an important part of it, economically, but British electrical engineering is capable of running its own business. Let them provide, by way of reparation payments, those things which we cannot make for ourselves and which it is unimportant that we should be able to make in order that we may be safe.

In the *Financial Times* of November 18th appeared an article with this heading, by Mr. R. H. Bicknell, M.Inst.C.E., drawing attention to the work of the National Salvage Council, and of Mr. J. C. Dawes, of the Ministry of Health, in connection with town refuse. It seems that the Ministry has just sanctioned the raising of a loan of £200,000 by the Corporation of Sheffield for establishing a salvage installation on a huge scale. The refuse will be screened and sorted, the fine screened dust being used as a fertiliser. The cinder is to be recovered and washed for use as fuel in the Corporation baths and elsewhere; but, so far as we can learn, not for raising steam at the electricity works. Rags, bones, tins, and bottles are to be picked out and sold for re-use. The Sheffield plant is designed to treat 500 tons of dry refuse per day, at an estimated cost of £36,000 a year, against a present cost of £50,000. Neither of the figures includes the cost of collection, which is about £66,000.

It appears that medical officers who have investigated the process on a working model scale have expressed approval of the hand-picking methods referred to, which will be carried out by women and boys. It is stated that there will be a good market for the articles recovered. Mr. Bicknell condemns tipping and dumping (in which we heartily agree with him), and also incineration and pulverisation. But when he says that incineration involves the destruction of useful material and means of power we differ from him. We entertain a strong suspicion of sanitary methods of hand-picking; and we are exceedingly doubtful about the economy of recovering cinder from the bulk by screening and washing, to be sold elsewhere. The Sheffield undertaking being on such a large scale, will soon prove the economy if it exists.

Our own view is, however, that the best way to realise any fuel value is to turn the material into electrical energy as soon as possible, and if that energy can be used to charge up electric collecting wagons, then, by "washing one hand with the other," a true economy is likely to be realised. But the economy of selling articles separated from the rubbish of the dust bin is dependent on the state of the market, and is, to say the least, a risky business with material that it will not pay to transport very far.

We shall certainly watch the Sheffield undertaking with interest, but at present we do not share Mr. Bicknell's anticipation that at last a final economical solution of the refuse problem has been found.

In our view it is well to screen out the fine dust, which is mostly fine ash completely burned. But it remains to be proved whether it is not better to put all the larger material into furnaces and turn it into steam and electricity at once, rather than to subject it to expensive separation processes, and afterwards to send it away again, at a further cost for transportation, to be used as a fuel. The fine dust should find a market for improving clay land, and the clinker resulting from the burning is valuable for concrete and road making and other purposes.

Trade with Latin-American Countries. DURING the course of the war European goods disappeared from the markets in South America, and, in fact, from the whole of Latin America. The United States and Japan sought to enter these markets or to obtain a greater share of the trade with them in the temporary absence of European competition; and a fair measure of success attended their efforts in this direction; but the Spanish-American buyers, always accustomed to the credit conditions and punctuality in delivery of European firms, never took kindly to North American methods, including cash payments or delivery against a confirmed credit in a month, these conditions being frequently associated with uncertainty as to the time of delivery being adhered to and no certainty that the goods would be up to samples or of the quality stipulated in the orders.

Under such circumstances it is no wonder that South American customers again turned their attention towards Europe as soon as possible after the conclusion of the armistice, while on their part the Europeans began to resume their interrupted relations with South America with the hope of recovering the markets. The final result of the rush of European goods and the great activity displayed in 1919, was the glutting of the South American markets with goods or the accumulation at the ports, warehouses, and custom-houses of goods which, owing to the effects of the world economic crisis which had arrived in the meantime, it was impossible to dispose of.

As a result of his own personal observations on the occasion of a visit extending over almost a year in South America, Mr. Kiek, chairman of the Commercial Bank of South America, recently stated that in the still precarious state of international political and economic conditions, it would be futile to attempt to predict the future of the countries with which the bank is associated; Through the opportunities afforded by the war, the United States had displaced much of the British export movement, and now Germany and Belgium were specially cultivating these prospectively valuable markets, assisted by the fateful advantage of depreciated currencies. In addition the American banks and the investing community had latterly entered the lists by more freely granting loans to South American Governments, thus following the policy so successfully adopted in England for close upon a century, of bold, adventurous, and on the whole remunerative supply of capital, which invariably brought direct and indirect returns to British industry and commerce. Such form of co-operation, Mr. Kiek remarked, was welcome, as there was room enough for all. It was, however, essential not to slacken any of our efforts, and the experience of his long journey confirmed the view that, given settled labour conditions at home and industrial peace instead of strife, we should hold our own against any foreign competition if we only remained true to our traditional policy of sound trading, fair dealing, good workman ship, and a respect for and a sympathetic consideration of the Latin-American point of view.

As is well known, we exported capital before the war on a large scale in the form of loans to South American Governments, but the bulk took the shape of capital and credits poured into Latin-America by British companies for developing vast tracts of country, the construction of railways and docks, and the organising of public utility undertakings, all of which had materially aided British trade, industry, and shipping. Though we

cannot export capital now on the same scale as prior to the war, Mr. Kiek thinks that the time will come when we shall again have similar opportunities, and he naturally considers it to be desirable that these investments should be made by British companies registered under the British flag, so as to ensure that effective control should continue to be exercised in England, and that the many direct and indirect benefits should continue to accrue to British trade and industry.

The Post Office Engineering Department. OUR comment last week regarding the handicap imposed upon a Government Department by the system of promotion by seniority elicited a protest from the Engineer-in-Chief, Sir William Noble, on the ground that that system did not obtain in the Post Office Engineering Department, and as the result of an interview, at which he explained to us very fully the organisation which he has developed, we are bound to admit that his point is well taken. Whilst seniority is not wholly ignored, it is relegated to the background, and certainly does not constitute a dominating factor in the choice of men for advancement in the Service. The keynote of our leaderette was *efficiency*, and we are very pleased to find that the increase of efficiency is the guiding principle in the function of selection.

When a vacancy is to be filled in a position of responsibility, the qualification of the officials who are eligible for the post are minutely examined; of those who are found to be in every way the most competent to fill it, the official with the highest seniority is chosen; but at the same time those who are passed over are informed that they are not necessarily out of the running for future promotion—whether or not they shall be chosen on the next occasion depends upon their own efforts to augment their efficiency and usefulness in the interim. By this means it is sought, and, we understand, with good effect, to make the promotion of an official act as a stimulus to his colleagues, who might otherwise be disheartened by rejection. An obvious objection to promotion otherwise than by seniority is the fear that favouritism may creep in, but this is avoided in the Post Office system by arranging that the decision shall not be left in the hands of an individual, but shall be made on the basis of reports by several officials of higher rank than the candidate, and subject to the approval of the head of the Engineering Department himself.

In order to ensure that the reports above-mentioned shall be based on right principles and directly comparable with one another, schedules have been drawn up by Sir William Noble allotting definite weights to the respective qualifications demanded by the position which is to be filled; these schedules embrace psychological and sociological as well as professional considerations, the relative values attributed to them being varied in accordance with the nature of the duties to be performed—greater weight is attached to strength of character, for instance, in the highest ranks, and to professional skill in the lower grades. The same principles, though in modified form, are observed right through the Department, and every encouragement is given to personal effort to rise in the scale.

One of the most satisfactory features of the system is the fact that it is recognised by the whole body of employees. Trade Unions are notoriously, though mistakenly, averse from permitting the individual to raise his status by efforts in excess of the normal, but the P.O. Union of Engineering Workmen, which is a trade union, unanimously passed a resolution nearly three years ago, declaring that the main considerations that should be taken into account in promoting members were efficiency, good conduct, and seniority, in the order stated. We may add that in the case of men not on the "establishment," efficiency and good conduct are the supreme considerations.

So far as it is humanly possible to eliminate the drawbacks of State control, the Post Office Engineering Department has been relieved of them, and efficiency is its watchword.

THE PATH OF A SMALL PERMEABLE BODY IN A MAGNETIC FIELD.

By Prof. W. CRAMP, D.Sc.

In recent examinations a question has appeared to which an answer is not to be found in the ordinary text books. This is the more strange since the case is one of considerable practical importance, and has lately received careful experimental investigation at the hands of Hartog and Belas.

The question may be put briefly thus:—"A small sphere of soft iron is placed at various points in the

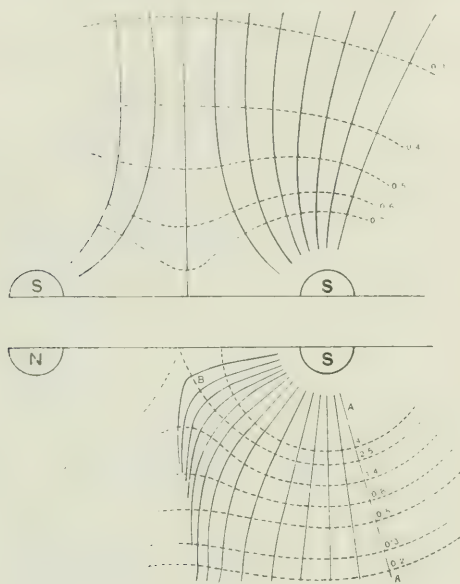


FIG. 1.

magnetic field of a straight bar magnet. Draw a series of curves showing the direction in which the sphere will tend to move from these points."

Nine out of ten elementary students having drawn a diagram of the ordinary lines of force due to the bar magnet, will reply that the sphere will tend to move along that line of force which passes through the point at which it is placed; and they will probably add that it will move along this line towards that pole to which it happens to be nearer. This answer is, of course, wrong. The lines of force represent those paths along which a particle possessing definite polarity will tend to move. But the sphere is not thus polarised, and consequently instead of experiencing attraction by one pole of the magnet and repulsion by the other, it is attracted by both.

Now, if the south pole of the bar magnet be placed at a distance equal to the length of the original magnet from a similar south pole, a particle having north polarity only would be attracted by both poles, and the paths along which it would tend to move would be the well-known lines for two like poles. These conditions are evidently somewhat similar to those of our question, and consequently the groups of curves in the two cases must have a certain resemblance. This resemblance, however, is only slight, and the cause of the difference is easily seen if we compare the force acting upon a small polarised particle placed within the influence of a field due to a single centre of opposite sign, with that acting upon a permeable particle placed in the same field. In the former case the surfaces of equal potential energy are spheres drawn about the point as centre, and the value of the energy corresponding to any sur-

face is inversely as the radius of the surface. In the latter case, assuming constant permeability of the particle, the surfaces of equal potential energy are also spheres drawn about the point as centre, but the value of the energy corresponding to any surface varies inversely as the fourth power of the radius. For the energy per unit volume of the particle is $\mu H^2/8\pi$, where H , the strength of the field is m/r^2 , m being the pole strength and r the radial distance of the particle from the pole. The energy per unit volume is therefore $\mu m^2/8\pi r^4$. Again, as regards force: the force upon the polarised particle will vary inversely as the square of the radius r , while for the permeable particle it will evidently vary inversely as the fifth power of the radius r .

By the usual methods of superposition we may arrive at the surfaces of equal energy and the lines of force due to a pair of centres. These I have drawn out in fig. 1, where in order to contrast the two cases sharply, the upper half of the drawing refers to a polarised particle near poles of similar sign, *ss*, and the lower half refers to a permeable particle near poles of unlike sign, *N* and *S*. The energy contour lines are shown dotted, and the figures near them show the relative potential energy corresponding to each curve. It will be noted that in the upper half of the diagram, the difference between one contour and the next is constant, whereas in the lower half these differences vary. This is necessitated by the steep potential gradient occurring near the poles, which renders it almost impossible to keep the differences constant and at the same time to keep the drawing clear. Within the dotted line marked 4, and also to the right of the line marked *aa*, the contours all become practically circles. The full lines represent paths along which the particle would tend to move. In the upper half of the figure the particle is supposed to have north polarity, and in the lower half to be unpolarised but of constant permeability, the value chosen being 112. All the full lines in the lower diagram are nearly radial within the dotted circle 4, and also to the right of the line marked *aa*.

The most characteristic difference between the two sets



FIG. 2.

of full lines is the sharp inflection of the lower set about the region *B*. This is due, of course, to the inverse fifth power law, and the consequent steep gradient.

In 1916 Prof. Marcus Hartog required a solution to this problem in connection with the analogy which he had drawn between the centred cell forces (mitokinesis), observed in cell division, and electrostatic or magnetic fields of force. Finding no solution in the textbooks, he and Belas devised a most ingenious method for determining experimentally the path of the particle. Their apparatus consisted of a powerful electromagnet of horse-shoe form, with limbs pointing vertically up-

wards. Laid across the ends of the poles was a trough containing glycerine, on the surface of which a small sphere of paraffin containing a quantity of reduced iron was floated. Above the trough a camera was arranged so that the position of the sphere could be focused on to a screen. Upon this screen dots were made with a pencil at the successive points of the screen occupied by the image of the zenith of the sphere which was spotted with black. A photograph of the dotted screen was then made, with the result that the trajectories reproduced in fig. 2 were obtained. The general agreement between the shape of the curves in fig. 2 and the full lines in the lower part of fig. 1 is quite obvious.

In exactly the same way as the field in fig. 1 has been obtained for the action of a pair of unlike poles upon a permeable particle, may another and quite different set of curves be obtained for the paths of a similar particle in the field due to two like poles. In fig. 3, ss repre-

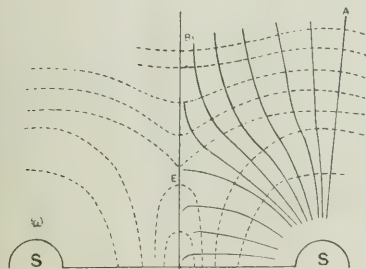


FIG. 3.

sent the positions of two like poles. A portion of the traces of the surfaces of equal energy for a permeable particle are indicated by the dotted lines, and the full lines show the paths which such a particle would take in moving slowly towards the pole. It might at first be supposed that as the diagram for unlike poles resembles the field of force for like poles, the converse would also hold true. But this is seen to be very far from the case. Instead, we have a most interesting series of energy contour lines giving rise to beautiful fan-like trajectories, to which fig. 3 hardly does justice.

If we regard ss as sinks, we see from the figure that there is an elevated region or watershed of which the line $\nu B \nu$ is the ridge. The ridge itself, however, is not

level, but slopes in both directions towards a critical point ϵ , such that $\nu \epsilon / \nu s = 0.708$, where ν is the middle point of ss. The point ϵ is arrived at by calculating the value of π along νB , which will be found to be proportional to $4a^2/(a^2 + l^2)^2$ where $s = 2l$, and a is the distance along νB , measured from ν . By differentiating and equating to zero the point ϵ is obtained as a solution to the equation:—

$$2a^6 + 3a^4l^2 - l^6 = 0$$

To the right of the line νA all the full lines would be practically radial, and near the centres ss this is also true.

In fig. 4 the results of Hartog and Belas for the case



FIG. 4.

like fig. 3 are shown, and once again the agreement is seen to be satisfactory.

In the above discussion, the permeable particle has been assumed to be small, compared with the distance νs or $s s$. If this is not the case, the introduction of the particle will seriously modify the lines of the figures. This change can easily be calculated for a single source or sink, but becomes difficult when there are two or more such centres. Hartog and Belas have also drawn attention to the lack of symmetry observable in fig. 2, but for such details the reader is referred to their original paper in the "Proceedings of the Royal Dublin Society," Vol. XV (N.S.), No. 4, February, 1916. Here it only remains for me to thank them for their kind permission to reproduce figs. 2 and 4 above.

MORE PROPAGANDA WANTED.

By E. S. HODGSON.

THE collapse of foreign exchanges has, temporarily at any rate, made it necessary for our large manufacturers of electrical plant and accessories to mark time until the exchange position has been stabilised or until the Government has elaborated its subsidy scheme for industry.

But that is no reason why manufacturers should be idle in other directions; for there is still a great deal of propaganda and "spade work" to be done in the interim.

The Germans, thanks to their low rate of exchange, are taking the utmost advantage of their position and finding access to lost markets and opening up fresh sources for their products. But they are doing more: they have embarked on an elaborate system of propaganda which far exceeds anything they did in that direction prior to 1914, at least so far as the purely publicity side is concerned. They are flooding the markets of the world with catalogues, trade papers, and other material of propaganda, well got-up and printed in the language of the country with which they are desirous of trading. Every trade has its *Fachzeit-*

schrift (specialised trade journal) the number of general trade journals printed in more than one language have increased, while the German Society of Engineers about a year ago fathered an important publication entitled *Industrial Engineering*, which, printed in German, English, and Spanish, has the avowed purpose of eulogising German achievements in all branches of engineering. This journal is well got up, contains a selection of interesting articles from month to month, and forms in all respects a valuable organ of propaganda.

What are British manufacturers doing in the same direction? Are they utilising their period of marking time in the preparation of foreign catalogues, pamphlets descriptive of their activities, and the publication of journals calculated to give the foreign buyer a comprehensive survey of modern British achievements in electrical and general engineering? Are they training salesmen to go out and study the markets abroad—to do the necessary spade work on the spot?

Every British firm of any importance ought to have salesmen (or, better, representatives) conversant with

their manufactures and equipped with the necessary knowledge of languages to enable them to cope with any and every possible inquiry that they may receive. And not only that: the really successful representative should be able to suggest new uses for electrical machinery and accessories, both to potential users and to his own firm. He should be something of a psychologist, and know something of the art of persuasion; he should have an eye to future developments in countries whose resources have been barely touched as yet; and he should have a head for figures, that he may be able to gauge roughly the cost of any large new undertaking that he cares to suggest. The ideal in this direction would be for a firm or a group of firms to have two representatives in the capitals of countries such as the South American republics—one representative being thoroughly versed in the details of electrical equipment, and the other the linguist, financier and man of the world.

Reverting briefly to the subject of catalogues and illustrated journals as a source of propaganda, the Americans are doing a great deal of useful work in that field. Some of their foreign trade journals are well illustrated—a point of great importance when dealing with the Latin races—and contain articles written from the broad standpoint of utility rather than too specific technical articles. The aspect that interests a nation that has not tried a particular application of electricity, for example, is not so much the technical details as the possible applications of the method to its scheme of in-

dustrial development. In this respect, therefore, two or three good photographs and interesting text, hinting at actual and possible advantages, are worth more than all the dry, technical descriptions put together.

To mention one or two possible fields of propaganda, wireless telegraphy and telephony, and power sets designed with prime movers suitable for running on the fuel available in given regions may be cited; also small-scale electric traction, and electrically-driven machinery for performing the operations which in certain countries are now carried out in a primitive fashion.

The function of making a thorough survey of requirements in particular countries or regions would devolve upon the representatives or propaganda agents sent out for the purpose. Nor should the smaller cultivator or farmer or manufacturer be neglected when making such a survey. These people only need to be persuaded of the advantages of electricity for doing their work more rapidly and—in the long run—more economically to get them interested, and the representative with imagination and initiative will quickly suggest the actual means of achieving such advantages.

Some one was bewailing in the daily Press recently that we had no new invention—that one was badly needed, in order to stimulate trade. Well, here is a field wide open and ready for exploiting—the vast and undeveloped regions of South America and other countries which would afford a new outlet for British genius and capital and—propaganda.

MAINS PHOTOGRAPHY.

By A. F. BEACH.

THE interesting article "Engineers and the Camera" in the ELECTRICAL REVIEW of October 7th, has prompted the writer to pen these notes on the special use of photography to the mains engineer, trusting that this will not be out of place, although the matter is, to a certain extent, supplementary to that article.

station, and a fault having developed, it was decided to cut at a place about half-way along; this happened to come nearly in the middle of a very large field. The plans showed the cables to be laid alongside, and within a few feet of a footpath, this footpath being merely a track worn bare of grass. Digging was started to find



FIG. 1.

The incident which first caused the writer to use a camera for the purpose of recording the position of a joint hole, illustrates in itself the advantage of this method.

A set of 10,000 volt mains was laid to supply a sub-



FIG. 2.

the cables at the spot indicated, but none were found, although a trench was cut across the position, and to a good depth.

A trial hole was then made on the other side of the track, and the cables were found immediately. The

path had been moved, probably by someone striking a fresh track, owing to the old one being covered with snow, or perhaps too muddy for comfort, and naturally all later travellers had followed in the footsteps of the pioneer, thus wearing a new path, while the old one was soon obliterated by the growing grass.

When the necessary repair was completed, two photographs were taken of a white staff stuck in the earth over the centre of the joint hole, including as many of the salient features of the distant background as possible, the two photographs being taken from positions roughly at right angles.

A test made a short time later proved this method to be perfectly reliable; a rod set up in a position corresponding with that in both photographs relative to the background was found to be within three inches of the original spot, shown by the hole where it had been stuck in when the photograph was taken.

After this a photograph was taken of every joint hole and cable trench which happened to be in such a position that the location might necessitate the measurement of fairly long distances, or where the objects used to measure from might change or disappear.

It is unnecessary to give further examples of the advantages of photographs for the purpose of recording positions, as every engineer responsible for the maintain-

ance of cables will see how they will apply to his own work, but the two photographs of a joint hole shown in figs. 1 and 2 will illustrate the point.

It may be mentioned that when the writer left the supply company for which this work was done, it was considered of sufficient importance to justify the purchase of a photographic outfit for the use of an engineer for this purpose.

There is obviously no great advantage in using this method to fix positions in town streets, but pictures of complicated pipe or duct arrangements, crossings, and other confusing tangles should be made (from more than one point of view) for office records, before they are buried. In this connection it should be remembered that occasionally a stereoscopic picture is exceedingly useful; this can be easily obtained with an ordinary camera, if there is nothing moving in the subject, by taking two separate photographs from positions about three or four inches apart.

A magazine camera taking one dozen $\frac{1}{2}$ plates was found to be all that could be desired, and as the light and conditions can seldom be chosen, the work sometimes has to be done on dull days. In practice, the best all-round results were obtained by using slow plates, a very small stop, and a time exposure, a "Century" testing set on its firm tripod being usually used to set the camera on.

THE EXTRA-HIGH-PRESSURE TRANSMISSION LINES CONFERENCE.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

COMMENCING last week and terminating in the early part of the current week, the above very successful meeting took place in the capital of France. Of late years European engineers have taken much more interest than formerly in extra-high-pressure transmission systems, hence this conference afforded an excellent opportunity of ascertaining their views on the subject—which naturally differ considerably from American practice, owing to the denser populations that they serve and the correspondingly shorter lengths of transmission, compared with American conditions and those of sparsely inhabited countries.

The method of organisation of the conference was to ask twelve countries (excepting Germany and Austria) to appoint official delegates; in addition, the conference invited the attendance of engineers who were interested in the general subject. About 50 delegates attended, those from Great Britain being Messrs. Hunter, Wedmore and Woodhouse. The English guests were Sir Tom Callender and the present writer. Great Britain was honoured by the election of Mr. Woodhouse as one of the vice-presidents. Dr. Kennelly, of the U.S.A., was also elected as a vice-president. The Presidents d'Honneur were Messrs. Blondel (Member of the Institute of France) and Mailloux (President of the International Electrotechnical Commission). The President was M. Legouez. As indicative of the great interest that the French Government is taking in the general subject, it may be mentioned that the proceedings were opened by M. Le Troquer, Minister of Public Works.

A very systematic programme of work had been prepared, so as to ensure that no details would be left undiscussed. Further, the meetings were so arranged as to be continuous, with no overlapping. In this way, each member of the conference was assured that he would miss nothing, owing to the circumstance of two papers being read at the same time. A week of very hard work was put in, since the proceedings commenced at 9.30 a.m., and with the exception of an interval for lunch, often lasted until 7 p.m. All functions (except that of attendance at the Ampère Centenary celebrations) took place in the evenings; and visits to works, &c., were arranged for the week following the conference.

As main divisions for the discussions, the programme

was divided into (a) the generation and transformation of electrical energy; (b) the construction of the transmission lines; (c) the operation and protection of the lines; and (d) legislation affecting these works. The papers presented at the meetings were very numerous—amounting to a total of 56. Most of these papers were available in advance, in both French and English—the official languages of the conference. During the course of the meeting a *résumé* of each speech was given in English or French, so that all might understand.

Everyone was enthusiastic as to the success of this the first International Conference on the subject, and it is proposed to make it an annual event. Rumour has it that next year's meeting will be in London.

On Thursday afternoon, November 24th, the Conference was adjourned so that the members might participate in the celebration of the Centenary of the most important discoveries of Professor André Marie Ampère. This afforded a unique opportunity for the study of French character, as illustrated by the manner in which, as a nation, they publicly give honour and praise to their great scientists of the past, whose discoveries have benefited not only France, but the whole world. The meeting was presided over by the President of the French Republic (M. Alexandre Millerand), who was supported by six Ministers, two Under-Secretaries of State, and many others holding prominent positions in the affairs of the country. This brilliant attendance alone was impressive, and showed that France really took to heart, realised, and properly appreciated the valuable work done by Ampère. Readers need hardly be reminded that Ampère was a Member of the Legion of Honour, Professor of Physics, Inspector-General of the University, and Member of the Institute. He was born at Lyons in 1775, and died at Marseilles on January 10th, 1836. In the course of the speeches—which took place at the Sorbonne, University of Paris—there was an amusing rivalry between the physicists and the electrical engineers, each body wishing to claim Ampère's work as being of most importance to the interests it represented. The vast audience was given time to think things over after each speech, while the famous band of the Garde Républicaine played stirring selections—again a typically French custom.

A further insight into French customs was given to the visitors one evening in the form of an old-world French concert, accompanied by musical instruments of the period and also by examples of old dances.

Two dinners were given in honour of the visitors; one by the Union des Syndicats de l'Electricité, presided over by M. Mahieu, Conseiller d'Etat, General Secretary of the Department of Public Works. The other dinner was given by the Société Amicale des Anciens Elèves de l'Ecole Supérieure d'Electricité, with the Under-Secretary of State for Posts and Telegraphs in the chair. Appropriately enough, after the dinner a demonstration was given of the latest developments of wireless telephony. On the following day a journey was made in a procession of 50 Citroën taxi-cabs to the wireless telegraph station at Saint-Assise. This visit was at the invitation of the Société Française Radio-Télégraphique. The portions of the station (a) for telegraphy in France and (b) to England and the Continent are in operation, while the Intercontinental Station is nearing completion. The last portion of the installation is the largest in the world, larger even than any which are projected; the plant will have a capacity of 3,000 kW. The 16 masts, 500 metres high, are already erected. They are placed in two rows, 400 metres apart, the distance from one post to the next in each row being similarly 400 metres. The pressure of operation on the antennae will be 120,000 volts. The masts themselves are earthed, there being no attempt to insulate them, as has been the tendency of late. Much interest was taken in the existing machine rooms. Evidently the day of the physical instrument maker for wireless station work has passed away, for this station was hardly distinguishable from a modern rotary sub-station. The modern desk type of switchboard was installed, and the plant consisted of motor generators. These were of two types: (1) to transform the 3-phase, 500-volt a.c. supply to 200 volts d.c., and (2) to transform the 200-volt d.c. current, by aid of a motor running at 6,000 r.p.m., to high-frequency current at 32,400 periods—an abnormally high frequency. These high-frequency alternators were constructed by the Société Alsacienne de Constructions Mécaniques, of Belfort, to the designs of M. La Cour. They are oil-cooled, and each has a capacity of 25 kW. The visitors were given a demonstration of the putting in parallel of two of these sets, which, at their abnormally high frequency, is entirely a different problem to that encountered in ordinary a.c. plant. By varying the frequencies of individual sets, quadruplex telegrams could be dispatched. Four hundred words can be dis-

patched per minute, and 200 words per minute can be received. The management is aiming at a very prompt service, and the normal time required for the dispatch of a radiogram to London from Paris is five minutes—cases have occurred where the reply has been received in 25 minutes. Should a message take longer than five minutes, rigid investigations are made, but this has not occurred for over twelve months. The new station is being constructed entirely of bricks and cement (so as to avoid electrical troubles due to presence of steel in the constructional work). The arched vaulted brick roof was pointed out with pride, as a novelty in modern building construction—and yet it is only comparatively a few years ago that ferro-concrete construction was itself a new thing.

One evening was devoted to an inspection of the Gaumont kineima film factory. The most recent system of three-colour screen film display was demonstrated, and also the latest development of talking pictures. In both cases the secret is synchronisation by electrical means. A speech by the Minister of Public Works was most realistically rendered. The figure on the screen was greatly enlarged, and the spectator could almost see the words coming from his lips, the synchronisation was so perfect; in fact, but for an occasional flutter of the hand, it was so realistic that the onlooker almost forgot he was looking at a screened film.

The concluding visit took place on Monday, November 28th, to the 200,000-kW power station at Gennevilliers. This plant comprises five turbo-alternators of 40,000 kW each, operating at 1,500 r.p.m. The voltage of the generators is 6,000 at 50 cycles. Stirling boilers, operating at 355 lb. per sq. in., are now being installed, but eventually one half the boiler room equipment will be Stirling and the other half Babcock & Wilcox. Each Stirling boiler has a heating surface of 22,600 sq. ft., and a guaranteed evaporation of 175,000 lb. per hour. The total number of boilers will be 20. Altogether this station is a wonderful example of the very latest ideas in super-power steam station construction.

So far nothing has been mentioned concerning the details of the real work of the conference, and this is for the reason that it has been thought wiser, as this conference was of such far-reaching importance, to give a summary in the form of a separate article, which is to appear next week. There is no question but that this conference has been a great step in forwarding the progress of extra-high-pressure transmission, which is bound to lead to more rapid and better progress, and so, all the sooner, all nationalities will be benefited by a better and cheaper supply of electricity.

A NORTH-EAST COAST LOCAL ELECTRICAL TRADING ASSOCIATION.

In July and August last, meetings were held in Newcastle-upon-Tyne of a committee which sat to consider the formation of a local trading association. The outcome of this was the appointment of an investigating committee, which drew up a report. This document was considered by a committee of interested parties at a meeting held on November 16th, 1921, and was unanimously resolved to accept the report and to send copies of it to each firm represented at the meeting, to the electrical Press, to all associations in the electrical industry likely to be interested, and to any firm making application.

The Investigating Committee comprised four members representing manufacturers, two representing cable makers, two supply companies, two factors, and two contractors.

In July, 1921, a question arose between the Newcastle-upon-Tyne Electric Supply Co. and the Electrical Contractors' Association as to the granting of trade discounts. The point bristled with so many difficulties and opened out so many controversial matters that the contractors called together representatives of the manufacturers, cable makers, wholesalers, and electricity supply companies, and members of their own body, and laid the matter before them.

After considerable discussion, extending over two meetings, it was recognised that at such a large gathering it was impossible to make progress, and the meeting therefore decided to appoint a committee to investigate the matter.

A committee was therefore formed, and the following terms of reference given for its consideration and guidance:—

"The committee to investigate and consider the advisability of forming a protective association, and the application of the principles of the Bradford Electrical Trading Association to this district."

"The committee finding that a scheme appears to be desirable, to report whether the application shall be (a) national; (b) local."

At first considerable difficulty was experienced in obtaining an expression of opinion because of the inability of individual members to bind their respective firms or associations. It was, therefore, resolved that, although the various members were appointed as representatives of the B.E.A.M.A., C.M.A., E.W.F., N.E.C.T.A., and the Newcastle Supply Co., this constitution should be dissolved, and each member should express opinions on his own behalf.

At first sight this procedure might give the impression that it robbed the committee of much of its value, but as each member was a responsible party this was not so. This report is, therefore, the considered opinion of responsible individuals engaged in various branches outlined above, and it is hoped will prove of service to the electrical industry.

For the better understanding of this report the agenda is shown itemised, and the committee's conclusions given after each item.

For reasons that will be obvious the committee decided to

refrain from recording in full the arguments put forward, and to confine its report to the bare conclusions arrived at under each heading.

REPORT.

1. Is the present method of trading in the electrical industry satisfactory from the point of view of (a) manufacturer; (b) wholesaler; (c) contractor; (d) supply company; (e) user?

With the exception of the user each party was represented, and after considerable discussion it was agreed, with one dissentient, that the present method was not satisfactory. The dissenting member thought it was satisfactory "because he knew no better method."

From the users' point of view it was agreed that a better control of the industry might mean higher prices, but this would be offset by greater reliability in the articles bought, and a better service. It was, moreover, felt to be highly probable that these last two considerations would ultimately lead to larger sales, and therefore cheaper production, resulting in lower prices.

2. If the present method of trading is not satisfactory, in what direction does the fault lie?

Considerable discussion ranged round this item of the agenda, and it must be confessed that each group sought, and with some success, to lay the fault at the door of the others. Eventually, however, the following resolution was unanimously agreed upon:—

"We are of the opinion that the question of apportioning blame for the present state of affairs is a matter too large and ambitious for this committee. We, however, offer the following as a formula for further examination.

"The present unsatisfactory method of trading in the electrical industry is due to the lack of sound trading principles and co-ordination.

"We recommend that the various associations within the industry seek to get together to:—

1. Agree the ethics of fair trading.
2. Seek some method of co-ordinating the activities of the industry as a whole to the end of:—

(a) Developing the resources of electricity.
(b) Encouraging its greater application.
(c) Securing a fairer division of profit to each section of the industry.

(d) Rendering a better and cheaper service to the public."

3. Can the fault be attributed to any particular group, i.e., the manufacturer, wholesaler, or contractor?

In view of the finding under the previous heading, the committee feels it is invidious to apportion blame to any quarter. Each section of the industry must bear its share of blame, and

a recognition of this fact should lead to an earnest endeavour to ameliorate trading conditions.

4. What is the remedy? (Note—Consider a system of grading of buyers by a joint association, as in Bradford.)

The committee feels that this is answered by the reply to Question 2. The Bradford Trading Association was carefully considered, and it was unanimously agreed that the committee could not recommend its application.

5. Can the remedy be applied (a) nationally; or (b) locally?

The committee is of the unanimous opinion that the remedy should be national, and suggests for consideration that local joint committees should be set up for the discussion and settlement of local matters in accordance with accepted principles.

Can the remedy be applied (a) wholly; (b) at once or deferred?

(a) It is too optimistic to hope that the remedy can be immediately inaugurated as a whole. It is felt that the task is a heavy one, and must necessarily be a process of development along accepted lines.

(b) The committee sees no reason why the work should not be attempted at once.

GENERAL.

It is possible that there may be an impression that this committee has exceeded the work outlined by the terms of reference, and it might, therefore, be advisable to explain that in considering the advisability of forming a trading association, and the application of the Bradford Association scheme, it was necessary to ascertain whether there existed such a state of dissatisfaction in the industry as to warrant an alteration in present methods of trading. Obviously, if the present methods were reasonably satisfactory, the necessity of altering them fell to the ground, and no consideration of the Bradford scheme was necessary. The agenda was therefore carefully drawn up to take care of this aspect of the case.

As soon as the committee got seriously to work it was apparent that it would be folly to attempt either to outline the dissatisfaction, apportion the blame, or to attempt a remedy. The conditions are national, and the remedy must be national, and it should not lie within the province of a local committee to attempt this work.

All the committee has sought to do is to establish the fact that there is considerable dissatisfaction, which is not confined to any particular section. It has, therefore, sought to find a formula that will merit acceptance by all parties, and influence the various associations to get together with a view to a closer examination of the subject. If this is done in an earnest spirit of goodwill there would appear to be no obstacle to a remedy being found.

Chairman, C. H. MERZ.

Hon. Secretary, SAMUEL C. DAVIS.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Atrax" Projector.

The GENERAL ELECTRIC CO., LTD., has sent us particulars of an effective advertising device which we have noticed at one or two recent exhibitions, where it has proved very "notice-compelling." This is the "Atrax" projector (fig. 1), which consists of a tube 17½ in. long and 4 in. in diameter, mounted on a base, giving a total height of 19½ in. A lens is fitted, and the light is provided by a special 100-W "Osram" gas-

and fixed at any desired angle through a large range. The image thrown by the "Atrax" projector is so brilliant that it is visible even in diffused daylight; surrounded by other artificial lighting it stands out very clearly.

The "Quixup" Cabinet.

We reproduce herewith two photographs of the General Electric Co.'s "Quixup" cooking outfit, which we men-

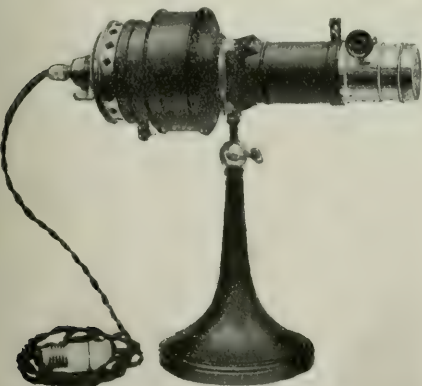


FIG. 1.—THE "ATRAX" PROJECTOR.



FIG. 2.—THE "QUIXUP" CABINET—OPEN.

filled lamp. The picture or advertisement takes the form of a glass slide. The projector tube is mounted on an extension, which slides in and out of the base, and it can be swivelled

tioned recently in connection with domestic electrical exhibitions at Messrs. Whiteley's and Harrow. Fig. 2 shows the "open" position with a "Magnet" electrical grill in the

centre, and a toaster and a kettle on the side pieces. The cabinet closes up as shown in fig. 3, the aluminium-covered tray being set up on four guides.

In its closed position the cabinet appears as an ordinary

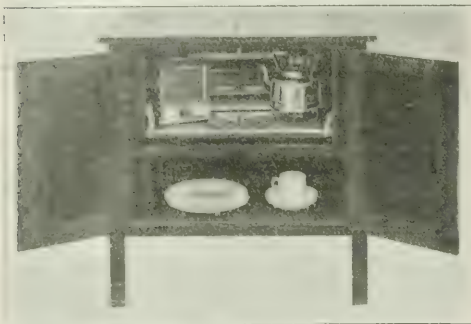


FIG. 3.—THE "QUINCE" CABINET—TOP CLOSED.

piece of furniture, and it can be made in any style or wood to suit its surroundings. The set should prove very serviceable in flats or other places where space is precious.

The "Utility" Cooker-Radiator.

The "Utility" cooker-radiator has been designed to provide, at a cost within the reach of all, an electric heating device that is effective and ornamental as a radiator and efficient as a cooker. The sheet-steel frame stands on cast-iron feet, and is fitted with polished aluminium plates on top, thus giving strength combined with lightness. Its weight is 4.5 lb. and dimensions are 12 x 6 x 4.5 in., the consumption being 750 or 1,000 watts. The small amount of metal employed ensures that this robust device quickly reaches its working temperature; the heating coil is mounted on a set of eyeletted mica

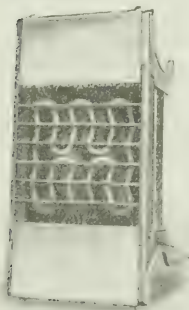


FIG. 4.—THE UTILITY RADIATOR.



FIG. 5.—THE UTILITY COOKER.

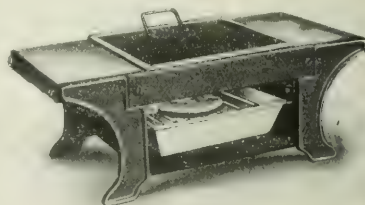


FIG. 6.—THE UTILITY GRILL.

supports, which are supported in mild-steel channels. Accessibility is a prominent feature, and by withdrawing five screws, the whole heating element with the terminal block and flex, can be easily removed to allow a new element to be fitted and connected up with the minimum trouble. Sufficient space is allowed at either end of the heating element to enable more than one utensil to be used at a time, as shown in fig. 5; the cooking space is 8 x 6 in., and will boil two pints of liquid in 10 minutes. When standing on end, as in fig. 4, it forms a radiator, or the device may be used as a grill, fig. 6, with a toasting space of 6 x 6 in. A movable polished aluminium reflector plate is provided to throw the heat up or down as required, and we understand from MESSRS. ELECTRICAL UTILITIES, LTD., 1 and 3, Shelgate Road, Battersea Rise, London, S.W.11, that the device is the forerunner of a series of British heating and cooking appliances.

Non-Magnetic Cast Iron.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs., have produced a non-magnetic cast iron to which they have given the name "No-Mag." This has a higher resistance than iron and a permeability as low as that of brass. The specific resistance is 140 microhms per cm. cube, and the magnetic permeability is 1.03, whilst that of brass is 1. It is therefore very suitable for use in the construction of transformers, where the presence of undesirable eddy currents is a serious consideration. A leaflet recently sent to us by the firm shows examples of its use, including a transformer cover, weighing 896 lb., an oil switch base, and resistance grids.

DEVELOPMENTS OF ILLUMINATING ENGINEERING.

At the meeting of the Illuminating Engineering Society on November 15th Mr. L. Gaster, in presenting his Report of Progress during the Vacation, recalled that the opening meeting of the session was customarily devoted to reports and exhibits of novelties, and in the course of the evening some interesting new applications of light were shown. Mr. Gaster alluded to various recent official reports as illustrating the interest now taken by Government Departments in lighting. Amongst these may be mentioned the second interim report of the Home Office Departmental Committee on Lighting in Factories and Workshops, the interim report of the committee under the Ministry of Health concerned with the effect of lights used in cinema studios on the eyes of actors, and the third interim report of the Ministry of Transport Committee on Lights on Vehicles. Various outstanding problems, photometric and general, were discussed at the recent first technical session of the International Illumination Commission, notably the ultimate prospect of framing an international code on factory lighting.

Following this a report from the Society's Committee on Progress in Electric Lamps and Lighting Appliances was presented by Mr. Caine, in the absence of Mr. S. H. Callow (Chairman). It was stated that various difficulties with regard to lamp-production recorded last year are now being satisfactorily overcome. Bulbs and tubes of good quality are now available without dependence on foreign supplies. The shortage of suitable reflectors for small gas-filled lamps, which in 1920 furnished one explanation of the tendency to use un-screened lamps in shop windows, has now been removed.

After the reading of these reports, there was a series of short demonstrations, covering a wide field. Mr. W. J. Jones very interestingly demonstrated the use of ultra-violet light (derived from a tungsten arc screened by glass practically opaque to visible light, but permeable to ultra-violet), for testing precious stones. In a dark room most gems fluoresce vividly under intense ultra-violet light; inspection of the colour and intensity of this fluorescence enables an expert to distinguish readily between genuine and imitation stones. It was particularly interesting to learn that by this means one can not only distinguish genuine natural pearls from artificially prepared ones, but also discriminate between the Oriental and the Japanese varieties. These varieties are almost indistinguishable when viewed by ordinary light, but under ultra-violet light the difference in the colour of fluorescence is most marked. In some cases it is even possible to distinguish between gems of the same type, but coming from different districts. This possibility is naturally of great interest to jewellers.

Mr. G. Campbell then exhibited and described several new types of industrial lighting reflectors, the chief feature of which is the careful design of the contour so as to obtain adequate screening of the filament and minimum liability to glare. The latter point is of special consequence in view of the recent recommendations with regard to the avoidance of glare by the Home Office Committee on Factory Lighting.

Mr. Armstrong demonstrated the Grubb motor headlight,* and Mr. W. J. Jones also exhibited a new form of headlight which has been designed with a view to solving the difficult problem of providing a sufficiently powerful beam for driving, safely without producing excessive glare in the eyes of approaching pedestrians or drivers of other vehicles.

The next item on the programme was the "Benjamin Lightmeter," devised by Mr. Haydn T. Harrison, which represents one of the latest attempts to provide a simple and portable instrument for measuring illumination. Mr. Harrison pointed out the simplicity of the instrument and its convenience for purposes of demonstration; a small lamp, fed from a portable accumulator, is placed at one end of a box with a whitened interior. One side of the box is cut away and replaced by a strip of opal glass, the brightness of which is a maximum immediately above the small glow lamp, and progressively diminishes as one goes further from the lamp. A small disk of white paper with a central grease-spot can travel along the opal glass plate; the white surface of the paper receives the illumination to be measured, and the

* ELEC. REV., October 7th, 1921; p. 467.

grease-spot is illuminated by light transmitted upwards from the opal plate underneath. Accordingly there will be one position of the grease-spot which gives photometric balance, and this is recorded on a scale, marked out on the opal plate, registering from 0.5 to 20 foot-candles. The paper disk is incorporated in a sliding metal sheath, in which there is also an aperture through which the scale-reading is read. A feature of the apparatus is that it can be inspected simultaneously by several people.

The audience was next treated to a demonstration of the latest developments in "artificial daylight" by Mr. Green and Mr. Lamplough respectively, who dealt with two distinct methods. The "Sheringham daylight" has been described in our pages, but Mr. Green pointed out that an accurate imitation of daylight, suitable for careful colour-matching, inevitably involved a considerable sacrifice of light by absorption. For the latest reflector, however, a much lighter pure blue ultramarine pigment had been secured, and also a better emerald green; a small amount of yellow had also been incorporated in the design, which led to more accurate results. The effect of these improvements was that the efficiency of the apparatus had been approximately doubled. A variety of models, including a portable type with a Sheringham unit and an ordinary glow lamp side by side for purposes of comparison, were shown, and it was mentioned that a trough-type unit had been developed for use in art galleries and elsewhere. This form of unit had been adopted by colour-printers engaged in the production of bank-notes. Apart from its primary use in industries concerned with colours, artificial daylight had proved of value in the grading of flour, rubber, tobacco, and fur.

The method of producing artificial daylight shown by Mr. F. E. Lamplough effects the desired change in colour by passing the light from a gasfilled lamp, equipped with a suitable reflector, through a disk of special Chance glass. With the latest form of glass a light eminently suitable for accurate colour-matching is said to be obtained, and the method lends itself well to the production of a concentrated light. Where extreme accuracy is needed, still greater exactitude in the composition of the light may be obtained by combining the use of an appropriate glass disk with a reflector, the inner surface of which is coloured with a selected blue pigment. An interesting point emphasised by Mr. Lamplough was that an improperly designed artificial light may be apparently very similar in colour to daylight, but may nevertheless prove quite misleading when colour-matching. Certain dyed fabrics may appear identical under daylight, but absolutely different in colour under artificial light, and *vice versa*. Mr. Lamplough exhibited a cabinet containing true artificial daylight, spurious artificial daylight of the variety mentioned above, and light from an ordinary untreated gasfilled lamp. By placing selected coloured fabrics under each of the three lights in turn the misleading character of the false artificial daylight was demonstrated.

The other exhibits included some pleasing developments in illuminated signs shown by Mr. E. T. Ruthven Murray, and a display of the new neon lamps now being used for letter-signs by Mr. H. A. Carter. Mr. Murray's signs are based on the principle of illuminating the interior of a vertical glass plate by means of concealed tubular lights placed along its edges. In these circumstances the light undergoes total internal reflection within the glass, and any device or motto engraved on the back appears vividly illuminated. The latest development is the introduction of colour in such signs, and when operated by a flasher they may be made to reveal pleasing changes in the tint of the lettering. It is also possible to engrave a coloured picture behind the glass. The small neon letter-sign lamps shown by Mr. Carter were introduced this year, and are now becoming familiar. The letters appear outlined in a species of pink glow, and some degree of violet fluorescence is apparent. This gave rise to some discussion on whether such lamps emitted an appreciable amount of ultra-violet light, but it was suggested that the amount of such rays was, if anything, probably less than that met with in ordinary tungsten lamps.

One other small exhibit that deserves mention is the "Luminor" sign described by Mr. Ancotts, which utilises small convex mirror disks, which can be mounted to form various devices. The mirrors have a focusing effect, that causes them to appear as bright spots of light in daylight, and it is claimed that they can be rendered visible even in a very faint light, such as is met with in many streets at night time.

Electric Vehicles at Blackpool.—Owing to the flatness of the town and the excellent road surfaces, Blackpool is generally regarded as an excellent centre from which to operate electric vehicles. It is claimed that in this town "electrics" show better results than in most other places, as, owing to the absence of hills, the most efficient service can be obtained from the cells.

One Blackpool firm of bakers and confectioners is using four electrics with Chloride batteries. One of these batteries has given 2½ years' service, and has been in use for over 9,000 miles, with a minimum mileage of 20 a day.—*Commercial Motor*.

LEGAL.

WORKMEN'S COMPENSATION.

A compensation case was mentioned at Preston County Court last week, in which the applicant was Mary Wilkinson and the respondents were Messrs. Dick, Kerr & Co., electrical engineers.

Miss Wilkinson was at her bench when an electric chandelier, being repaired above her, fell 20 ft. with all the fittings, and struck her in the base of the back. A settlement was reached by payment of £50 and 15 guineas for legal and medical costs.

WEENER & CO., LTD., v. J. B. BERRY & SONS.

MR. JUSTICE ROWLATT, in the Commercial Court last week, began the hearing of an action by R. O. Weener & Co., Ltd., of Water Lane, E.C., against James B. Berry's Sons, Co., Incorporated, Cannon Street, E.C., claiming damages for alleged breach of contract relating to the sale of 800 barrels of transformer oil. Defendants denied the alleged breach, and counterclaimed for £2,237 7s. 2d. on the ground that plaintiffs had refused wrongfully to accept 600 barrels of the oil.

Mr. HAROLD MORRIS, K.C., for the plaintiffs, said they were oil merchants and defendants were an American incorporated company with a branch in London. The contract was made in November last year for the sale of 800 barrels of oil. Plaintiffs accepted delivery of 200 drums of oil to satisfy part of the contract, and refused to accept the tender of a further 600 drums. They now claimed damages mainly because the oil was not delivered in barrels but in drums, and they asserted that this was a breach of the description of the goods under the contract. Plaintiffs were merchants only, and had done business with defendants' manager before, and he knew plaintiffs were buying for resale. The damages claimed were the amount lost on the resale, £380, or alternatively, the difference between the contract price and the market price. Defendants set up a defence that they were an American company, and when they put the word barrel in the contract they meant drum, and further that plaintiffs knew drum was meant, because when Americans used the word barrel they meant drum. Therefore there was no breach of contract, and defendants claimed damages against plaintiffs for breach of contract. Defendants set up a second defence that the word barrel was not a description but only a quantity, and a further defence that plaintiffs waived the description. He (counsel) contended that it was quite clear in the contract that it was a description, and plaintiffs were entitled to reject on the day they did, January 10th, because the oil delivered was in drums and not barrels. Counsel explained that transformer oil used for transformers had to be of a very special quality, free from all moisture. A barrel was 55 American or 42 English gallons, containing 3½ cwt. of oil. He added that of the contract quantity of 800 barrels, 400 were rejected because they were drums, and 200 because they were not delivered in the contract time. Barrels were worth about 12s. 6d. each, whereas drums, such as those in this case, were valueless.

Evidence was given in support of plaintiffs' case, and the hearing was adjourned.

The hearing was continued on Wednesday last week, when further evidence was given for plaintiffs that when barrels were contracted for, only wooden barrels would be accepted.

For the defence, Mr. HAROLD GEORGE FURLONG, M.I.E.E., a consulting engineer, of High Holborn, and formerly manager of the transformer department of the Ferranti Co., said he had ordered large quantities of transformer oil for that company, and it was essential that transformer oil should be free from moisture; it was the practice of transformer managers not to accept any oil except in steel barrels. Prior to 1914, transformer oil was sometimes put in wooden barrels, and it was due to the enormous amount of trouble on transformers caused by moisture that no oil was accepted except in steel barrels. If he had made a contract for transformer oil he would expect the oil to arrive in suitable containers, by which he meant steel drums. Wooden barrels were unsuitable, because of their liability to shrink and to admit moisture.

Mr. C. H. WORDINGHAM, consulting engineer, agreed that wooden barrels were unsuitable for transporting transformer oil, partly because the wood might contain moisture, partly because the oil might become contaminated by acids from the wood, and partly because the wood might fray and give rise to fabrics which would prove deleterious. It was usual for transformer oil to arrive in steel containers, and if he made a contract for barrels of oil he would expect to receive steel containers.

Mr. GEORGE BERRY, manager of the British Electric Transformer Co., gave similar evidence, and said the experience of his firm of oil in wooden barrels was disastrous, and they had to insist that all oil was delivered in steel containers. The steel containers in which their oil came were always known as barrels.

Mr. HAMILTON JAKES, managing director of Reesoids, Ltd., Newcastle, said that transformer manufacturers and power stations absolutely insisted on having transformer oil in steel barrels. With a contract for barrels of transformer oil he would expect to get steel barrels, but if he were making the contract he would specify steel barrels. His firm would

not supply transformer oil in anything else than steel barrels. It was universal in the trade to put transformer oil into steel barrels.

Mr. WILLIAM J. SMITH, defendants' London representative, said they entered into the contract that plaintiffs required a quantity of 250 barrels, and had no idea they wanted wooden barrels. The steel containers in which the oil was supplied were universally known as barrels in America. His firm would never think of shipping transformer oil in wooden barrels because they knew that no one who understood the trade would accept them. After the contract was entered into, the price of transformer oil steadily declined, and his firm had suffered damage to the extent of the amount for which they counter-claimed.

Mr. JUSTICE ROWLATT, in giving judgment on Thursday last week, said he thought that the word barrel used in the connection in which it was used in the contract, meant a wooden barrel only. But it was said that this oil being transformer oil must be put in steel containers. His Lordship, however, did not think that was right, for it had not been made out that if a little moisture got in, the oil ceased to answer the description "transformer oil." Even if it had been shown to be imperative that transformer oil should be put in steel containers, that did not carry defendants all the way, for if people bargained for barrels, and barrels meant barrels, there had to be made out an overwhelming case before it could be said "in this particular case, with this particular commodity, you can't have meant what the words say." Such an overwhelming case had not been made out. His Lordship did not think there had been any waiver by plaintiffs. From the facts and figures put before him, having regard to the falling market, he was unable to say that plaintiffs had suffered any damage, nor could they claim loss of profits. There would be judgment for plaintiffs on their claim for one shilling, without costs. Defendants' counter-claim must be dismissed, with costs.

THE CLAIM BY MR. A. SIEMENS AGAINST SIEMENS & HALSKE.

ACCORDING to the *Financial Times*, the Anglo-German Arbitral Tribunal on Friday last gave judgment in this case in which Mr. Alexander Siemens was the claimant and Siemens and Halske were the respondents.

The judgment stated that in 1908 the claimant undertook to transfer to the respondent company 10,133 shares of £5 each in Siemens Brothers & Co., an English company, and in consideration for this was to be made a shareholder of 506 shares of a new issue of shares in the respondent company, Siemens and Halske Aktiengesellschaft, a German company, established according to German law. It was further agreed that the share certificates of the issue which it was not intended for the time being to introduce on the Berlin Stock Exchange should not immediately be printed and delivered, but the claimant was to receive the dividend on the 506 shares, should have the right to vote at general meetings of the respondent company as the holder of those shares, and the respondent company should, on his demand, deliver the documents for the 506 shares to him, or in the event of his death to certain persons named by him, and that then the respondent company would on demand procure the introduction of the new issue of which the 506 shares were a part on the Berlin Stock Exchange. The claimant had received until the outbreak of war the dividends declared by the German company and might have voted, although he did not as a fact do so, at general meetings of the German company. It was urged on behalf of the claimant that in spite of his having received dividends and having the right to vote as a shareholder, no shares had been issued to him, that he never was in fact a shareholder, and that the contract was at the outbreak of the war unfulfilled by the respondent company.

The Tribunal held that the contract contained in the correspondence between the parties was duly performed by the claimant and also by the respondents except as to the delivery of the share documents and the introduction of the shares on the Stock Exchange, but as the claimant had never called upon them to do these things there was no breach of contract in these respects. The Tribunal consequently decided that the claim failed, and awarded the respondents the sum of £75, to be paid by the claimant in respect of the cost of the proceedings.

TELEPHONE POLE WAYLEAVE CASE.

IN THE Victoria Courts last week Lord Ilkeston had before him a case brought on behalf of the Postmaster-General, respecting the rights of property owners to determine agreements for consents given for placing telephone posts on private property and the appropriate annual amount which should be paid by the Post Office for the facility.

A consent had been given in 1910 to the National Telephone Co. by Mrs. Helen Hector, of Edgbaston, for the maintenance of a pole, underground pipe, and stays in the rear of property owned by her at Parker Street, Edgbaston, for an annual payment of £12. On Thursday last, the Post Office engineers removed the pole, on account of deterioration, and without again approaching Mrs. Hector, and it was alleged that some damage had been caused to the property. As a consequence notice under the terms of the agreement was given for the removal of the pole, and the case was taken up by the Postmaster-

General under the extended powers granted to him by the Telegraph (Construction) Act, 1916.

Evidence was given on behalf of the Post Office that no complaints of damage or inconvenience had been received from the occupiers of the premises, and that the amount of 25s. previously paid had been agreed to by the National Telephone Co., who had no statutory powers, and that under the conditions as altered by the recent Act, the Postmaster-General was advised that any amount paid in respect of wayleave should bear direct relation to the loss or inconvenience caused by the presence of his fixtures, which in this case was assessed by him at 2s. 6d. per annum.

After hearing evidence, Lord Ilkeston made an award consenting to the maintenance of the fixtures subject to a payment of 2s. 6d. per annum. He assessed the costs of the appeal at five guineas, and directed that they should be paid by Mrs. Hector.—*Wolverhampton Express*.

POSTMASTER-GENERAL v. THE MAYOR AND CORPORATION OF LIVERPOOL.

ON November 24th, in the Divisional Appeal Court of the King's Bench, before Justices Shearman and Salter, the appeal of the Postmaster-General from a decision of Judge Thomas of the Liverpool County Court commenced hearing. The original claim was (according to a report in the *Liverpool Daily Post and Mercury*) to recover the agreed cost of repairing certain damage done to telephone plant belonging to the appellant by the electric light mains belonging to the respondents as the electrical authority for the City of Liverpool.

The Attorney-General and Mr. E. Justin Lynskey were briefed for the appellants, and respondents were represented by Mr. F. H. Maughan, K.C., and Mr. Layton.

The grounds of appeal were that the judge misdirected himself and was wrong in law in a number of points.

Further, it was submitted that there was no evidence from which the learned judge was entitled to infer that the plaintiff's plant was laid improperly or negligently, or that the damage to the plaintiff's telephone plant was occasioned or contributed to thereby. It was contended that the judge was wrong in not holding that the damage to the plaintiff's telephone plant was the result of the defendants' acts of nuisance, and that the acts of the National Telephone Co., Ltd., whether amounting to negligence or not, were no defence to plaintiff's claim against the defendants.

The appellant finally submitted that on the facts he was entitled to judgment for the agreed sum of £40 8s. 7d., the respondents' costs of repairing damage in respect of which the judge on April 15th, 1921, directed a non-suit.

Mr. JUSTIN LYNKEY, in putting the case for the appellant before the court, dealt at some length with the grounds of appeal, and read the judgment in respect of which the appeal was brought.

Replying to JUSTICE SHEARMAN, counsel for the Postmaster-General said he claimed to be clearly entitled to recover from the Liverpool Corporation damages reasonably following from a nuisance. The only thing which the county court judge in reality found was that plaintiff's telephone cable was almost in contact with the Corporation's electric light cable. In spite of this finding, he contended, appellant was entitled to damages for a nuisance. Briefly, his action was founded on the claim for nuisance, and respondents replied that they relied on the agreement.

One provision in the agreement was that the Corporation was not to be liable for damages caused by electric light wires.

The case was adjourned.

MARTIN v. LONDON & COLOGNE S.S. CO., LTD.

IN THE King's Bench Division on November 25th, Mr. Justice Rowlatt heard an action brought by Mr. C. Martin, hair-dresser and dealer in electrical appliances, against the London and Cologne Steamship Co., Ltd., in which the plaintiff claimed the return of goods or their value and damages for detention, or, alternatively, damages for conversion of goods to defendants' use.

Mr. STUART BEVAN, K.C., for the plaintiff, said the goods in question were a case of electrical appliances comprising two dozen hair dryers and two dozen massage machines. In September, 1920, he bought a quantity of things, including these four dozen articles, from the International Trading Association, and remitted the sum of 30,000 marks in payment. It appeared that the International Trading Association purchased the goods from a firm called Reiss & Graeber, in Cologne, and paid them. It was then arranged by forwarding agents in Cologne that the goods should be shipped to England by the defendant company under a bill of lading dated November 26th, 1920. The goods were to be delivered to the order of the plaintiff, who endorsed the bill of lading and sent it to the defendants for them to send him the articles, and he expected to receive them. Then a Mr. Hart appeared and claimed them. His story was that he had employed the company, who in turn employed the International Trading Association to buy for him, not electrical appliances, but toys from, among other firms, J. Reiss & Graeber, and he had remitted through the company and the International Association 35,000 marks to pay for the toys. He apparently complained to the shipping

company that had paid for toys he had not received, and that the company ought to deliver these electrical appliances to him. The defendants, having received the plaintiff's bill of lading, against which they were to deliver the goods, proceeded to add a disbursement of 19,564 marks, and so in effect that Mr. Martin could only have the articles if he paid them that sum, and that it would not do. He ought to have had them in time for the Christmas trade.

Mr. CARTWRIGHT SHARP, for the defendants, argued that Mr. Martin's money had been applied to some purpose other than that for which it was intended it, and that it was Mr. Hart's money which he had gone to the payment of these electrical goods; therefore Mr. Martin could not get them unless he reimbursed the money which had been paid by Mr. Hart.

His LORDSHIP said he could see no answer to the claim, and the plaintiff went into the goods or their value. He awarded him a hundred guineas with costs.

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address for our possession.

1. Durability of Lead-covered Wiring.

With reference to the controversy which has been appearing in your recent issues as to the durability of lead-covered wiring, the following fact may be of interest to your readers.

I recently had occasion to pull out a length of 19/20 lead-covered cable in connection with the reconstruction of a country-house installation. This cable had to the knowledge of the servants been in for 14 years. Where it passed through a retaining wall it was enclosed in a porcelain duct; but throughout the remainder of its length it had no protection whatever, being in at a depth of 4 ft. through the ordinary soil of the garden. On getting this cable out I found the lead sheathing to be in perfect condition, and the cable appeared to be as good as new.

I think your readers will agree that this speaks well for the durability of this class of cable, and I should be pleased to send a sample pipe to anyone interested.

Having had some experience of Admiralty ship wiring also, I have found lead-covered cable of all sizes fixed under some of the worst conditions that it is possible to think of, viz., boiler and engine rooms, navigation lights exposed to all weathers, &c., yet standing up to its work excellently.

I am inclined, with some of your correspondents, to think that workmanship has more to do with the satisfactory working or otherwise of a lead-covered installation than the material itself, and Mr. Allwright has certainly given a list of faults which he constantly found.

W. Lawrence.

Torquay, 19th December 22nd, 1921.

The pros and cons advanced by correspondents interested on both the practical and technical sides have proved particularly enlightening, in so far as they prove that the differences of opinion expressed on this important point by engineers depend upon the party they represent, i.e., supply or demand.

Let us take a concrete case. The Alliance Electrical Co., London, used Siemens Stannos wires for external and internal wiring in connection with the installation of electric light in the Covent Garden Market, as shown in your advertisement columns. Any wiring in a market of this description would have to withstand some very rough treatment and would be subject to exposure to all conditions of weather, especially wet walls. It was a non-lead-covered system adopted in preference to a lead-covered one, if the latter is so very efficient, as "Otello" has it? Why, simply because, as previous correspondence proves, engineers tackling the question from the demand side know lead-covered wiring to have been superseded by modern improvements, and supply using every effort to his demand. "Otello" undoubtedly is interested in the supply party, whilst Mr. A. J. Abraham and others represent demand. We laymen are largely governed by the actions of the practical men on the demand side, and certainly in view of concrete examples like the present, and an analysis of the correspondence, can only come to the conclusion that lead-covered wiring, whether protected or not, is obsolete.

A Layman.

November 1st, 1921.

As a close student of methods of wiring extending over a number of years, I have been deeply interested in the correspondence in your columns on the above subject.

Like Mr. W. A. Allwright, I, too, have unfortunately seen installations where the work has been carelessly done, and even "scamping," which, for the sake of the good name of electricity generally, is greatly to be deplored. But there is this to be said for lead-covered wiring—that it is generally easier to detect "scamped" work and have it put right, than

it is to deal with such "scamping" in steel tube or wood casing.

Your correspondents who stress the importance of efficient bonding and earthing do so wisely, and with an evident sense of the almost absence of consideration for these important but simple operations, displayed by many "cheap" wiremen contractors.

I cannot understand why there should be the least difference in bonding and earthing. The best of the proprietary lead-covered wiring systems have accessories which make bonding and earthing easy. My experience with those supplied with the Henley wiring system convinces me that no wireman who does not want deliberately to "scamp" his work has any excuse for not doing this essential part of the installation properly and permanently.

In conclusion, I am rather surprised that an electrical engineer like Mr. A. J. Abraham, should, as he did in your issue of the 4th November, advocate any system which can be put in by "the jerry wireman's smallest boy." Mr. Abraham is perfectly entitled to retain his hatred of lead-covered systems, but surely it is not for him, or any electrical engineer, to advocate methods capable of encouraging the army of jerry wiremen. However perfect the system, Jerry will probably botch it, as closely as you like to spend your time in "watching his ends."

W. R. Clements.

London, S.W.,

November 25th, 1921.

Having had considerable experience with this class of work, I should like to say that we have used the Henley system since 1912, and we must have used scores of miles of their cable or Callender's.

These cables have been used in factories, installations of all kinds from public supplies, and private plants; but the bulk of our work consists of country house lighting. We have used it all over the British Isles and on the coast from Cornwall to the Hebrides, and we can find no fault with it in any shape or form.

Among our country-house lighting we have carried out complete installations in many old castles, manor houses, and abbeys, &c., which are built of stone and have no damp-proof courses, whilst in some cases the houses lie so low in the ground that the lawns are level with the windows of the ground floors, and although these houses are naturally damp, we have experienced no trouble up to the present.

Quite recently we made a thorough inspection of an old abbey that was wired by us in 1913, and found the insulation tests perfect and no trace of electrolysis at either switch or fittings ends of the cables or at the bonding. This is a 100-volt d.c. job. There is no trace of chemical action on the sheathing, although most of the cables are run on the surface of stone walls which have been left plain and unplastered.

We have never found this cable attacked by rats or mice.

The main points in erection are absolute continuity of the sheathing with perfect bonding and earthing, careful planning of runs, "feeding out" of cable from the drums, and good workmanship.

We have often been called in to inspect work that has been spoiled by careless workmanship, and we think it is generally that the man is strange to the work, which is quite different to wiring with conduit or casing.

If any contractor or consulting engineer, who is not conversant with lead-covered wiring, would like to inspect any of our jobs, the writer would be only too pleased to fix up an appointment and run him out to see some of our country house jobs or factories.

Rich. A. Parsons.

Gloucester,

November 22nd, 1921.

The majority of your contributors to this interesting correspondence agree that everything is right if the cable is properly bonded throughout by the bonding devices supplied by the makers of the various wiring systems, but, if the naughty wireman omits them, and the wood blocks hide the omission, everything is wrong.

There is, however, one wiring system, a feature of which is that the edge of the bonding ring can be seen at the bottom of the blocks, and the foreman or inspector can convince himself at once that it is properly inserted.

Modesty forbids that I should say which wiring system this is.

F. Charles Raphael.

Ponders End,

November 28th, 1921.

One Solution of the Frequency Problem.

I have read with considerable interest Mr. C. Sutton's article under the above heading in your issue of the 25th November, and whilst the solution may be the most satisfactory when employing the Ljungstrom turbo-alternator, I cannot agree that the solution as outlined gets over the difficulty with minimum capital outlay and minimum losses when compared with other alternatives employing a standard impulse or reaction type of turbo-alternator.

Summarised briefly, Mr. Sutton's scheme, I understand, is to provide a new turboalternator unit which can generate its full load output at one of two frequencies or generate at two frequencies with the respective loads split up in any proportion within the capacity limit of the turbine. Also, to provide a frequency-changer available for use with either generating plant installed in the station, and to add this with minimum capital outlay and minimum losses.

An alternative to the scheme outlined by Mr. Sutton would be to employ a standard impulse or reaction turbine and, instead of coupling one alternator only, to couple two alternators in tandem, one of which would be capable of loading the turbine fully at 100 cycles, and the other at 50 cycles, the combined set being capable of:

1. Giving full load output at 100 cycles, or
2. Giving full output at 50 cycles, or
3. Giving any combination of outputs at 50 and 100 cycles within the capacity of the turbine, or
4. Running as a frequency-changer by shutting off steam to the turbine when the alternators are in synchronism across the bars, allowing the turbine to be run round by the two alternators acting as a frequency-charger. It might be possible so to arrange the turbo-set that the turbine be uncoupled from the alternators and by means of a pony motor the two alternators could be run up as a frequency changer having double the capacity of the coupler set suggested.

The advantages of a scheme of this description are:—

(a) Ultimately when the 100-cycle supply ceased the 100-cycle alternator could be taken away, leaving a standard 50-cycle turbo-set.

(b) The 100-cycle alternator could be rewound for 50 cycles, and would come in for the next set to be installed, instead of having to be written off as obsolete plant as would be the case with the coupler set and one alternator end of the Ljungström turbine set.

(c) There would be no conversion losses.

(d) If one alternator only were required the losses in the other (unexcited) would be windage and friction only.

I should expect the capital outlay and losses with a scheme of this description to be considerably better than with the coupler set scheme outlined by Mr. Sutton, not forgetting the question of obsolete plant.

I do not profess to know sufficient of power station management to say whether both or either scheme presents any practical difficulties; and while Mr. Sutton's scheme may be one solution of the frequency problem, it does not seem to me to be all that he claims, namely, *the solution embodying minimum capital outlay with minimum losses.*

As one interested in the sale of impulse turbines I may be unduly biased and will therefore welcome criticism.

E. W. Dorey.

London,
November 28th, 1921.

A Dynamo Problem.

I would suggest that "Electron" carries out the following tests to end his trouble:—

1. Check both ammeters with a standard instrument.
2. See that all switches are ground in on this machine, including the equaliser switch and circuit breaker.
3. Examine all nuts, cable sockets, and connections, and see that all is in proper order.
4. See that the ammeters are in circuit in the opposite pole to the equaliser.
5. Examine the shunt regulator and carry out a lamp test on it.
6. Make a pressure drop test across shunt coils and see that they read about the same.
7. Carry out the same test as the above on the series winding.

G. W. L. Wolland.

Norwich
November 28th, 1921.

Telephone Line Work.

I was interested in the paper by Mr. E. S. Byng on telephone work in America.

Mr. Byng states that 20 men drew 4 miles of cable in 10 hours of 44 drums. Why 44 drums containing 160 yards of cable? A drum must have been placed at every joint box, which, no doubt, would look very pretty on a road or street. Is the time taken in placing these drums, mounting them, dismounting and carting away included in the 10 hours? I am afraid not. Also the cable must have been small and stretched in the drawing-in wire, instead of their having to draw in a rope but perhaps in America they place a magnet in the joint box, switch on the juice, and the job is done.

It is also stated that 150-170 pairs of wires are jointed per hour. It makes one want writing about it. That is a fair rate there would be more comes and this than good pairs, and I should not like to have to test the cable. There are jointers here who can do 70 per hour, and the job is done, and they don't have to spend time opening up joints for faults. That man is better than the 160-170 pair man, whom I have never seen, nor anyone else.

It is also stated that the jointers' mates are better. I have had jointers' mates here who could make wire joints as well

as jointers, and gave them every assistance, and Mr. Byng has some to-day, but do they get the help given them that they should? No. The paper states that they would. Also I have seen a mile and a half of composite cable drawn into ducts with split couplings (not boxes), and off 3 drums, not 44, in 9½ hours, with 10 men and tackle off job. I am afraid Mr. Byng's paper is a little misleading.

A. E. Tubb.

Birmingham.

November 28th, 1921.

The Profits of the A.E.G.

I venture to suggest that your article on the profits of the A.E.G. is rather severe on the Berlin correspondent of the *Daily Telegraph*. It is no more fair to reckon German profits in sterling than it would be to reckon sterling profits in dollars, or French francs in Swiss francs. To Fritz a mark is a mark, even if its purchasing power is only one-fifth of its pre-war purchasing power.

With regard to the relative prosperity of Germany and this country, one must remember that there are four to five times as many unemployed in this country as in Germany. Which is the more prosperous country?

L. M. Sandison.

Ayton,

November 28th, 1921.

The Installation and Use of Electricity in Coal Mines.

New Regulations and Memoranda have just been issued by the Home Office relating to the above, and several interested bodies have discussed them, such as the Association of Mining Electrical Engineers.

The outstanding features of the new Memoranda appear to indicate that in the opinion of the inspectors, the weak point up to now, of electrical gear as installed in mines, is the switchgear rather than the motors.

There is, however, one problem relative to switchgear which appears to have been entirely overlooked both in the present regulations and in any previously issued, namely, the kVA breaking capacity of the oil switch.

Taking the average colliery equipment supplied with power generated on the premises, the total capacity of the generating plant seldom exceeds 3,000 kVA. Assuming normal conditions of reactance, &c., for turbo plant, this capacity would necessitate the kVA breaking capacity of any oil switch to be, say, 18,000 kVA, and any mining-type oil switch of repute would be capable of rupturing a short circuit on such a system. There are, however, a number of collieries taking electricity supply from a public supply authority. The writer has knowledge of at least two collieries each placed within a mile of the public supply generating stations, one of which stations has a capacity of something like 40,000 kW.

This under similar conditions will require an oil switch breaking capacity of 240,000 kVA, and it is extremely doubtful whether there is any mining-type oil switch on the market which would deal with this capacity.

There is another aspect of the case which should also have consideration, namely, the fact that public supply authorities are admittedly not installing switches on consumers' premises which have the required breaking capacity for the worst possible short-circuit conditions which can apply. This policy may or may not be right, but the attitude of the supply authority engineers appears to be: first, that a short circuit or earth in most cases builds up gradually, and as a consequence, oil switches are seldom required to break what is really a dead short circuit.

Secondly, even should the short circuit be of such a nature as to damage the oil switch, the latter will in most cases rupture the circuit and if it is badly damaged or destroyed in doing so, the monetary loss incurred by the destruction of an oil switch occasionally is nothing compared with the increased capital cost which would be entailed in installing oil switches up to the full breaking capacity in every case.

This line of argument is reasonable for surface work where the explosion of an oil switch, enclosed as a rule in sheet steel or stonework cubicle, is not likely to cause either external damage or loss of life.

The consequences of the explosion of an oil switch below ground are very different, and in the case of a colliery taking power from a public supply, it might be necessary to install oil switches on the feeder circuits below ground, which were very much larger than the supply company's main switch.

It would be hard to convince any colliery company that this was necessary, but nevertheless such might undoubtedly be the case if the spirit of the Mines Regulations were to be lived up to. It is doubtful whether colliery electrical engineers have ever really considered this question of oil-switch breaking capacity, but it appears to be one of first importance from the safety-in-mines point of view, and it is a question which should be seriously considered in view of the present-day tendency to take electricity supply from large bulk sources rather than to install separate isolated stations.

There is no doubt that the risks of explosion on switchgear are considerably greater where the supply comes from a bulk source as against a supply which comes from a small private station, and if colliery installations are going to be

connected to the huge industrial networks which will be the vogue in the future, would suggest this matter be given very careful consideration in order to avoid the possibility of accidents which might damage the reputation of electricity supply in general.

F. G. Travis.

Manchester,
November 28th, 1921.

Electricity in Isolated Buildings.

The article under the above heading by Mr. E. H. Freeman is most interesting, but one may question if the whole contribution is not of the nature of an apology. In any case the matter submitted, though excellent, gives undue precedence to one class of plant, and does not sufficiently or comprehensively review the whole of this important subject.

The class of plant, *i.e.*, non-automatic, so enthusiastically described by Mr. Freeman, is unquestionably a sound proposition when the work is properly carried out. Such installations, however, usually apply to what may be termed the larger country houses, establishments with anything over 100 lights, and a fair power load. This class of resident, however, does not by any means represent the average country dweller, who with the small automatic plant, now on the market, may enjoy equal felicity in an electrical sense to that of the bigger folk. In the past, it is to be feared that many non-automatic plants have merely comprised a "general-purpose" farm engine belted to a high-speed dynamo, the whole outfit being only suitable for battery-charging, duty calling for much attention.

The descriptions and illustrations of representative "non-automatic" installations put forward by Mr. Freeman are undoubtedly excellent, but the refinements enumerated are bound to involve the owner in relatively large expense. To best meet any extensive country demand for electricity is required an isolated plant to deal with 30 to 40 lights and small-power duty, suitable for installation in any existing outhouse (or even a basement), to be simple in operation and maintenance, and to require no special attendance. This matter of attendance is all-important, for by no means every country dweller has a gardener or odd-man about the place. Without doubt, it is the relatively low cost of installing, with the minimum amount of attendance required, that is responsible for the large sale of the "automatic" type of plant. In fact, if very many present owners of small plants of the automatic type had been compelled to go to the expense apparently involved in the case of jobs illustrated in Mr. Freeman's article, there would have been no sale!

Many disputable points are raised by Mr. Freeman, *e.g.* relative efficiencies, fire risk, correction of defective cells, overcharging of battery, voltage, supply of appliances, &c., where it may be said that the automatic plant is in no way inferior to the non-automatic type. A further argument advanced, that those attending to any automatic plant forget the existence of lubrication, fuel supply, and general cleaning

is peculiar, as this could not be done unless such party were deliberately careless. The list of plants given is noted to be in error in one or two instances at least; moreover, it is very far from complete. It may also be said that numbers of automatic plants have been in operation for at least 10 years, so that this proposition may be taken as proven.

On the power side the position is equally clear, and the method usually recommended of running the generating set when there is a power load (motors, radiators, &c., up to the capacity of the plant) is quite sound, as any excess current over that actually required may pass into the battery, and thus there obtains a most economical system of working. Certainly, such a method of operation, or the handling of lighting load in an equivalent manner, is justifiable, and is an infinitely better proposal than a mere battery-charging proposition. Apart from this, it is an indubitable fact that the majority of average installations of the kind in question are primarily for lighting duty, the power side being more or less a side-issue.

As suggested in the foregoing, the various plants—full, semi, and non-automatic—have their respective fields of application. There is, however, little doubt but that the advent of the semi-automatic plant in this country has brought much additional business to the electrical trade—business that would have been wholly lost were such alternative not available. Semi-automatic plants, in particular, more closely meet the general demand for small country-house electric lighting than any other type as, with the relatively small wiring job attached, they more closely fit the average country dweller's pocket. A commentary that applies to the situation is contained in a recent traveller's report, which states: "This firm's country-house work has been in handling large jobs only, but as this class is about worked up Mr. . . . is now considering small plant jobs, of which he is likely to get quite a few." One may believe this rather bold statement just about represents the present-day state of affairs.

Marshall Tate.

London,
November 26th, 1921.

Unemployment and the Cure.

In your issue of October 28th, in the article entitled "Unemployment and the Cure," it is stated that it is foolish to attempt economies by reducing the selling price. This does not seem to me to make sense with the context, and it has occurred to me that perhaps there has been a mistake, and that "price" should read "force." We should then have: "The futility of attempting to economise by reducing the selling force is manifest." With that I think everyone will be in agreement.

Quester.

November 28th, 1921.

[Our correspondent's suggestion is correct. The word "force" was incorrectly printed as "price."—Eds. ELREC. REV.]

BUSINESS NOTES.

Notice to Advertisers.—The attention of advertisers is directed to an announcement which appears in our advertisement pages to-day, respecting the dates for sending in "copy" for our issues of December 23rd, and 30th.

Bankruptcy Proceedings.—T. RAWSTHORNE, electrical engineer, 67b, Paradise Street, West Bromwich.—Receiving order made November 21st on debtor's own petition. First meeting, December 9th, at the Official Receiver's Offices, 191, Corporation Street, Birmingham. Public examination, December 14th, at the Law Courts, West Bromwich.

S. H. DOUGHERTY (Mersey Electric Co.), electrical engineer, Liverpool.—Last day for proofs for dividend, December 9th. Trustee, H. W. Bowler, 30, North John Street, Liverpool.

J. SMITH & SON, electrical engineers, 1, Central Street, E.C.—Receiving Order, November 24th. First meeting, December 7th. Public examination, February 7th, both at Carey Street, W.C.

W. BENNETT, electrical contractor, Back Sitwell Street, Derby.—First meeting, December 7th, at the Official Receiver's Offices, 4, Castle Place, Nottingham. Public examination, December 20th, at the Court House, Derby.

C. P. M. DOWNIE (P. Downie), electrical engineer and factor, Southend-on-Sea.—Last day for proofs for dividend December 14th. Trustee, T. Gourlay, 29, Russell Square, W.C.1.

J. HARRISON (Harrison & Son), electrical engineers, Southend-on-Sea.—First and final dividend of 3d. in the £, payable December 9th, at 29, Russell Square, W.C.

G. H. GER, electrician, 10, Front Street, Annfield Plain, Durham.—First and final dividend of 2s. in the £, payable December 7th, at the Official Receiver's Offices, 4, Northumberland Avenue, Newcastle-on-Tyne.

Company Liquidations.—NATIONAL ELECTRIC TIME CO., LTD.—Meeting of members is called for January 2nd at 18, Queen Street, E.C., to hear an account of the winding up from the liquidator, Mr. A. C. Vincent.

FRITCHETT & GOLD & ELECTRICAL POWER STORAGE CO., LTD.—Meeting of members called for December 30th at 50, Grosvenor Gardens, Victoria Street, S.W., to hear an account of the winding up from the liquidator, Mr. A. M. Woodward.

ELECTRICAL & ENGINEERING DEVELOPMENT, LTD.—Winding-up voluntarily. Liquidator, Mr. D. J. Longden, 67, Broxash Road, London, S.W.11, who is authorised to enter into an agreement with Electrical Utilities, Ltd., on terms stated.

ENGINEERING DEPOTS, LTD.—Particulars of claims must be sent to the liquidator, Mr. C. H. Wells, 21, Fargate, Sheffield, by December 31st.

Dissolutions of Partnership.—S. G. COZENS & CO., electrical engineers and contractors, 63, Queen Victoria Street, E.C. Messrs. S. G. Cozens, R. Grose, and E. G. Coombs have dissolved partnership. Messrs. S. G. Cozens and Mr. E. G. Coombs will attend to debts and continue the business.

LOWNDES & STEVENS, automobile, electrical and mechanical engineers, Trafford Park Garage, Manchester.—Mr. E. Lowndes and Mr. E. J. Stevens have dissolved partnership. Mr. Stevens will attend to debts and continue the business under his own name.

Trade Announcements.—We are informed that Messrs. T. E. NANKIVILL and S. E. GRUBE have resigned their directorships of the STANDARD ELECTRICAL & MAINTENANCE CO. (SEMCO, LTD.), and are not now connected with the firm. Messrs. C. E. Rapson and E. F. Burrill are the remaining directors.

THE ANTI-ATTRITION METAL CO., LTD., have closed their city offices (35, Queen Victoria Street, E.C.), and have opened more extensive offices at 1, Victoria Street, Westminster, S.W.1.

THE PARADAY ELECTRICAL INSTALLATION Co. are commencing business at 14a and 14b, Railway Approach, Shepherd's Bush, London, W.12. They wish to receive trade catalogues and terms from manufacturers and suppliers of installation accessories.

MR. JOHN C. WHITE, JUN. has resigned the position of manager of the electrical department of Messrs. Weisman Electric Co., and is commencing business as an electrical engineer at 11, Victoria Street, Windsor, in partnership with Mr. J. C. White & Co.

THE LION ACCESSORIES CO., LTD., are holding stock in London at their new address referred to last week (13, Corsair Street, E.C.4).

Messrs. SHAW & Co., of Manchester, have taken over show and sale rooms at Booth Street West, An Saints, Manchester, where they will hold weekly auction sales of electrical goods and machinery.

Catalogues and Lists.—**BRITISH INSULATED & HELSBY CABLES, LTD.**, Prescott, Lancs.—A catalogue of jointing materials, tapes, compounds, paint, &c.

Messrs. JOHNSON & PHILLIPS, LTD., Charlton, S.E.7.—"Transformer Abstracts," an illustrated booklet giving descriptions of a number of types of transformers. The publication is designed to aid selection.

VANNER TIME SWITCHES, LTD., 45, Horseferry Road, Westminster, S.W.1.—A folder illustrating four types of time switches for shop window use, &c.

THE LION LIFT CO., LTD., 20, High Holborn, W.C.1.—An illustrated catalogue describing a number of types of passenger lifts, engines, controllers, &c.

Mr. ALFRED E. DEAN, Leigh Place, Brooke Street, Holborn, E.C.1.—A priced and illustrated catalogue of X-ray apparatus, including cabs, switchboards, interruptors, couches, portable sets, tube stands, &c.

THE RELAY AUTOMATIC TELEPHONE CO., LTD., Marconi House, Strand, W.C.2.—A booklet illustrating a 50-line "Relay" installation, with notes on various parts of the system.

Messrs. HIGGS, Bros., Sand Pits, Birmingham.—Monthly magazine for December, containing stock lists of a.c. motors and d.c. dynamo and motors, notes on shafting, humorous items, &c.

ELECTRICAL UTILITIES, LTD., 1 & 3, Shelgate Road, Battersea Rise, S.W.11.—Priced leaflet, O.R./1, illustrating and describing the new "Utility" cooker-radiator.

THE CHEMICAL ENGINEERING CO. (MANCHESTER), LTD., 49, Deansgate, Manchester.—An illustrated pamphlet giving a description of the "Kek" densimeter, a simple device for continuously indicating the density of water in steam boilers, by the balancing of a column of distilled water against a column of boiler water.

Book Notices.—"Blue Printing and Modern Plan Copying," by E. J. Hall, M.A. Mech.E., 130 pp., 65 figs., London: Sir Isaac Pitman & Sons, Ltd. Price 6s. net.—This publication deals very fully with the subject of the first importance to engineers and architects. A large number of systems are described, and comparative costs are given, of daylight printing, various types of printing by artificial light, the use of the photostat, photo-mechanical copying, &c. An appendix treats of the preparation of drawings for photographic line blocks. The illustrations are of value in ensuring a proper understanding of the text.

"Electric Lighting in Factories and Workshops," by Gaster and Dow (37 pp.). London: The General Electric Co., Ltd. *Gratis.*—This booklet deals with the effect of lighting upon the efficiency and well-being of workers; the cost of lighting in relation to the cost of production in a factory; the ascertainment of the amount of lighting necessary; and types of lighting systems. Illustrations of actual applications are included.

"Ypres to Verdun," a collection of photographs of the war areas in France and Flanders, specially taken by Sir Alex. B. W. Kennedy, F.R.S., 84 pp., 124 plates. London: Country Life, Ltd. Price 12s. net.

"Pattern Making," by W. R. Needham, pp. iv+114; 171 figs., London: Blackie and Son, Ltd. Price 2s. 6d. net.

"A First Book of Applied Electricity," by S. R. Roget, Pp. vi+117, 112 figs., London: McMillan & Co., Ltd. Price 2s. 6d.

"Rays of Positive Electricity and their Application to Chemical Analyses," by Sir J. J. Thomson, F.R.S., Pp. x+237; 41 figs., 9 plates. London: Longmans, Green & Co. Price 16s. net.

Underground Railways Joint Committee.—A Joint Committee representing employers and employed is being set up to deal with wages and conditions on the Underground group of railways. This machinery will be similar to that which exists on the trunk railway lines, and is in accordance with the recommendations made between the companies and the trades unions.

German Activity in Spain.—As has already been stated, German trade propaganda is very active in Spain, and German commercial interests are being protected as best as before the war. German trade papers in the Spanish language are circulated widely among the commercial community. H.M. Consulate at Valencia has received the first of these United Kingdom publications received are still usually printed in English, and are of great value to the Spanish commercial community is concerned, serve no useful purpose.

The Lyons Fair, 1922.—British manufacturers and traders should take note that the Spring Fair at Lyons takes place from March 1st to 15th, 1922. No words of emphasis should be needed to-day to impress our readers with the importance of this event from the international trading point of view. In previous fairs, quite a number of British electrical engineering firms have taken a very practical interest, and we have no doubt that many of them will desire to embrace the opportunity which will present itself a few months hence, of displaying their products before the eyes of our friends in France and of the large number of buyers from other countries who will make Lyons a rendezvous in March. British exhibitors will be taking part in the British Industries Fair in London and Birmingham at about the same time (February 27th to March 10th), but the Lyons opportunity is not one that should be missed, and we recommend our firms to get into touch with the British representative of the Lyons Fair, at 31, Budge Row, London, E.C.4., who will furnish all particulars including the conditions, &c., under which it is possible to have a stand of one's own including space, erection, and lighting and heating, for a total outlay of about £100.

The E.P.E.A.—REPORT OF NATIONAL EXECUTIVE COUNCIL.—The report of the N.E.C. of the Electrical Power Engineers' Association, published in the *Electric Power Engineer*, expresses regret at the small number of "industrial" members who have joined the Association. It was debated whether to drop this section or to enlarge the Association's scope to include all engineers who were connected in any way with electrical engineering. The following resolution was adopted: "That in the opinion of this Council the policy as now laid down by the S.T.E. is detrimental to the best interests of our industrial members, and therefore unless some modification can be made in this policy in consultation with this Association, the activities of the E.P.E.A. shall be extended to embrace the whole of the technical staffs engaged in the design, manufacture and erection of machinery used in the generation, utilisation and distribution of electrical energy."

It was also resolved that the whole of the technical engineering staffs of electric railways and tramways be eligible for membership. The Council decided to make subscriptions the same for all branches. The "sick leave" clause embodied in the Schedule is still a cause of differences; it is therefore to be reconsidered and, if necessary, revised. Mr. Essex has been added to the number of the Association's representatives on the National Joint Board, making the total seven. A draft schedule of salaries in undertakings of less than 1,000 kW capacity has been drawn up, and is still under the consideration of the N.J.B., and it will be submitted to the District Boards. It has been decided to become affiliated to the National Federation of Professional, Technical, Administrative, and Supervisory Workers, and two delegates are being appointed. Until the Council has definitely decided upon the nature of the qualifications to be required of applicants for membership of the Association, the rule relating to the passing of the A.M.I.E.E. examination is to be held in abeyance. The diversity of conditions relating to the positions of charge engineers in various undertakings has militated against a satisfactory arrangement of grading. The suggestion of the formation of a mutual benevolent fund has received approval, and the N.E.C. has decided to fix a compulsory annual subscription of 5s. per member. The question of unemployment has proved a serious one. The N.E. Division has instituted a voluntary levy of 2s. 6d. per week upon employed members for the benefit of those out of positions. The other sections have been circulated upon the subject, and, at the same time, the Management Committee is considering the matter.

Dundee Corporation Contracts.—A committee of Dundee Corporation is considering the advisability of inserting in contracts a model clause to meet rises and falls in prices. In the course of discussion of the matter a member expressed the view that contractors would not supply the Electricity Committee if a clause covering reductions in prices were included in the contracts.

Dutch Enterprise in Germany.—A short time ago a Dutch company was formed under the title of the Reuss Electricity Co., of Amsterdam, to acquire the undertaking of the firm of Vogel & Muller, of Gera, who were engaged on the construction of electric motors and the extensions of installation work, &c. The share capital amounts to 500,000 florins, out of which shares for 200,000 fl. are now being offered by a Dutch Bank Association for subscription in Germany.

French Companies.—*Société Hydroelectrique de Luz St. Sauveur* is the title of a company formed with a capital of 300,000 fr. for the production and utilisation of electric energy. Its offices are at 115, Cours d'Alsace-Lorraine, Bordeaux.

There has been established at Paris (76, Faubourg Saint-Antoine) the *Société Française des Etablissements Nioca*, with a capital of 1,400,000 fr., for the manufacture of insulators and electrical apparatus.

There has been formed at Paris (56, Faubourg Saint-Honoré), the *Société de Reconstruction d'Usines Sinistrées* (Groupement Energie Electrique du Nord de la France, Société Reconstitution de l'Eclairage par le Gaz et l'Electricité), with a capital of 1,000,000 fr. for the rebuilding of factories in the devastated regions.

Illuminating Glassware.—The Board of Trade has given notice that, in exercise of the powers conferred upon it by Part II. of the Safeguarding of Industries Act, 1921, it has referred to a Committee constituted for the purposes of that part of the Act, and consisting of Sir William Ashley, Ph.D. (chairman), Mr. J. Arthur Aiton, O.B.E., Sir Thomas W. Allen, Sir John N. Barran, Bt., and Mr. F. E. Davenport, a complaint by the British Flint Glass Manufacturers' Association and the National Flint Glass Makers' Society, that articles of domestic glassware, illuminating glassware, and mounting glassware, manufactured in Germany and Czecho-Slovakia, are being sold or offered for sale in the United Kingdom at prices which, by reason of depreciation in the value in relation to sterling of the currency of the above-named foreign countries, are below the prices at which similar goods can be profitably manufactured in the United Kingdom, and that by reason thereof employment in the glass industry in the United Kingdom is being or is likely to be seriously affected.

The Committee proposes to hold its first sitting for the taking of evidence at 2.30 p.m. on Monday, December 12th, 1921, at the Hotel Windsor, Victoria Street, London, S.W.1. The Secretary to the Committee is Mr. W. G. Fergusson, Board of Trade, Great George Street, London, S.W.1, to whom all communications should be addressed.

English as She is Written in Germany.—We have been privileged to see a copy of a circular issued by a Berlin export firm offering metal-filament lamps for sale in the British market. We reprint it as an interesting example of trade literature "Made in Germany."

Conformable the surrounding prices and conditions of delivery I am in the situation, to day to deliver large posts of metal-threat-lamps

first german quality, with edison ore svan-brass-socket in execution of peace

if you superscribe your orders going about.

I foot at this offert upon large conclusion wich I did place early.

The prices are fob german haven ore port-paid german border, incl. original chests and export tax, payable by accreditiv by an german bank, to pay out against bill of acceptation.

I advise to you, an quick resolution therewith you can become the purveying still this season.

Yours very truly

Down in the right-hand corner are instructions to the reader "please to turn round," otherwise turn over and see on the reverse side the list of prices at which these "metal-threat-lamps, half-wat-lamps gas fillt, and glimm-lamps of light propaganda" are offered.

German Metal Interests.—According to *The Times*, Dr. Emil Hirsch, head of one of the world's biggest metal groups, has been in London on a visit from Germany; also Herr Hugo Stinnes endeavoured while he was in London to secure large quantities of steel scrap for his German works.

Unemployment.—The latest available information shows a further increase in the total of unemployed persons, the figure for November 18th being 1,817,000, as against 1,789,432 a week earlier. There was a slight decrease in the number on "short time." On June 24th last the total of unemployed was 2,177,899.

Local Electrical Exhibitions.—Mr. Rowberry, a local electrical contractor, arranged an electrical exhibition on November 17th and 18th, at the Memorial Hall, Wellington (Hereford). The hall was artistically and effectively lighted by lamps of many designs and domestic appliances of all kinds were exhibited. These included, cookers, toasters, vacuum cleaners, irons, an "A.B.O." washer, &c. There were also motors for various purposes, such as farm work, and pumping, and an electric drill was shown in operation. Wellington is one of the places covered by the Hereford rural electricity scheme.

An exhibition of domestic electrical appliances was held last week, under the auspices of the Holmhirth (Yorks.) District Council, at the Council offices, and Mr. H. H. Parker, the Council's electrical engineer, gave explanations and demonstrations daily.

At the Blackpool Trades Exhibition, which concluded on November 30th, there were some interesting electrical exhibits. Two of the best-stocked stands were those of Mr. George Morrison, electrical engineer, of Birley Street, Blackpool. This display included vacuum cleaners, an electric washer, radiators, electric irons, kettles, and coffee percolators, &c. Another good display was that of Messrs. R. Darbyshire, Ltd., electrical engineers, of Upper Talbot Square. One stand was devoted to a demonstration of the "Magical" electric fire. Another novelty by the same firm was a Christmas "log fire," made of painted earthenware.

Employment in Lead Processes.—The Home Secretary has recently issued further Statutory Rules and Orders under the Women and Young Persons (Employment in Lead Processes) Act, 1920 (Nos. 1,713, 1,714, and 1,715, H.M. Stationery Office, 1d. net each). The first defines the expression "lead compound" used in the Act. The others relate, respectively, to medical examinations and welfare (accommodation, &c.).

Forthcoming Exhibitions.—The following exhibitions are being organised:—

LONDON.—February 27th to March 10th, 1922, British Industries Fair; March 1st to 25th, 1922, Ideal Home Exhibition.

MANCHESTER.—January 2nd to 13th, Trades Fair and Market.

BIRMINGHAM.—February 27th to March 10th, 1922, British Industries Fair.

CARDIFF.—May to October, 1922, Welsh National Exhibition.

CANADA (Winnipeg).—February, 9th to 11th, Motor Show.

BRUSSELS (Brussels).—April 3rd to 8th, 1922, Commercial Fair.

FRANCE (Lyons).—March 1st to 15th, 1922, Spring Fair.

HOLLAND (Utrecht).—February 21st to March 3rd, 1922, International Fair.

ITALY (Milan).—April 12th to 27th, International Sample Fair.

SPAIN (Barcelona).—March 15th to 25th, 1922, Samples Fair.

SWITZERLAND (Basle).—April 22nd to May 2nd, Sample Fair.

TRIESTE.—May, International Sample Fair.

UNITED STATES (New York).—January 15th to 25th, 1922, General Merchandise Fair.

JAPAN (Tokio).—March 10th to July 31st, International Peace Exhibition.

Belgian Companies.—"Mexinel" is the style of a company just formed at Brussels (13, Rue du Canal), with a capital of 400,000 fr., for the manufacture of electric and other kinds of heating apparatus.

With a capital of 1,250,000 fr. has been constituted at Forest, Brussels, the Compagnie Industrielle et Commerciale d'Electricité for the trade in and manufacture of electrical and other material.

Vanneukerke Gebroeders is the style of a company constituted at Gentbrugge (253, Brusselschen Steenweg), to carry out electrical installations.

There has been formed at La Hestre the Etudes Industrielles Raymond Evens & Co., to undertake electrical and other manufactures and general electrical operations.

Fire.—A fire broke out on Thursday afternoon last week in the building in which the Tudor Co.'s London offices are situated. Although the fire spread to the Tudor Co.'s premises it did not originate in their offices. Five of their staff had to dash through the flames to effect their escape, but before doing so stayed long enough to ring up the fire brigade. Naturally the fire tended to dislocate the Tudor Co.'s business, but the excellent efforts of all the staff have resulted in no matters suffering more than 24 hours' delay.

Denationalised Russian Industries.—The British Agent at Moscow has informed the Department of Overseas Trade that, according to a decree issued by the Russian Soviet Government, all undertakings in Russia which were not *de facto* nationalised before May 17th, 1921, are to be considered as denationalised and the owners are immediately to be reinstated. In view of the possibility that certain British-owned undertakings may fall within the scope of this decree, British firms interested are invited to communicate the facts to the Department of Overseas Trade in order that the necessary inquiries may be made through the British Agent.—*Daily Mail*.

Public Supply Superseded by Private Plant.—MESSRS. WILLYS OVERLAND CROSSLAND, LTD., have sent us a copy of a letter from Messrs. Tom Norton, Ltd., of The Automobile Palace, Llandrindod Wells, stating that they have changed over their supply from the town mains to a supply from a Willys light set, which is running satisfactorily. The makers also inform us that owing to reduction in the manufacturing costs they have been able to make a material reduction in the price of the generating set, as well as in that of the complete outfit, from December 1st.

China's Import Tax.—The Chinese Government has sent a memorandum to the Legations requesting permission to increase the Customs tariff, bringing the present 5 per cent. up to 7½ per cent. The tariff at present in force was agreed to by China and the Powers many years ago, and China is requesting an immediate sur-tax, raising the tariff on all imports, until the revision is completed. If the Powers agree it would considerably ease the financial situation. If successful the Government intends to raise a loan of about £6,000,000.—*Daily Mail*.

E.D.A. Activities.—We were surprised recently to receive a telegram announcing "House burned down, dinner as usual —Doris," but on further examination were relieved to find that the message was upon the front cover of an E.D.A. booklet. This purports to be a letter from a lady to a friend explaining how, in spite of the destruction of her house by fire, she managed to cook a dinner for her husband with a rescued electric stove, upon the lawn. The Association has also sent us a copy of a poster. Upon a background showing a power-station appears the exhortation: "Do it the electric way." "Saves more than it costs." A price list of publicity matter has also reached us.

Aluminium.—THE BRITISH ALUMINIUM CO., LTD. has issued a sheet giving tables of information regarding aluminium. This gives the weight per unit of aluminium wires, tubes, sheets, bars, strips, &c., with notes on the relative physical and mechanical properties of aluminium, brass and steel, and particulars of aluminium alloys.

Electricity Supply Commercial Association.—The address of the general secretary of this association has this week been altered to 27, Well Hall Road, Eltham, S.E.9. All future communications should be sent there.

Chinese Notes.—The Hung Yau Electric Co. is to raise \$20,000 capital to install an electric light plant in Heiho within a period of three months.

Lead.—Reporting on November 26th, Messrs. James Forster & Co. stated: "Makers of sheet and pipe lead report a little better inquiry, but this trade is far below normal, some of the most important works barely working half time. The electrical trades are also a little busier, but in neither case is there anything like normal work. For export there has again been considerable inquiry. On the other hand, supplies are very short, due to the absence for some weeks past of Spanish imports."

LIGHTING AND POWER NOTES.

Alderley Edge.—**PRICE REVISION.**—The Alderley and Wilmslow Electricity Supply Co., Ltd., has applied to the Electricity Commissioners for a special order for the revision of the maximum prices authorised under the orders of 1895 and 1903, and for other purposes.

Australia.—**LAUNCESTON (TASMANIA).**—The annual report of the Electricity Department for the year 1920-21 shows a total revenue of £37,435, as compared with £30,478 in the previous year. The total expenditure amounted to £34,678 (£23,463). There was a surplus for the year of £2,757.

Bingley.—**ELECTRICITY EXTENSIONS.**—The District Council has decided, subject to approval by the Electricity Commissioners, to accept tenders for the supply of a small engine and alternator, for which application is to be made to borrow £500. The plant is intended to generate electricity for the town during the brief periods when the overhead supply line from Keighley is "dead" for overhauling purposes, with a view to having more frequent overhauling and testing to avoid the repeated breakdowns which have occurred during the past.

Blackrock (co. Dublin).—**ELECTRICITY SUPPLY.**—The Urban District Council has accepted the offer of the Irish Overseas Direct Trading & Electric Lighting Association for the supply of electricity to the district. The scheme will be completed within two years.

Continental.—**FRANCE.**—A message from Grenoble to the *Journée Industrielle* says that a number of hydro-electric concerns have formed a group for the purpose of establishing a large system for the distribution of electricity in the south-east of France and the Massif Central. The companies concerned are the following: Compagnie Electrique de la Loire et du Centre, Compagnie Hydro-Electrique d'Auvergne, Société des Forces Motrices de la Loire, Acieries et Forges de Firminy, Société des Forces Motrices de la Truyère, and Union Electrique. The group has taken the name of Société de Transport d'Énergie du Centre, and has its headquarters at Saint Etienne, 14, Rue du Treuil. The State was asked to grant a concession for a system of transmission of electric power linking up the numerous hydro-electric works of the above companies.

Details of the lines in the first section are as follows: three-phase current, frequency 50, pressure about 120,000 volts, possibly 150,000; minimum transmission capacity: Cantal-Loire feeder 25,000 kW; Loire-Auvergne feeder between St. Etienne and Roanne 25,000 kW and between Roanne and Commeny 15,000 kW.—*Reuter's Trade Service* (Paris).

The Union des Gaz at Vésinet, Seine-et-Oise, has decided to substitute an underground system for its present overhead high-pressure service of single-phase current at 2,700 volts, using in its stead three-phase current at 10,000 volts. The company has just received a provisional authority to set up four of these lines for one year, preliminary to its applying for a concession for the whole of its network.

Vitry-M.—An intercommunal association comprising 30 communes has been formed at Bouge with the object of providing electricity in the area. Plans have been invited for the installation of a generating station and high and low-pressure networks.

Owing to the lengthened drought the Canal of Willebroeck has sunk so low as to prevent the working of some of the machines at the municipal power station at Brussels. In consequence restrictions on the general consumption of electricity have had to be imposed.

POLAND.—The completion of the water-power installations for the Province of East Prussia is now impending, which will render the province independent of coal for electricity purposes. According to the *Wasserwirtschaft*, water power stations are to be built at Friedland and Gross Woldsdorf, on the Alle river, and these are expected to be completed by the end of 1922. The direction of the Alle is already in hand for the supply of water power to an auxiliary station, which will be able to supply electricity by December. Near Friedland a huge reservoir is to be built capable of holding some 20,000,000 cu. metres, with a surface area of 4.2 sq. kilometres. A reservoir will also be built near the power station at Gross-

Woldsdorf capable of holding some 4.7 million cu. metres and of 2.3 sq. kilometres surface area. The two stations will yield in an average year about 34,000,000 kWh.

GREECE.—A strike of power-station employes, last week, put Athens in darkness. Later the strikers were joined by the tramwaymen and gas-workers. The Government announced its intention of putting sailors to work in the power stations.

A *Reuter* message dated November 27th stated that the strike had been settled and a number of the strikers accused of sabotage had been awarded severe sentences by courts-martial.

SPAIN.—The Spanish Government has lately granted a concession for the establishment of a plant to utilise the water power of the River Duero, near Aldeafuente (Province of Soria) for generating electricity for lighting and power purposes.

Darlington.—**PRICE REDUCTIONS.**—The engineer and manager of the Corporation Electricity Department (Mr. J. R. P. Lunn, M.I.E.E.) informs us that under the new rates, shortly to be put into operation, lighting supplies will be 4d. per unit, a reduction of 4d. The last 10 per cent. increase on power rates will be withdrawn. These reductions will bring the lighting rate to within 14 per cent., and the power rate to within 33 per cent., above the pre-war rates.

Grampian Scheme.—**PUBLIC NOTICE.**—Public notice has been given under the Private Legislation Procedure (Scotland) Act, 1899, of the intention to form a company to carry out certain hydro-electric works in the Grampian District of Scotland. The works are fully set forth and the Petition and Draft Order are to be lodged on or before December 17th.

Huddersfield.—**YEAR'S WORKING.**—The income of the electricity department for the year ended March 31st last was £212,161, and the expenditure, excluding charges for interest, £173,432, the gross surplus being £38,729.

India.—**THE POONA HYDRO-ELECTRIC SCHEME.**—Work on the Tata hydro-electric scheme near Poona, which involves the flooding of a large area occupied by farms and villages, for the formation of a great reservoir for the supply of water power, has again been postponed, this time until December, owing to the continuance of the passive resistance tactics of the inhabitants.—*Reuter* (Bombay).

Jersey.—**STREET LIGHTING.**—The St. Helier Town Council has decided to endeavour to replace the present gas-lighting of the town by electricity. A number of French engineers are in the island, and will bring forward a scheme to utilise sea-water power.—*Daily Telegraph*.

Leatherhead.—**SYSTEM OF SUPPLY.**—The Electricity Co. has applied to the Electricity Commissioners for permission to make the standard voltage of supply to all future consumers within its area 220 volts between one phase and neutral, and, at its option, to alter the supply to any existing consumers within the area from 110 to 220 volts. The cost of replacement or alteration of any apparatus on consumers' premises necessitated by the change will be borne by the company.

Newton Abbot.—**TIME EXTENSION.**—The Ministry of Transport has consented to the extension until August, 1922, of the time in which the Council has the option to acquire the local electricity undertaking.

Rugby.—**MUNICIPAL TRADING.**—The local Building Trades Employers' Association recently complained to the Electricity Committee that the electricity department was carrying out installation work to the detriment of contractors' interests. It was suggested that the Council had no legal powers to do this. The committee found that under the Rugby Water and Improvements Act, 1901, powers for this purpose were conferred. Nevertheless, the committee recommended that the Council should cease to carry out installation work. When the recommendation came before the full Council it was defeated, and a decision to carry on with the work was made.

Runcorn.—**NEW STATION.**—On November 25th the wife of the engineer and managing director of the Mersey Power Co. opened the company's new station at Runcorn. The plant comprises two 12,500 kW turbo-alternators generating 3-phase current at 6,600 V, supplied by Messrs. C. A. Parsons & Co. The boiler plant consists of three B. & W. water-tube boilers with superheaters, economisers and chain grate stokers. The switchgear, of the remote control type, was supplied by Messrs. A. Reyrolle & Co., and the cables from the station were made by British Insulated & Helsby Cables, Ltd. This plant is the first part of a large installation. The station is capable of accommodating plant of 100,000 kW capacity.

South Africa.—**GRAHAMSTOWN.**—Subject to the consent of the ratepayers and the Administrator the Council has adopted a scheme for the supply of electricity to the town at an estimated cost of £65,000.

SALESBURY (SOUTH RHODESIA).—The annual report of the Electricity Department shows a revenue of £19,206. The total expenditure amounted to £18,105, leaving a profit of £1,101.

Todmorden.—**YEAR'S WORKING.**—The annual report of the electricity department shows a loss of £5,223 during the past year, as compared with a deficit of £3,774 in the previous year.

Truro.—**ELECTRICITY SUPPLY.**—The Town Council, after considering an electric light scheme by which it is proposed to take a bulk supply from the Cornwall Electric Power Co., has asked the company to revise its sliding scale of prices, which it was felt would adversely affect the scheme during the first few years.

Yeovil.—**TIME EXTENSION.**—The Ministry of Transport has approved the extension, by one year, of the Electric Lighting Order of 1914.

TRAMWAY AND RAILWAY NOTES.

Bristol.—**PROPOSED RAILLESS CARS.**—The Corporation has under consideration the running of railless electric cars to Hotwells and Avonmouth. The city engineer has reported favourably upon this system as compared with a tramway. The road improvements necessary would involve the expenditure of £98,000; the cost of constructing a tramway track, as originally proposed, would have been £176,000.—*Commercial Motor.*

Chile.—**RAILWAY ELECTRIFICATION CONTRACT.**—The Chilean Government recently ordered from the Westinghouse Electric International Co. the equipment required for the electrification of the State railways between Valparaiso and Santiago and the Los Andes branch, a total route mileage of 144. The rolling stock is to comprise eleven local passenger locomotives, fifteen goods traffic locomotives, six express locomotives, and seven switching engines. The system, which is direct current at 3,000 V, will be supplied by five 4,000-kW sub-stations. A traffic increase of 50 per cent. is allowed for. The value of the contract is 7,000,000 dolrs.—*Railway Review.*

Continental.—**BELGIUM.**—Owing to certain dismissals, the Brussels tramway employees ceased work last week. To meet the needs of traffic 'bus services were instituted and operated by volunteers.

NORWAY.—According to a notice in *Tidens Tegn* of November 3rd the Kristiania Elektriske Sporvei A/S (Electric Tramway Company) has decided to extend its Lilleaker Line to Stabæk. The extension of this line, which now terminates at Oraker, will cover a distance of about four kilometres. Work will be commenced as soon as possible.

FRANCE.—It was estimated that the working of the six tramway undertakings in Paris, which were acquired by the City Council in conjunction with the General Council of the Seine Department, and leased as an amalgamated concern to an operating company at the beginning of 1921, would result in a loss during the first five years under the new management, which would have to be borne by the General Council. It is now foreseen that the deficit will amount to 85,000,000 fr. for the present year.

Edinburgh.—**TRAMWAY ELECTRIFICATION.**—The Town Council has not yet decided upon the method to be adopted in electrifying the tramways along Princes Street. Mr. R. S. Pilcher, the tramway manager, puts forward three methods. One is for the track to be on the south or garden side of the street, with side pole and bracket arm construction; a second method is on the north side; and a third along the centre with centre poles. He points out that the Ministry of Transport will not, however, sanction centre poles in Princes Street. The conduit system, with Brussels or London types of plough, is also dealt with.

Mr. Pilcher recommends the conversion to the electric system throughout the city without further delay. His report states that the working of the Leith electric system costs 4.20d. per car mile less than the Edinburgh cable system, and that over the area of the cable system represents £98,000 per annum on the present mileage. This saving in working expenditure would not only meet the capital charges on the cost of conversion, but would leave £53,365 to meet renewals and provide for the reduction of fares.

Glasgow.—**TRAMWAY PURCHASE.**—The Tramways Committee has recommended that an offer of £200,000 be made for the Paisley and district tramway undertaking. In the event of the offer being confirmed and accepted it is intended to link up the undertaking with the city system.

Halifax.—**REVISED FARES.**—According to the *Yorkshire Post* the Tramways Committee has decided to abolish the fare transfer system and to establish penny stages, each of which will be half the length of the present 2d. stage. It is hoped that, as a result, there will be a large increase in revenue.

Hull.—**NEW ROUTE.**—The Town Clerk has been instructed by the Corporation Parliamentary Committee to apply for a light railway order for the extension of the tramway system to Hessel.

Leeds.—**LIGHT RAILWAY.**—The Tramways Department has decided to start the laying of the light railway track from Harehills to Oakwood in about six weeks' time.

London.—**LOWER FARES.**—The action of the L.C.C. in restoring the penny fare on the London tramways has led the L.G.O.C. to come into line on routes covered by both 'buses

and trams, although it is stated that the company cannot afford to make the reduction general. The Underground Railway Companies have decided not to make any immediate reductions in fares, as it is their stated policy to encourage the use of surface transport by short-distance passengers, the railways being intended, primarily, to serve the outer districts of London.

BERMONDSEY.—The L.C.C. Highways Committee has again had under consideration the future of the old horse tramway in Bermondsey. Electrification had previously been discussed, but, owing to the heavy expenditure involved, and to the fact that the probable traffic would not be large enough to be remunerative, it was decided to defer the matter. Now, acting upon a resolution of the Bermondsey Borough Council, the committee recommends that the track be taken up and the road reinstated.

Manchester.—**PROPOSED ELECTRIC RAILWAY.**—Two Manchester engineers have put before the Lord Mayor and the Chamber of Commerce a scheme for the construction of an electric railway from Heywood to South Manchester and Styal, a distance of 25 miles. The *Manchester Dispatch* gives details of the route, which would have 24 stations or halts. The line would connect with the L. & Y. Railway at Heywood, and would embrace two-thirds of Manchester. The estimated cost is £1,500,000. The suggestion is made by Messrs. J. W. Welch and James W. Newton, of Victoria Buildings, Manchester.

Middlesex.—**EXTENSION OF COMPANY'S LEASE.**—At a meeting of the County Council on November 24th the application of the Metropolitan Electric Tramways, Ltd., for a further 20 years' extension of its lease was considered. The Highways Committee was in favour of negotiations being entered into for the extension of the lease, which expires in 1930, and the Committee's recommendation was approved. The company desires this extension to enable it to recoup expenditure which it proposes to make upon improvements and renewals.—*Daily Telegraph.*

Rochdale.—**RAILWAY ELECTRIFICATION.**—The L. & Y. Railway Co., having notified the Corporation of its intention to electrify the line between Manchester and Oldham, the General Purposes Committee has decided that the desirability of extending the electrification from Oldham to Rochdale be urged upon the company.

South Africa.—**RAILWAY ELECTRIFICATION.**—It is understood that the Government has decided on the electrification of the Glencoe-Maritzburg line.—*Reuter's Trade Service* (Capetown).

United States.—**NEW YORK.**—Among the objectives of the Transit Commission of New York City, recorded by the *Electrical World*, are: the municipal ownership of all railway lines within the city; the surrender by the holders of all existing "franchises"; the unification of all systems and the appointment of a board of control to secure that all payments for property to the present companies are made on a proper valuation—not "book" values; the construction of new subways; and to secure the participation of employees in the surplus profits.

Wicklow.—**CLOSING OF TRAMWAY ROUTE.**—The County Council has decided to close the Dublin and Blessington tramway in the Wicklow area.

TELEGRAPH AND TELEPHONE NOTES.

China.—**TELEGRAPH SERVICE.**—The report on the working of the Chinese Post Office for 1920 reads, in part, as follows:—To its various activities the postal service has added the acceptance and delivery of telegrams at places not provided with telegraph offices, and telegrams can now be accepted at 1,320 places and delivered at 10,000 places which were formerly outside the sphere of the telegraph service.

India.—**IMPORTATION OF APPARATUS FOR WIRELESS TELEGRAPHY.**—The following Customs circular has been issued by the Government of India, Department of Commerce: "In exercise of the powers conferred by section 19 of the Sea Customs Act, 1878 (VIII. of 1878), and in supersession of the notification of the Government of India in the Department of Commerce and Industry, No. 5120-73, dated July 14th, 1909, the Governor-General in Council restricts the bringing by sea or land into British India of any apparatus for wireless telegraphy to cases in which (1) such apparatus is imported by any person to whom a licence to establish, maintain, and work a wireless telegraph has been granted under the first proviso to sub-section (1) of section 4 of the Indian Telegraph Act, 1885 (XIII. of 1885); or (2) a licence to import such apparatus has been granted by the Director-General of Posts and Telegraphs.—*Reuter's Trade Service* (Calcutta).

Norway.—**PROPOSED NEW CABLES.**—On November 2nd *Tidens Tegn* published proposals said to have been submitted to the Norwegian Board of Telegraphs for two new cables for telephonic connection between Norway and Denmark and

Germany. The first proposal is for a cable, either from Arendal to Hirtshals, or from Hirtshals to Hirtshals, to cost about one and a half million kroner. The length of the cable would be 774 or 884 sea miles, according to the connecting points chosen, and would give three telephonic and one telegraphic connections. The cable between Arendal and Germany would be laid over practically the same route as the existing telegraph line between Arendal and Sylt. The length of the cable would be 440 kilometres, and the total cost about five million kroner. By this cable three telephonic and one telegraphic connections could be made. In addition to the connection with Germany it would be possible to telephone to countries with which Germany is or may be connected, such as Holland, Belgium, France, Switzerland, Italy, &c. It is stated that a further proposal may be submitted to the Board of Telegraphs for a cable between West Norway (Stavanger) and England, calculated to cost about six or seven million kroner. The length of cable would be about 500 kilometres. The total cost of these lines would be about 14 million kroner, of which Norway would find seven millions, the assumption being that the remainder would be contributed by the other countries in the same manner as in the case of the existing telegraph cables, says the Department of Overseas Trade.

Russia.—TELEGRAPHIC COMMUNICATION.—*Seensk Handelstidningen* learns that direct telegraphic communication will shortly be re-established between Sweden and Russia. The telegraphic station at Petrograd is now being reconstructed by the Stora Nordiske Telegrafsekska.—*Reuter's Trade Service* (Stockholm).

The Telephone Service.—SERVICE CHARGES.—As a result of users of telephones being called upon to settle their accounts, based on the new scale of charges, indignant protests against the costliness of the service are a feature of the daily Press. According to *The Times*, in the case of large subscribers the expected has happened. In spite of their strenuous efforts to reduce the number of calls even below the level of efficiency, and far below that of convenience, the abolition of the flat rate, the new rentals, and the scales for trunk calls, have raised the cost of the service to a menacing height. The small subscriber is even more unfairly charged, as he is asked to pay sums which work out from 5d. to 1s. 6d. per call. So far most of the predictions made in the public protests against the new rates have proved correct.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Australia.—MELBOURNE.—January 25th. Victorian Government Railways. Ten coasting recorders or, alternatively, 10 coasting and service recorders for the trains (cont. 34,736).

January 4th and 11th. Postmaster-General's Department. Telegraph instruments and telephone apparatus and material (Schedules 1,718 and 604). (November 18th.)

Belgium.—December 7th. Belgian State Railway. Supply of about 183 kilometres of electric cables, electric wire, and other miscellaneous material in connection with the railway electrification work. Particulars from the Office de l'Electricité des Chemins de Fer de l'Etat, Brussels.

Dublin.—December 12th. Dublin Union Tramways Co. (1896), Ltd. General stores, including electric supplies, for six months. (November 25th.)

Egypt.—ALEXANDRIA.—December 21st. Port and Light-house Administration. Stores, including electric lamps, for six months.

Farnworth.—December 7th. Urban District Council Electricity Department. L.p. cables, distribution pillars, transformer, h.p. and l.p. switches. (November 25th.)

France.—French Post and Telegraph Authorities in Paris. Supply of 22 kilometres of phosphor-bronze cable for the Croix-d'Hins wireless station.

Leeds.—Health Committee. December 10th. Installation of telephones at Old Killingbeck Sanatorium. Medical superintendent.

Liverpool.—December 28th. West Derby Board of Guardians. Engineering work, including electric power installation, electric lift, telephone installation, boilers, stokers, &c. (November 15th.)

London.—L.C.C. The Council is inviting applications by December 31st from firms, and particularly manufacturers, for proposals for the electrical power and fittings from which the Council from time to time invites tenders for the supply of fittings, electrical and mechanical equipment, and spares, &c., required for the Council's tramways. (See our advertisement page 749.)

H.M. Office of Works. December 14th. Electrical and mechanical engineering labour-in-daywork in connection with the construction of the new tramways in the Glasgow and Edinburgh districts during a period of three years from January 1st, 1922. Contracts Branch, H.M. Office of Works, London, S.W.1.

Manchester.—December 9th. Electricity Committee. Heating plant and hot-water service apparatus for offices, and self-sustaining electric hoist, Barton power station. (November 18th.)

New Zealand.—WELLINGTON.—March 6th. Public Works Tender Board. Waikato power scheme. Two 2,500-kVA alternators, two 3,100-h.p. water turbines; two exciter sets.*

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CLOSED.

Australia.—MELBOURNE.—Morwell power scheme. Further to the note on p. 715 of our issue of November 25th, it is stated that Messrs. John Thompson, Ltd., secured, in the face of keen American competition, the contract for the supply of 12 water-tube boilers in connection with the electric power station at Morwell, Victoria. Each of the boilers, which are to have a working pressure of 200 lb. per sq. in., will evaporate 70,000 lb. of steam per hour, the steam being superheated to a temperature of 650 deg. F.; they are to be fired by underfeed forced draught traveling grate stokers, to burn the brown coal.

Belgium.—Thirteen firms submitted tenders to the Société du Canal et des Installations Maritimes de Bruxelles for the supply and installation at Wintham of an electric pump capable of delivering 150 cubic metres of water per hour. The lowest offer was that of Messrs. Desmedt, of Ixelles, who quoted 23,735 fr.

Glasgow.—Tramways Committee.

Motor for hoist. Crompton & Co., Ltd.
Copper bonds—British Insulated & Helsby Cables, Ltd.
Cable—Siemens Bros. & Co., Ltd.

London.—ST. PANCRAS.—Electricity and Public Lighting Committee. (Accepted):—

1,000 tons Beninck Nutty Slack, 27s. 4d. per ton; 500 tons Paxton Low Main Slack, 27s. 4d. per ton; 600 tons Ramscroft Hard Steam, 37s. 11d. per ton.—J. H. Beattie & Co., Ltd.
500 tons Beninck Nutty Slack, 25s. 10d. per ton plus 3s. 6d. per ton cartage.—A. Blackman & Co.
100 tons Russia's Black Vein Washed Nuts for special trial on No. 1 British Niclausse boiler, 41s. 8d. per ton, plus 3s. 6d. per ton cartage.—Harper & Christopher.

(Recommended):—

Power rectifying plant, revised tender (£12,260).—Power Rectifiers, Ltd.

Singapore.—The Whesoo Foundry & Engineering Co., Ltd., have received from the Admiralty a contract for the supply and erection in Singapore of 10 steel oil fuel tanks, each 116 ft. diameter by 45 ft. 6 in. deep. They will be capable of holding about 12,000 tons of oil each.

FORTHCOMING EVENTS.

Batti-Wallahs.—Friday, December 2nd. At the Engineers' Club. At 7.45 p.m. Annual smoking concert.

Institute of Marine Engineers.—Friday, December 2nd. At the Hotel Cecil. Annual dinner.

Junior Institution of Engineers.—Friday, December 2nd. At Caxton Hall, S.W. At 8 p.m. Lecture, "Notes on Maintenance of Electrical Accidents," by Mr. B. L. Latham.

Friday, December 9th. At the Royal United Service Institution, Whitehall, S.W. At 7.30 p.m. Presidential address by Mr. C. H. Worthingham. (Midland Section).—Tuesday, December 6th. At the Birmingham Chamber of Commerce, New Street, Birmingham. At 7 p.m. Presidential address by Mr. R. B. Ashpith Ellis.

Northampton Polytechnic Institute, Clerkenwell.—Friday, December 2nd. At 7.30 p.m. Annual prize-distribution (by Lord Southwark) and students' convocation.

Salford Technical and Engineering Association.—Saturday, December 3rd. At the Royal Technical School, Salford. At 7 p.m. Annual meeting.

Institution of Electrical Engineers. Informal Meeting.—Monday, December 5th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Some recent developments in the design of a.c. instruments," to be opened by Mr. C. L. Lipman.

(Western Centre).—Monday, December 5th. At the Merchant Venturers' Technical College, Bristol. At 6.30 p.m. Paper on "Cyclic Process of Automatic Electric Weldings," by Messrs. L. J. Steele and H. Martin.

(North-Western Students' Section).—Tuesday, December 6th. At the Grosvenor Club, Grosvenor Gardens, W. At 8.30 p.m. Paper on "The Insulator and Manufacturing Tests," by Mr. F. C. Lawrence.

(London Students' Section).—Friday, December 9th. At the Ship Restaurant, 46, Charing Cross, S.W. At 7 p.m. Smoking concert.

(Wireless Section).—Wednesday, December 7th. At the Institution, Victoria Embankment. At 6 p.m. Paper on "An Investigation of Transmissions in the Wireless," by Mr. L. J. Steele.

(Irish Centre, Dublin).—Friday, December 9th. At the Royal College of Science, Dublin. At 8 p.m. Paper on "Electric Vehicles, their design, construction, and performance," by Mr. F. L. Wadler.

Society of Engineers (Incorporated).—Monday, December 5th. At Burlington House, W. At 8.30 p.m. Paper on "Northwich Sewerage and Sewage Disposal Works," by Mr. W. M. Beckett.

Roentgen Society.—Tuesday, December 6th. At the Institution of Electrical Engineers, 21, Bedford Square, W.C. At 8.30 p.m. General meeting.

Institution of Electrical Engineers (Incorporated).—Wednesday, December 7th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Paper on "Recent Researches on the Three-Phase System," by Mr. F. C. Lawrence.

Pamsey Association of Engineers.—Wednesday, December 7th. At the Grosvenor Club, Grosvenor Gardens, W. At 7.30 p.m. Paper on "A Few Years' Experience of Electric Lamps," by Mr. P. McKenzie.

Northampton Engineering College Engineering Society.—Wednesday, December 7th. At the Institute, St. John Street, E.C. At 5.30 p.m. Paper on "Efficiency of Combustion," by Mr. V. R. Chadwick.

Chelmsford Engineering Society.—Thursday, December 8th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Hydro-electric Opportunities," by Mr. D. Spencer.

Chemical Society.—Thursday, December 8th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 8 p.m. Lecture by Prof. J. W. Gregory, F.R.S., on "The Genesis of Ores."

Edinburgh Electrical Society.—Friday, December 9th. At the Philosophical Institute. At 8 p.m. Paper on "A Chat on Wireless," by Mr. A. Whiteley.

Physical Society of London.—Friday, December 9th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary meeting.

Birmingham and District Electric Club.—Saturday, December 10th. At the Grand Hotel. At 7 p.m. Annual meeting.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

QUERIES addressed to the ELECTRICAL REVIEW will be answered by post, if the desired information is available, provided the following simple rules are observed:—

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2. Do not ask for information until you have satisfied yourself that it is not already contained in our advertisement pages.
3. If we are the means of putting you in touch with the firm or firms that you require, do us the favour of mentioning the ELECTRICAL REVIEW.

No charge is made for the service.

INQUIRIES.—The attention of manufacturers and suppliers is specially directed to the fact that we have this week, amongst many other items, inquiries for:—

The "Safety First" bed warmer.

The "Semco" No. O Traveling Iron.

A four-pole switch bearing the trade mark "OFA" in a triangle surrounded by a circle.

A portable ammeter and voltmeter fitted with plugs and bayonet socket and suitable for reading both a.c. and d.c.

The "Tourtel" patent sealed locks.

The "Wizard" electric turbine and the "Wizard" dust extractor, Standard No. 2. Griffith's patent No. 11,837/09.

NOTES.

Association of Consulting Engineers.—The annual dinner of the Association of Consulting Engineers (I.A.C.E.) was held at the Engineers' Club, London, on November 4th, when Mr. W. Vaux-Graham, chairman of the Committee of the Association, presided over a gathering of some 95 members and guests; the function proved successful in every way. Following the loyal toast, that of "Princess Mary" was honoured, and a telegram of congratulation was dispatched. The "Association of Consulting Engineers" was proposed by the Rt. Hon. Lord Meston, K.C.S.I., and in his brief response the chairman paid a tribute to the work of the hon. officers of the Association, saying it was remarkable that the society did not employ a single paid officer. Mr. Sidney R. Lowcock, in a humorous speech, proposed the "Legal Profession" which toast was responded to by the Hon. Mr. Justice Shearman, and that of "Engineering Institutions," proposed by Mr. J. W. E. Binnie, was responded to by Sir Alex. B. W. Kennedy, LL.D., F.R.S., past president of the Institution C.E., and Mr. J. S. Highfield, president of the I.E.E. The former was understood to imply that if the Institution of Civil Engineers was not actually modifying its constitution, it was hoped that its council would at least adopt a more liberal policy in future. "British Industry" was proposed by Mr. A. H. Dykes, Hon. Sec. of the Association, and in responding therefor Sir Edward E. Pearson indicated his hopeful outlook of the future prospects. South America, he said, was crying out for British goods and manufacturers should never forget that it would be fatal to let them down; they must keep their promises with regard to delivery and maintain quality, workmanship, &c. He had confidence in labour; wages would fall, but would never reach the pre-war level, and every workman was worthy of his hire. If treated properly labour would be all right. The toast of "Our Guests" was proposed by Mr. G. Midgley Taylor; Sir John Snell, Chief Electricity Commissioner, and Sir William Noble, Chief Engineer to the Post Office, responded. Mr. G. M. Freeman, K.C., also spoke. Amongst those present were Sir Alfred T. Davies, K.B.E., C.B., Sir James Devonshire, K.B.E., Sir Harry Haward, the Hon. Mr. Justice McCardie, the Rt. Hon. C. A. McCurdy, P.C., K.C., M.P., Messrs. W. J. Jeves, O.B.E., K.C., W. E. Tydesley Jones, K.C., H. Booth, C.B.E., W. W. Lackie, O.B.E., A. Page, Mr. G. Scott Ram, Capt. H. F. J. Rowley, C.B.E., R.N., Eng. Lieut. W. T. Townend, R.N., Lt.-Col. H. G. K. Waite, O.B.E., D.S.O., R.E., Lt.-Col. C. E. Norton, C.M.G., R.E., and many others.

Midland Electrical Engineers' Ball.—This popular function, held on Friday evening, November 25th, at the Grand Hotel, Birmingham, was as usual extremely enjoyable by reason of the first-rate "staff-work" which had ensured an excellent band, good catering, and a splendid muster of dancing people. Mr. Chattock, as usual, was in excellent form, and the popularity of the well-known Birmingham chief was made evident by the fact that having made a short speech in one supper-room, he was forcibly compelled to repeat the process in the other. Altogether the evening reflected the greatest credit on the organisers.

Service Note.—The Admiralty, having come to the conclusion that the complicated character of electrical apparatus and torpedo equipment in the fleet warrants the division of the electrical artificer branch of the Navy into two sections, an Order in Council just issued has sanctioned the institution of the two branches, described in a schedule, with the pay and conditions of service of the existing electrical artificer branch, which they now supersede. The titles, under the new order, will be—electrical lieutenant and ordnance lieutenant (T); commissioned electrical officer, and commissioned ordnance officer (T); warrant electrical officer, and warrant ordnance officer (T); chief electrical artificer, chief torpedo artificer; and electrical artificer, and electrical torpedo artificer.

Appointments Vacant.—Consulting electrical engineer, for the Dun Laoghaire (Kingstown) Urban District Council; mains foreman (£5 15s.), for the City of Birmingham electric supply department. (See our advertisement pages to-day.)

The International Conference on Extra-High-Pressure Lines.—The International Conference on Extra-High-Pressure Transmission Lines, of which Mr. R. Borlase Matthews gives a preliminary account elsewhere in this issue, was organised by the Union des Syndicats de l'Electricité, the organising committee being under the chairmanship of its President, Mr. Raynald Legouez. The National branches of the International Electrotechnical Commission have collaborated in the conference, and have done much to assist in the success which has been achieved.

We understand from Mr. le Maistre, the General Secretary of the I.E.C., that in future close co-operation will be maintained with the Conference, which is to hold another meeting during the next year or two, and the organising committee and its very able secretary, M. Tribot Laspiere, have been invited to organise this next meeting.

The Conference unanimously agreed to recommend that its proceedings when published shall be transmitted to the National Committee of the I.E.C. for use in connection with the work of international standardisation, on which the latter is engaged.

Incidentally, we understand that the opportunity was taken for an exchange of views amongst those present who were particularly interested in the work of the I.E.C., and that important advances have been made towards a clearer understanding of the existing difficulties which hitherto have prevented the recommendations of the I.E.C. regarding industrial electrical machinery being completely accepted, and there is every hope that agreement amongst the various National Committees will not now be long delayed.

Educational.—At the annual distribution of prizes at the Aston (Birmingham) Technical School, on November 33rd, the Principal (Mr. C. A. White) said that nine firms in the district sent a number of youths, without loss of wages, to the school. These firms were well satisfied with the results, and reported increased efficiency. Prof. W. Cramp, of the University of Birmingham, presented the prizes, and said that he hoped more of the electrical firms of the district would follow the lead of those companies mentioned by the Principal.

Under the auspices of the Garden Cities and Town Planning Association, a series of lectures on "Garden Cities of the World," is being delivered at King's College, Strand, W.C. The third lecture of the series is to be given by Mr. Halsey Ricardo, F.R.I.B.A., on December 8th. His subject will be "Milan, and other Italian Cities."

Einstein and Ether.—The following letter appeared in *The Times* of November 26th:—"To avoid the continuance of a mis-conception which has crept into the popular apprehension of Einstein's theory, I translate the conclusion and summing up of an address which Professor Einstein gave in May, 1920, to the University of Leiden:—

'According to the general theory of relativity, space is endowed with physical qualities; so in this sense an ether exists. Conformably with the general relativity theory, space without ether is unthinkable; for in such a space not only could there be no propagation of light, but also there would be no possibility of the existence of measuring rods and clocks, nor any space-time intervals in a physical sense. This ether, however, must not be thought of as endowed with the characteristic properties of ponderable matter . . . nor must the idea of motion be applied to it.'

With all this—I perhaps need hardly say—I heartily concur.

Yours faithfully,

OLIVER LODGE."

King's College Engineering Society.—The 24th Annual Dinner of this Society was held at the Holborn Restaurant on Friday last, and a happy and successful evening was spent by a record number of 160 past and present members who were able to attend. The chair was occupied by Mr. J. S. Highfield, president of the I.E.E., and a past member of the Society. The guest of the evening was Mr. W. B. Worthington, B.Sc., president of the Institution of Civil Engineers. The presence of the Principal of King's College, Dr. Barker, the Dean, Rev. Matthews, the Dean of the Faculty of Engineering, Prof. Wilson, and a muster of past and present members made the gathering a thoroughly representative one of the Society and its associations.

INSTITUTION NOTES.

The Institution of Electrical Engineers.—[NORMAL MEETINGS.—At the meeting held on November 7th the chair was taken and a discussion opened by the president, Mr. J. S. Highfield, on "How best to speed up Electrical Progress." Mr. Highfield commenced by saying he would define electrical progress as "a condition where everybody who wants a job can get a job." To reach that happy state we must get our services appreciated and find out what was appreciated most. It was no good thinking of easy profits, it meant hard work and good service. As an example of how not to do it, he took the recent history of the coal trade. At the time of the Armistice the French and Italians were badly needing coal, and if the coal industry had put their backs into it we might now have had the goodwill of these nations. Instead, the situation was greedily exploited to the very utmost, with the result that the Frenchman, having got back his mines in Alsace, and the Italian counting up his water-power resources, resolved to avoid buying our coal at all costs, and the industry, instead of flourishing, was now in a state of lamentable depression. If the demand for electricity all over the country was in every way fostered by good service and honest efforts to cheapen supply there was a wave of prosperity just ahead. Bearing on the efforts to cheapen supply, the president gave some serious figures of the past and present labour output and the cost of materials. As it cost three to four times the old rates to connect a consumer, the small lighting service with low-current lamps might be years in proving a source of revenue to a system. He thought, therefore, that a customer should be induced to extend as far as possible the use of small apparatus, such as irons, toasters, &c., all of which might be served by the existing house wiring and a single meter, but charged for on the two-part tariff system. To this end it was very desirable that journeymen electricians and supervisors should be better trained in a knowledge of advocacy of electrical appliances. In the course of the discussion which followed, the I.E.E. wiring rules were criticised as unduly severe, and simpler methods were advocated. The vexatious regulations of supply authorities, which had no legal force, were also objected to, and Mr. Highfield in summing up dropped a hint that the wiring rules might be revised before long.

At the informal meeting on November 21st, Mr. J. F. Avila was in the chair during the discussion opened by Mr. A. J. Hainsworth on "Hydro-Electric Power." Mr. Hainsworth pointed out that it was essential that any power station should at the outset be designed for the ultimate capacity of the available water-power and so arranged that the full development might be carried out in stages. There was nothing to hinder this being done in water-power stations, as the total power available could be determined at the start. If it were decided to develop the station by stages as the demand for power increased, it would be good practice to commence laying out the general plans at the centre, and assume that the building would extend longitudinally in both directions. A station layout was often spoilt by having the switchboard placed across one end, so that as the station developed the distance between the switchboard operator and the floor engineer became greater as the units increased in number. Mr. Hainsworth described a typical station with a head of water on the turbines of approximately 170 feet. This station was designed for a maximum plant capacity of 144,000 h.p. in twelve 12,000 h.p., 11,000-volt, 3-phase, 50-cycle generating sets, with eight 15,000 kVA step-up, 11,000 to 110,000-volt transformer banks. He also described a transmission system proposed by Mr. E. Parry for the New Zealand Government, for a distance of 1,000 miles of 110,000-volt transmission lines in North Island, and an existing 66,000-volt system in South Island. It was pointed out that the only fault which has been in service since 1914. A well-maintained discussion followed, of which perhaps the most striking feature was the ubiquity of the engineer. First-hand knowledge was contributed of water-power stations in every part of the globe.

Greenock Association of Electrical Engineers.—At a meeting held on November 1st, Mr. J. M. S. Schell, B.Sc., of Glasgow, gave a very interesting paper on "Electrical Troubles and their Causes." Mr. Schell laid stress on the advantage of possessing a fundamental knowledge of electro-mechanical science in the tracing of faults.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Col. O. C. ARMSTRONG, D.S.O., who was last week elected president of the Federation of British Industries in succession to Sir Peter Rylands, is chairman of Messrs. Greenwood and Batley, Ltd., the well-known engineering and electrical manufacturing firm of Leeds. Previous to his taking up that appointment in 1914, he had been for five years managing director of Messrs. William Beardmore & Co., Ltd. A brief account of his career was given in the ELECTRICAL REVIEW for October



COL. O. C. ARMSTRONG, D.S.O.
The New President of the Federation of British Industries.

28th (p. 576). Col. Armstrong has been prominent in his association with engineering organisations, both in the mechanical engineering group of the F.B.I. and as chairman of the British Engineers' Association.

On Friday last, in the staff café at the Edison Swan Electric Co.'s Ponders End Works, there was a gathering of the staff to do honour to Mr. J. S. CHILD (joint sales manager), who is leaving the company after upwards of 30 years' service. A concert was organised by Mr. A. P. Ambler, and during the interval Mr. J. W. Elliott (lamp sales manager) presented a canteen of silver to Mr. Child on behalf of the staff. Mr. Elliott voiced the general regret of all that Mr. Child was leaving them, and referred to his splendid services rendered to the company. He also referred to Mr. Child's forthcoming marriage. Speeches in a similar strain were also made by Messrs. J. Bacon, T. S. Read, F. C. Raphael, W. C. Cooke, E. H. Miller, P. Evans, and A. P. Ambler. Mr. Child briefly responded.

On 22nd November Mr. J. M. MOFFAT was the recipient of a handsome solid silver cigar box and a cheque from the directors and staff of the Edison Swan Co. upon his completing 40 years' service. In making the presentation Mr. C. H. Cox, the commercial manager, spoke of Mr. Moffat's services to the company, and to the electrical industry in general, especially in its early days. Mr. R. H. Parker (the company's secretary), Mr. J. W. Elliott (lamp sales manager), and Mr. T. S. Read (assistant sales manager) also paid their tributes. Mr. Moffat, in responding, gave interesting reminiscences of the early days of the electrical trade.

At a far-well concert last week, Mr. J. W. HAME, late manager of the York Electricity and Tramways Department, was the recipient of a writing bureau from the staff and employees of the two departments. Mr. E. J. Nicholls presided over a large gathering, and the presentation was made by Mr. H. Chatto, the oldest employé in the electricity department.

Mr. G. W. Holmes, superintendent at the power station, expressed the hope that Mr. Hame would soon be strong and robust in health again. Mr. Hame, in thanking the staffs, paid a high tribute to the services rendered by Mr. Nicholls, Mr. Horton, and the other heads of departments.

On 24th November Mr. FRANK A. RAWLINGS, of the Finance Branch of the Electricity Commission, was presented with a handsome canteen of cutlery by the Commissioners and their staff on the occasion of his marriage. Sir John Snell, chairman of the Commissioners, made the presentation in appreciative and felicitous terms, and conveyed to Mr. Rawlings the good wishes of his colleagues.

The distinction of Chevalier de la Légion d'Honneur has been conferred on M. SCHUMER, professor of industrial electricity, and editor in chief of our Paris contemporary, *l'Electricien*, on the recommendation of the Minister of Public Instruction.

A Sheffield paper states that Mr. JOHN LITTLE, chief engineer of Messrs. Cammell, Laird & Co.'s works at Sheffield, &c., who was elected to the Southport Town Council in November, has been appointed vice-chairman of the Southport Electricity Committee.

A local paper reports that Mr. W. D. BRIGHTMAN, secretary of the Bournemouth and Poole Electricity Supply Co., has been appointed to the dual office of manager and secretary of the company.

The works staff of Messrs. BAROCK & WILCOX, LTD., Renfrew and Dumbarton, marked with a gift of Treasury notes the retirement from active service of Mr. J. Wilkie, a member of the staff, after a continuous service of 31 years.

Obituary.—**ALD. J. S. HINCHLIFE.**—We regret to announce the death, at the age of 57 years, of Alderman J. Stringer Hinchliffe, A.M.I.E.E., a member of the Leeds City Council and a partner in the firm of The Hinchliffe-Green Manufacturing Co., Ltd.

Mr. H. WILSON FOX.—We regret to state that Mr. H. Wilson Fox, M.P., editor of the *South African Mining Journal* in 1892, and appointed a director of the British South Africa Co. in 1913, died on November 22nd, in London, at the age of 58 years. He is described as the inventor of a system of hydraulic storage. His most important recent work has been in connection with the advocacy of Empire resources development as a means of making employment and relieving the burdens of taxation. He was a member of the Conjoint Board of Scientific Societies.

Mr. HART, whose death we announced last week, was for many years associated with the firm of Peto & Radford, of London. He was 63 years of age.

NEW COMPANIES REGISTERED.

Wheeler's Electric Shade Carrier, Ltd. (177,916).—Private company. Registered November 19th. Capital, £10,000 in £1 shares. To take from H. F. Wheeler the benefit of certain existing patents relating to improved means for securing shades to holders of electric lamps, and an improved metal-cutting tool, together with the business carried on by him in connection therewith. The subscribers (each with one share) are: H. F. Wheeler, 83a, Mosley Street, Manchester, mining engineer; T. Smith, 71, Princess Street, Manchester, solicitor. The first directors are to be appointed by the subscribers. Qualification: £100. Remuneration as fixed by the company. Solicitors: Slater, Heelis, Colley, Sandbach and Anderson, 71, Princess Street, Manchester.

G. Hands & Co. (Glasgow), Ltd. (11,939).—Private company. Registered in Edinburgh November 14th. Capital, £7,500 in 7,000 preference shares and 500 ordinary shares of £1 each. To acquire the business of George Hands & Co., and to carry on business as electrical, gas, hydraulic, sanitary, mining, mechanical, civil, and motor engineers, &c. The subscribers (each with 100 ordinary shares) are: G. Hands, 71, Farringdon Road, London, E.C.4, merchant; C. R. Arthur, 87, Dunlop Street, Glasgow. The first directors are: G. Hands and A. R. Arthur. Qualification, 50 ordinary shares. Registered office: 87, Dunlop Street, Glasgow.

Railgrip Syndicate, Ltd. (177,962).—Private company. Registered November 22nd. Capital, £10,000 in £1 shares. To acquire the world's rights in connection with an invention of a rail grip wheel, and to carry on the business of manufacturers of railway carriages and wagons, &c. The subscribers (each with one share) are: H. L. Bromhead, 10, Basinghall Street, F.C.2, accountant; W. A. Haberfield, 42, Crutwell Avenue, Streatham Hill, S.W.2, accountant. The subscribers are to appoint the first directors. Remuneration, £100 each per annum (£150 for the chairman), free of income tax. Registered office, 10, Basinghall Street, E.C.2.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Henry Bisseker, Ltd.—Satisfaction on October 31st, 1921, in to the extent of £1,000 of first debentures, dated October 2nd, 1919, securing £7,700, and (b) to the extent of £1,000 of second debentures dated February 22nd, 1921, securing £8,300.

New Welding Co., Ltd.—Issue on November 4th of £100 and on November 9th, 1921, of £250 debentures, parts of a series already registered.

Ernest F. Moy, Ltd. (47,408).—Capital, £10,000 in 8,500 ordinary and 1,500 preference shares of £1 each. Return dated August 30th, 1921. All shares taken up. £10,000 paid. Mortgages and charges, £7,450.

Mersey Power Co., Ltd.—Trust deed dated October 31st, 1921, to secure £200,000 per cent. mortgage debentures secured on freehold and leasehold buildings, plant, machinery, and other contents, takings and company's other assets, present and future, subject to a first charge. Trustees: Law Debenture Corporation.

Russells (Manchester), Ltd.—Second debenture dated November 7th, 1921, to secure £50,000, charged on the company's undertaking, property, present and future, including uncalled capital. Holder: W. S. Berry, 60/62, Spring Garden, Manchester.

Stanley J. Watson Magneto Co., Ltd.—Debenture dated October 31st, 1921, to secure £200, charged on the company's property, present and future, including uncalled capital. Holder: Mrs. E. F. Watson, 89, Queen's Road, Richmond, Surrey.

Bedale and District Electric Supply Co., Ltd.—Satisfaction in full on November 5th, 1921, of mortgage dated January 16th, 1920, securing £1,500 notified. Debenture dated November 7th, 1921, to secure £900 and mortgage of even date as further security for the sum £600 and £1,000 secured by prior debenture, charged on the company's undertaking and property, present and future, including uncalled capital and land and premises in Bedale, Yorks. Holder: Sir William C. Gray, Bt., Thorpe Perrow, Yorks.

Aelaide Electric Supply Co., Ltd.—Acknowledgment of indebtedness dated November 14th, 1921, in the further sum of £350,000 under a trust deed dated June 11th, 1915, charged on such part of the company's undertaking in Adelaide as referred to in original deed. Holders: Electrical and General Investment Co.

A. and A. Electrical Co., Ltd.—Debenture dated November 15th, 1921, to secure all moneys due or to become due from the company to L.C.W. and Parr's Bank not exceeding £25,100, charged on the company's undertaking and property, present and future, including uncalled capital.

Kalgoorlie Electric Tramways, Ltd. (73,127).—Capital, £250,000 in £1 shares. Return dated August 11th, 1921. All shares taken up. £250,000 paid. Mortgages and charges, £143,820.

British Electric Traction Co., Ltd. (49,855).—Capital, £2,998,397 15s. of which to July 8th, 1921, £712,744 5s. had been issued in 6 per cent. cumulative participating preference stock and £1,326,263 10s. in ordinary stock. £2,039,007 15s. paid. Mortgages and charges, £1,733,133.

Royce, Ltd.—Capital, £170,000 in 70,000 preference and 100,000 ordinary shares of £1 each. Return dated August 11th, 1921. 34,955 preference and 72,487 ordinary shares taken up. £1 per share called up on 3,865 preference and six ordinary, and 15s. per share on 30,000 preference £27,461 paid. £79,981 considered as paid on 72,481 preference and 30,000 ordinary. Mortgages and charges, £44,394.

White, Jacoby & Co., Ltd.—Issue on October 18th, 1921, of £170 debentures, part of a series already registered.

Yorkshire Cable Co., Ltd.—Debentures dated October 12th, 1921, to secure £7,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Bank of Liverpool & Martins.

CITY NOTES.

The Eastern Telegraph Co., Ltd.
Sir J. Denison Pender presided on Tuesday at this company's meeting. He said that the gross revenue showed an increase of £322,793 over the previous year, which was their record year. On the other hand, the very large increase in working charges this year was relatively considerably greater, so that the net revenue for the year was £352,500 less than for 1919. In anticipation of a further increase in expenses they carried forward from 1919 £416,082, so that the available balance for the past year was £1,335,140. The principal increase in expenses was due to the revision of the standard scales of salaries and wages, and to the temporary allowances granted to the staff on account of the exceptional conditions of life which they in common with others working under similar conditions had experienced, both at home and abroad. There had been an increase of 318 in the number of the staff as compared with 1919, but they were only now beginning to overcome the shortness of staff from which they suffered during the war, and afterwards, when the growth of traffic increased in such a marked degree. The staff, though reduced in numbers, responded loyally to the expansion of the business, and willingly worked long hours in order to meet the demands of the Government and the public, but as that condition of affairs could not continue indefinitely, they had been making every effort to speed up the training, and the additional number which had passed through their college and been distributed over the various stations abroad was having the effect of reducing the amount of overtime and allowing the usual well-earned home leave. Fortunately their financial resources had enabled them to deal generously with their staff. It was also a source of satisfaction that they were able to justify an increase in the rate of dividend on the ordinary stock from 8 to 10 per cent. for the year 1919. When he last addressed them he stated that they were making every effort possible to re-establish the efficiency of the service, which had in common with other public services, been adversely affected during the war, when it was impossible to transmit commercial traffic without very heavy delay owing to their inability to lay new cables, or carry out the necessary constant renewals of their older sections. This drawback naturally prevented them from carrying satisfactorily the greatly increased volume of traffic with which they had to deal at that time, but he then informed them that an improvement had already taken place, and foreshadowed a still greater improvement when the whole work on hand was finished. That work was still proceeding, and as each section was completed the good effect was realised, and when the whole programme was finished they anticipated a cable service even more efficient and faster than that prior to 1914. The improvements would have entailed an expenditure by the company alone of about £3,750,000 sterling. So far, £1,300,000

had been charged against the general reserve fund, only £1,000,000 additional ordinary capital being raised. The traffic last year had been very variable, at which no one could wonder, but when business became more normal he hoped they might look for a traffic little short of that they had been carrying during the last two or three years, and if so they might find it advisable to still further increase their carrying capacity by laying additional cables in order to provide a larger margin of capacity in the possible event of an abnormal succession of temporary interruptions to their main line sections occurring, so that the traffic could be, even under those circumstances, carried without delay. They must be prepared to undertake that responsibility, therefore it was more than ever essential to carry substantial amounts to reserve fund whenever they were able to do so. The depreciation of the reserve fund investments had, at the date of the accounts, been fully provided for, and the sum of £2,215,000 odd at which they stood in the accounts represented approximately the actual value on December 31st last. Referring to the triple rate service, he said they would have welcomed its universal cancellation, but so long as foreign countries recognised this express system of communication at a charge of three times the ordinary rate, the merchant on British territory would be at a disadvantage if the same facilities were not accorded to him. Therefore the only way to modify the objections to this system which had been raised in certain quarters was for them to give such an efficient service at ordinary rates as would make the difference in the times of transit between the two services so small that it would not be worth the while of the merchant to pay for the use of a triple rate service, and it was that object the directors had always in view. Sir Albert J. Lepoc Cappe¹, K.C.T.E., seconded the motion, which was carried.

The *Financial Times* states that the first report covering the period of nineteen months to May 31st, 1921, states that the company acquired the business of the Telephone Manufacturing Co. as from October 31st, 1919, and shares of eight installation companies in Great Britain as from December 31st, 1919. The profits totalled £45,891, plus dividends from installation companies, £52,173, making £98,064. There have been placed to investment reserve all profits accrued on installation companies to date as from which shares were purchased, £32,053; to general reserve, proportion of net manufacturing profits earned prior to date of incorporation, which the directors proposed to utilise in writing down preliminary expenses, £12,454; leaving available £53,496. A dividend of 2s. per share, less tax, is proposed, carrying forward, subject to E.P.D. and Corporation Tax, £24,796. No figures are included in the above for five new British companies in Bristol, South Wales, Liverpool, Newcastle and Sheffield, the whole of the shares in which are held by the company. These companies have been in operation since about June, 1920, and it is estimated that considerable profits have already been made. The accounts of the companies abroad have not yet been completed, and nothing has been included in respect of their profits.

Barcelona Traction, Light & Power Co., Ltd.

any resolutions.

Mr. Harold G. Brown, who presided, stated that he had been appointed by the National Trust Co., of Toronto, who were the trustees for the bond-holders of the Barcelona Traction Light & Power Co. The meeting had been convened by the company with the approval of the trustee company, and also with the approval of the Bond Holders' Committee. He requested Mr. Thomas Porter to act as secretary of the meeting, and asked Mr. Peacock, the chairman of the Bond Holders' Committee, to explain the proposals of the company.

Mr. E. R. Peacock said the report of the Bond-holders' Committee, of which those present had had copies, explained quite clearly what the proposals were, and he should therefore not go into the matter in great detail. The company was the holding company, dependent for its income on the revenue from the results derived by the Barcelona Traction, Light and Power Co., and that revenue was not good enough to allow them to pay 2 per cent. The outbreak of war threw everything into disorder, and to save their property, the bond-holders met and worked out a plan by which the first mortgage bonds were put into the first place. In 1917 the construction of another large hydro-electric plant was begun, and in 1918 a new arrangement was entered into by which the company paid a minimum of 2 per cent. on the first mortgage bonds, and a possible, up to 5 per cent. It was also agreed that the minimum should be raised to 4 per cent. The position justified them in taking an optimistic view of the situation. They formed a prospect that the power produced by the two stations would be rapidly sold. They all knew, however, that since the outbreak of the war, Spain had suffered, and the business had been dull, and the exchange had become unfavourable, with the result that they had not been able to raise the interest to 4 per cent., as it required £150,000 to pay the additional 3 per cent. The directors of the company came to the conclusion that the simplest method of dealing with the difficulty was to propose

that the interest should not be less than 2 per cent., and that the maximum should be increased up to 6 per cent. It would be unwise to bind themselves as to when the interest must be raised. What they could say was, that the operating companies in Spain were in a position to take advantage of any improvement in business. They had a large reserve of power available for sale, but it was always necessary to spend money in an expanding business of this kind. He had a great faith in Barcelona as a field for electricity in the future. Next to Manchester it was a most important cotton manufacturing centre in Europe, and also had large woollen enterprises. The city continued to grow, and gave every indication of maintaining its claim as a most important industrial centre. The rates received for power now were much more in accord with the present day ideas of the value of power, and the company undoubtedly possessed the finest electrical plant in Spain. He moved the resolutions which were placed before the meeting. They had found no opposition to the proposals put forward in any quarters, and had received very substantial support.

The resolution having been seconded, Mr. Maxwell asked what the position of the ordinary stock of the company was, and whether the proposals contained in the resolution were made for the protection of the whole of the ordinary stock.

Mr. Peacock, in reply, said that Mr. Maxwell's question was one which had occurred to a good many people because the bond-holders seemed to be asked to make all the sacrifices in the organisation, and people wanted to know why the stockholders were not made to do something. It was what he had often thought himself, and it was an entirely safe inference to draw from what had happened, but it was not a correct one. To begin with, his conclusion had been that it had been impossible to get the stockholders to do anything that was worth while in an effective way for the company, and it would be foolish therefore to attempt it unless they were prepared to go to the length of buying them out. That involved a great many things, and it had always seemed to him to be better to try and carry on with the structure of the company as it was, rather than face a very complicated, and in some respects, dangerous result arising from the complete re-organisation of the company. The attempt to establish the company's credit in Spain, had been progressively successful, and they would probably cause more damage than good by a drastic re-organisation.

The chairman announced that the total amount of bonds represented at the meeting was £2,659,450, but the amount required for a quorum was over four millions, so that there was not a quorum present. That being so, he proposed, under the provisions of the Trust, to adjourn the meeting automatically until Thursday, the 29th December next, at the offices of the Canadian, General, & Finance Co., 3, London Wall Buildings, E.C., at 12.15 p.m., when the meeting would be purely formal, and the resolutions would be put to the meeting in any circumstances.

The meeting accordingly stood adjourned to the date mentioned.

Nairobi Electric Power and Lighting Co., Ltd.

The directors, in their statement just issued, say that in their last report it was indicated that early in 1920 the value of the local rupee was permanently fixed at 2s., and it was re-named the florin. In previous yearly accounts the local rupee was treated as the equivalent of 1s. 4d., and differences arising from its increasing value appeared in the revenue account as gain on exchange. In the accounts now submitted to the shareholders the florin is naturally translated at 2s., and there is no large gain on exchange as appearing in previous accounts. The result, however, of treating the local unit as having a value of 2s. instead of 1s. 4d. is an increase of approximately 50 per cent. in the items appearing on both sides of the revenue account, which must be borne in mind in attempting any comparison with the figures of previous years. The share capital remains at the same figure as before, but the outstanding debentures have been further reduced to £13,000. The repairs and maintenance account for the year is heavy, chiefly on account of repairs to the auxiliary steam plant, after the exceptionally heavy call upon its services in the recent years of water shortage. Dividends have been paid amounting to 10 per cent. for the year, less income tax, being at the same rate as in previous years. The units generated were:—

	1919.	1920.
By water power	1,056,670	1,472,804
By steam power	195,139	167,840
Total	1,291,809	1,640,644
Motors connected, b.h.p. ...	716	952
Lights connected, 40-W equiv. ...	15,752	17,173

Meeting: London, December 14th.

Victoria Falls & Transvaal Power Co., Ltd.—Net earnings, including those of the Rand Mines Power Supply Co., Ltd., for the quarter ended September, 1921, £205,885, before providing for taxation in South Africa and the United Kingdom.

Castner-Kellner Alkali Co., Ltd.—Dividend of 5 per cent., making 13 per cent. for the year.

Prospectus.—*Midland Counties Electric Supply Co., Ltd.*—This company, which recently changed its name from the Tramways Light & Power Co., has been offering for sale £400,000 seven and a half per cent. mortgage debenture stock at 96 per cent. The prospectus contains a statement signed by the chairman, Lord Chilton, in which the growth in the profits from 1915 to 1920 is tabulated. The net profits for 1920 (income tax paid) were £53,696, and after paying debenture and loan interest (£17,645), the surplus for dividends, reserve, &c., was £36,051. For 1921, the net receipts are estimated at £60,000 at least, and but for the coal strike effects they should have been £80,000. The proceeds of the issue will be utilised for the redemption of £200,000 8 per cent. Notes now outstanding, for discharging obligations to bankers, and for the general purposes of the company. The list is to be closed on or before December 5th.

Western Telegraph Co., Ltd.—The revenue for the year ended June 30th, 1921, was £2,073,498, and the working expenses were £1,024,425. Debenture-stock interest requires £32,747; Income Tax, E.P.D., and Corporation Profits Tax, £306,536; balance, £709,790, added to £149,410 brought forward, making £859,200. There has been transferred to general reserve £350,000, to the maintenance ships' reserve fund £50,000, and to land and buildings depreciation fund, £50,000. The distribution on the shares has been 10 per cent., free of income tax, for the year, and 4s. per share, free of income tax, on 96,102 new shares. There is a balance of £128,739 to carry forward. Annual meeting held on Wednesday.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—The report for the year ended December, 1920, which was submitted at the annual meeting on Wednesday, shows that the gross revenue was £2,514,855 less £744,934 working expenses, and £451,307 for maintenance of cables and special expenditure, leaving a balance of £1,318,554. After providing £665,138 for E.P.D., Corporation Tax, and Income Tax, payable in England, £30,096 for interest on mortgage debenture stock, and £5,451 on account of expenses of issue of new capital, there is a balance of £616,958 plus £232,440 brought forward, making £849,398, of which £450,000 has been put to general reserve. After paying dividends of 10 per cent. free of income tax, and a dividend of 4s. per share free of tax on the new shares, there is a balance of £80,779 to carry forward.

A Swedish Company.—The accounts of the Elektriska Aktiebolag Chr. Bergh & Co., which has a share capital of 5,089,000 kr., show a loss of 3,202,000 kr. for 1920-21 as contrasted with a loss of 1,131,000 kr. in the previous year. The loss is attributed to the holding of extensive stocks, doubtful claims arising from the preceding year, and the unfavourable situation of trade in conjunction with German competition. Having regard to the uncertainty of the general economic situation, the directors are unable at present to put forward any proposal for covering the loss, but will submit a scheme of reconstruction as soon as prospects exist for the consolidation of the position. Apparently manufacturing was suspended during the year, as the receipts are reported at merely 26,000 kr., most of which were rents.

Cape Electric Tramways, Ltd.—For the year ended June 30th there was a profit of £81,724. After providing for debenture interest, redemption of debentures, and including the balance brought forward, the net credit balance is £60,046. The reserve fund has been credited with £18,000, leaving £42,046. A dividend of 6 per cent. on the ordinary is to be paid, leaving £12,573 to be carried forward. After protracted negotiations, the Municipality of Cape Town came to a decision not to proceed with its proposal for acquisition of this company's Cape Town system. The concession will, therefore, run on until 1925, when the question may again arise.

Greenock and Port Glasgow Tramways Co., Ltd.—The total receipts for 1920 were £84,518. After providing for all expenses, including mortgage interest, amounts payable under agreements, and setting aside £6,000 for renewals, there was a surplus of £3,937, plus £216 brought forward. The directors propose placing to sinking fund for loan redemption £1,743, to reserve £2,000, leaving to be carried forward £410. The result does not admit of payment of any dividend.—*Financial Times.*

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148a:—*British Thomson-Houston Co.*—£1,500,000 seven per cent. mortgage debenture stock, issued at 92½ per cent., partly paid (and fully paid on December 1st), after issue of allotment letters.

Low Temperature Carbonisation—40,928 ordinary shares of £1 each, fully paid, Nos. 200,001 to 240,928.

British Vacuum Cleaner Co., Ltd.—After writing off depreciation of plant, premises, &c., £1,351, there is a balance of net profit of £1,008 plus £582 brought forward. There has been placed to reserve £1,000, leaving to be carried forward £590.

Tube Investments, Ltd.—After paying the final dividend on the 7 per cent. preference shares, a dividend has been declared on the ordinary shares for the year ended in October at the rate of 8 per cent., less tax.

Montreal Water & Power Co.—Dividend of 3½ per cent. for the half-year ended October on preferred and common stocks.

Canadian General Electric Co., Ltd.—Quarterly dividend of 2 per cent. on common stock, for three months ending December, 1921.

Globe Telegraph & Trust Co., Ltd.—Quarterly dividend of 3s. per share less tax on the preference, and 5s. per share net on the ordinary shares.

STOCKS AND SHARES.

TUESDAY EVENING.

THE financial outlook continues to be not unlike that of which characterised the weather in the early part of the week: foggy, that is to say; rendering it difficult to "see one's way," as the Stock Exchange says. There is nothing very fresh in the situation, Ireland and the foreign exchanges being the chief niggers in the hedge, while cheerful talk of improvements in various trade conditions have been a little tempered by the inevitable disappointments and setbacks that occurred, even in such industries as those which are undoubtedly working towards brighter days. Investment money is clamantly required, by borrowers who offer gilt-edged stocks which are taken with a little less readiness than prevailed at the beginning of the month by the real investor.

Having regard to the striking success of its new issue of £1,500,000 7 per cent. mortgage debenture stock offered at 92½ by the British Thomson-Houston Co., it was expected that there might be a premium of 2 or 3 points on the stock when the market began, but the opening price led off at ¼ discount. Next day, it hardened to ¼ premium. How the company will fare in the future is a matter likely to engage no little attention from those who are interested in electrical and engineering concerns, for, as was mentioned last week, the company did not pay the dividends on its preference shares from 1906 to 1920 inclusive, although the whole lot of arrears was cleared off in July last year. The ordinary shares also received 10 per cent. at that time, after going without a return for seventeen years.

An issue of ten million dollars Pacific, Gas & Electric Co. 1st mortgage 6 per cent. bonds, 1941, at 98½ has just been made. The investment will probably appeal more to capitalists in the United States than to those on this side. The Midland Electric Corporation has been offering £400,000 7½ per cent. mortgage debenture stock at 96. Prompt subscription led to the list being closed six days in advance of the full time indicated by the prospectus. An issue of £300,000 Telephone Manufacturing Co. 8 per cent. cumulative income bonds, at 96 is expected. Some of the cable companies' reports for last year are now available, and make an interesting showing. The Western gross revenue was just over two million pounds, a decline of £600,000, while the working expenses of a little over a million sterling showed an increase of £85,000. The company's bill for taxes, however, at £306,000 is less than half that of the preceding year and the dividend is maintained, as already announced, at 10 per cent. free of tax, the company carrying forward a smaller balance to the new year. The Eastern Telegraph Co. has done better. The gross revenue of £4,400,000 is £320,000 up, as compared with the previous year. The expenses, however, advanced by half-a-million sterling, owing mainly to an advance in salaries and wages. On balance, the net revenue fell off by £352,000, but owing to the large amount brought forward, the company not only maintained its usual 10 per cent. free-of-tax dividend, but placed half-a-million to general reserve and carried forward £316,000, which is about £100,000 less than that similarly dealt with in 1920.

The Eastern Extension results are handicapped by the taxes of £666,000, being £250,000 larger than those for the previous year. The depreciation-of-investments account gets nothing this year, as against £200,000 a year ago, and the company carries forward the small amount of £80,000. The results are good enough, considering the times through which industry is passing, and cable stocks are amongst the very few which have shown hardly any depreciation during the trade slump throughout the world.

Marconi have gone back to 1½, and the wireless group is very quiet.

Kensington ordinary, amongst electric lighting shares, have gained another 2s. 6d. at 44. County of London at 8 13 16 are better, but there are shares on offer at this price. Notting Hill preference have risen to 7½, a gain of 5s. Manufacturing issues are inclined to be dull. General Electrics ended off to 17s., English Electrics gave way to 8s. 9d. and Edison 1st debenture at 61 is a point down. Stock changed hands at 63. India Rubbers, following upon the report of last week, shed another 1/16 to 11s. 3d., though there have been a good many buying orders in the market on the basis of 10s. to 11s. Evidently, people recognise that the company has an ex-

cellent business, and it is only a matter of time before the melancholy loss, just reported, has been wiped out and the company sets out in the direction of prosperity once more. Babcock & Wilcox at 2½ is 1/16 higher.

Metropolitan Consolidated, at 24, has a rise of 10s., and is the only stock in the Underground group to exhibit any trace of vitality. The market is somewhat disturbed by the restive condition of the London General Omnibus men, who, although they have decided against a strike, seem to be far from satisfied with the new arrangements which the company is about to introduce in order to meet the decrease in fares that takes place this week. Home Railway dividend estimates in respect of this year are anything but exhilarating, although the underground is expected to suffer less than the steam railway companies.

Mexican Utility bonds are better. The American buying of the past few days has spread beyond Mexican Government bonds, and has included within its scope Mexican Light and Power, Mexico Tramways, and Mexican Electric Light issues. Those who are in touch with Mexican conditions aver that President Obregon is faced with conditions more difficult than most people realise, owing to the fact that corruption is declared to be rife in his country, in consequence of which a considerable proportion of revenue fails to reach the people for whom it is intended. Once the Mexican can be educated to take a more serious view of responsibility, it is held that commerce and industry will go ahead freely, and, in anticipation of this, the speculative investor is laying in a few stocks and bonds of the utility companies.

Rubber shares remain firm, with a moderate amount of business going on in them. The produce keeps about a penny or so under 1s. per lb. Armaments and kindred descriptions continue under the chastening influence of the proposals propounded at the Washington Conference.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend.	Price	Rise or	Yield
	1919, 1920.	Nov. 29, 1921.	fall.	p.c.
Brompton Ordinary	12 12	63	—	£9 18 0
Charing Cross Ordinary ..	7 8	43	—	8 17 10
do. do. 4½ Pref.	44 44	94	—	7 4 4
Chelsea	9 4	39	—	9 4 8
City of London	13 14	26 9	—	10 9 6
do. do. 6 per cent. Pref. ..	6 6	17 6	—	6 17 2
Connolly of London	8 8	83 1	—	9 1 6
do. do. 5 per cent. Pref. ..	6 6	70	—	7 10 0
Kensington Ordinary	7 9	43	+ 1	9 4 8
London Electric	24 24	1	—	7 10 0
do. do. 6 per cent. Pref. ..	6 6	3	—	10 0 0
Metropolitan	6 6	7	—	9 6 8
do. 4½ per cent. Pref. ..	44 44	21 2	—	7 13 2
St. James' and Pall Mall ..	12 12	62	—	8 17 10
South London	6 6	28	—	10 13 2
South Metropolitan Pref. ..	7 7	16 3	—	8 12 4
Westminster Ordinary	10 10	53	—	8 13 10

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	6 6	82 1	—	7 5 7
do. do. Def.	14 14	17	—	8 16 6
Chile Telephone	6 6	54	—	5 17 8
Cuba Sub. Ord.	7 7	7	—	10 0 0
Eastern Extension	10 10	16 2	—	6 2 2
Eastern Tel. Ord.	10 10	16 2	—	6 3 1
Globe Tel. and T. Ord. ..	10 10	16 2	—	6 3 2
do. do. Pref.	6 6	94	—	6 9 9
Great Northern Tel.	22 24	25	—	9 12 0
Indo-European	10 10	30	—	8 6 8
Marconi	25 15	14	—	10 0 0
Oriental Telephone Ord. ..	12 12	22	—	6 0 0
United R. Plate Tel.	8 8	5 1	—	7 0 8
West India and Panama ..	Nil	Nil	—	Nil
Western Telegraph	10 10	16 2	—	8 2 2

HOME RAILS.

Central London Ord. Assented	4 4	40 1	—	8 1 8
Metropolitan	14 14	21	—	6 5 0
do. District	Nil	Nil	—	Nil
Underground Electric Ordinary	Nil	Nil	—	Nil
do. do. "A"	Nil	Nil	—	Nil
do. do. Income	4 2	65 1	—	4 13 0

FOREIGN TRAMS, &c.

Anglo-Arg. Trams, First Pref. ..	5 12 1	28	—	10 9 6
do. do. 2nd Pref.	Nil	5 1	—	10 4 8
do. do. 5 per cent. Deb. ..	5 5	65	—	7 15 10
Brazil Traction	Nil	Nil	—	Nil
British Columbia Elec. Ry. Prefs. ..	5 5	58	—	8 12 4
do. do. Preferred	5 93 1	51	—	9 5 0
do. do. Deferred	5 124 1	60 1	—	10 14 6
do. do. Deb.	4 4	64	—	7 1 8
Mexico Trams, 5 per cent. Bonds ..	Nil	Nil	—	Nil
do. do. 6 per cent. Bonds ..	Nil	Nil	—	Nil
Mexican Light Common	Nil	Nil	—	Nil
do. Pref.	Nil	Nil	—	Nil
do. 1st Bonds	Nil	5 57 1	—	8 13 10

MANUFACTURING COMPANIES.

Babcock & Wilcox	15 16	22	—	6 14 9
British Am. Electric Ord. ..	10 10	14 1	—	10 0 0
British Electric Light Ord. ..	15 15	14	—	10 18 2
Caledonian	15 15	12	—	6 18 8
Edinburgh	10 10	14 6	—	13 15 10
Edinburgh	10	—	—	5 6
do. do. 5 per cent. Deb. ..	5 5	64	—	7 16 3
Electric Light	10 10	17 6	—	11 8 6
English Electric	8 8	13 9	—	18 6 8
do. do. Pref.	8 8	13 9	—	8 14 6
Gen. Elec. Pref.	6 6	64	—	7 18 0
do. do. Ord.	10 10	17	—	11 15 4
Honey	15 15	14	—	10 0 0
do. 4½ Pref.	14 14	20	—	6 8 8
India Rubber	10	—	—	—
Mt. Victoria Pref.	8 8	11 1	—	8 18 8
Swedish Ord.	10 10	14 6	—	9 8 2
Telegraph Con.	30 30	21 1	—	6 11 1

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 30th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
Acid, Oxalic	per lb.	9d.
Ammoniac Sal	per ton	286
Ammonia, Murate (large crystal) ..	"	268
Bisulphide of Carbon	"	251
Borax	"	281
Copper Sulphate	"	200
Potash, Chlorate	per lb.	64d.
Perchlorate	"	64d.
Shellac	per cwt	£17 10s.
Sulphur, Sublimed Flowers	"	215
do. Lump	"	214
Soda, Chlorate	per lb.	84d.
Crystals	per ton	27
Sodium Bichromate, casks	per lb.	64d.
METALS, &c.		
Babbitt's Metal and Anti-friction Metal—		
Grade I	per ton net	£180
Grade II	"	£118
Grade III	"	£71
Brass (rolled metal 30 to 12" basis) ..	per lb.	10 1/2
Tubes (solid drawn)	"	10 1/2 to 10 1/2
Wire, basis	"	11 1/2
Copper Tubes (solid drawn)	"	1 1/2
Bars (best selected)	per ton	£101
Sheet	"	£101
Rod	"	£101
(Electrolytic) Bars	"	£76 15s.
Sheets	"	£145 10s.
Wire Rods	"	£29
H.C. Wire	per lb.	11 1/2
Electric Rod	"	5/6
Sheet	"	5/6
German Silver Wire	"	2/9
Gutta-percha, fine	"	12 1/2
India-rubber, Para fine	"	1 1/2
Iron Pig (Cleveland Warrants)	per ton	Nom.
Wire, galv. No. 8, E.O. qual. ..	"	£22
Lead, English Pig	"	£27
Mercury	per bot.	£10 5s. to £10 10s.
Mica (in original cases) small	per lb.	8d. to 3/4
" " large	"	10/- to 30/- & up
Phosphor Bronze, plain castings ..	"	1/2
" " drawn bars and rods ..	"	1 1/2
" " rolled strip & sheet ..	"	1 1/2
" Wire	"	1 1/2
Silicon Bronze Wire	per lb.	1 1/2
Steel, Magnet, in bars	per ton	£101 10s.
Tin, Block (English)	per lb.	24 10s. to £5 10
Wire, Nos. 1 to 16	per lb.	3/6
White Anti-friction Metals	per ton	£65 to £275

Quotations supplied by—

A. G. Boor & Co.	G. James & Shakespear.
C. Thos. Bolton & Sons, Ltd.	H. Edward Till & Co.
Frederick Smith & Co.	J. Bolling & Lowe.
F. Wiggins & Sons.	J. Richard Johnson & Nephew, Ltd.
India-Rubber, Gutta-Percha and	P. Ormiston & Sons.
Telegraph Works Co., Ltd.	C. Clifford & Son, Ltd.
	W. F. Dennis & Co.

Electric Motor Vans in Sweden.—The Swedish State Railway authorities recently asked the Government for permission to purchase from abroad electric motor vans for the transport of travellers' luggage. Objections to the placing of the order outside the country were raised by the A. B. Svea, and to these the State Railway authorities have now issued a reply. They state that they were not aware that the A. B. Svea produced vans such as were proposed to be acquired, but in the middle of October the former asked the latter to submit a tender for the supply of such vehicles. No reply, however, has yet been received. The railway authorities state that they have learned privately that the A. B. Svea was endeavouring to get an offer from America. As the firm was unable to present the particulars asked for, the railway authorities recommend that no action should be taken with regard to the firm's objections.

Water Power in Scotland.—Reporting to the Edinburgh Chamber of Commerce on the British Association meetings, and particularly with regard to the use of water power in Scotland, Mr. I. Cockburn Miller said the Water Power Resources Committee of the Board of Trade had strongly recommended that additional facilities should be provided in technical colleges and universities for the study of hydro-electric development, and as the result of the Committee's representations it had been decided to initiate a chair of hydro-electric engineering in some chosen university. Edinburgh was the most favourable place for this, and he suggested that they should select a committee of engineers to promote the idea. It was agreed that the directors should take the matter into consideration.

Rayleigh Memorial.—The memorial tablet to the late Lord Rayleigh, executed by Mr. Derwent Wood, R.A., was unveiled in the North Transept of Westminster Abbey on Wednesday last, the anniversary day of the Royal Society.

EXPERT EVIDENCE.

[By A Legal Contributor.]

IN a recent case before the House of Lords (Attorney-General *v.* Cory Brothers) their lordships had something to say about the evidence of expert witnesses. It was necessary to determine what caused a colliery dump or slag heap to slide down into a valley and cause damage to the property of the plaintiffs. Much depended upon the evidence of certain eminent engineers and geologists who were called as witnesses on either side.

Lord Haldane, having discussed the various theories put forward, said, in the course of his judgment: "The conclusion to which I have come is one which is consistent with the scientific evidence, and it appears to me to be the only one which is borne out by the chronology of what was observed." Lord Atkinson said—referring to the evidence of one witness: "However eminent an expert may be, he cannot make an effect precede its cause," while Lord Shaw, commenting upon the somewhat involved testimony of another witness, said: "If the theory of this learned man be sound, it is extremely difficult to see why what happened could ever have happened."

It might be inferred from these expressions of opinion that judges are apt to speak contemptuously of scientific evidence; but this is not so. For one expert whose evidence is ignored; there are ten whose testimony is received and acted upon by the tribunal before which they have been summoned as witnesses. Without them, it had been impossible in many cases to do justice between the parties.

The truth is, of course, that although they may not often admit the fact in public, those who preside over our judicial tribunals cannot get on without the expert witness. He is not necessarily a scientific man, yet, in point of fact, expert testimony is mainly required in cases of a technical character, which may be of infinite complexity. There is no scientific matter which may not have to be discussed in courts of justice. One recalls the case in which a secret chemical process used in photography formed the subject of an action. Counsel for the plaintiff asked that the general public might be excluded from the court, or the process might be revealed. "Yes," said the judge, not appreciating perhaps that his words might have a double meaning, "the case ought certainly to be tried *in camera*."

The evidence of a scientific man is only "expert," when it involves a question of *opinion*; otherwise he is a mere witness to facts. Suppose, for example, he is describing the result of experiments conducted by himself, he gives an answer to a question of fact. If, however, he is asked what would be the chemical effect of mixing substance A with substance B, his answer is that of an expert witness.

The importance of expert evidence varies according to the tribunal before which it is adduced. For example: An "ordinary" (using the word in no invidious sense) judge will probably not be familiar with electricity in all its many applications to the needs of mankind. He may not even understand any of the terms which run so easily off the tongue of an electrical engineer. Once in half a century, perhaps, we have a judge like the late Lord Moulton, who was a veritable encyclopedia of scientific knowledge; but his was an intellect of the rarest. It may be assumed that in every technical case the judge will welcome the expert witness if only to enable him to understand the nature of the question which it is his duty to determine. But there are some tribunals before which it were superfluous to call experts. Thus the Electricity Commissioners require no

guidance on technical points, at any rate, from electrical engineers. Indeed, nothing was more remarkable in the recent inquiry conducted by these gentlemen at the Institution of Electrical Engineers than the way in which counsel appearing for the various parties were left far behind by the members of the tribunal when "the technical question" was before the court.

Between the two extremes above mentioned there is every variety of tribunal which may or may not require the assistance of the expert. That judges require technical aid from someone has been recognised more than once by the legislature. The Admiralty Court sits with nautical assessors; all judges have power to summon assessors if so minded, while judges of county courts frequently sit with medical assessors when deciding Workmen's Compensation cases.

One difficulty which besets the scientific man summoned as a witness is that he does not know what degree of ignorance or knowledge he is to attribute to the court. If he assumes that the judge knows nothing, say, of electricity, and begins at the beginning, he may be hauled up for wasting the time of the Court. If he assumes the judge knows all about the subject, he may again be accused of wasting the time of the Court in talking of things which no one present understands but himself. As a general rule, the legal adviser of the party on whose behalf the witness has been summoned, will be able to tell him something as to the extent of the judge's scientific knowledge. But even he may not be able to do this; and some of our judges have the two faculties of concealing their ignorance and of acquiring knowledge developed in a very marked degree.

The writer recalls an observation made to him by one of the experts who gave evidence in the celebrated Marconi case which was tried some years ago by Lord Parker, when he was a judge of the Chancery Division. On being asked whether the judge was able to understand the evidence, he said: "When I left the Court, after hearing the judgment, I was convinced that there was no expert who had a better knowledge of the scientific points discussed than Mr. Justice Parker!" This is the more remarkable when it is mentioned that the learned judge was a classical scholar who had never had any scientific training in his youth.

One of the principal functions of the expert witness falls to be discharged before he goes into Court at all. He has to coach learned counsel in the scientific aspects of the case. Some members of the Bar who make a speciality of technical cases will require little teaching; but there are others who are prone to get lost among technical terms and phrases unless their meaning is explained. To give that explanation is the duty of the expert in consultation. He will generally find his pupils very apt to imbibe instruction. He ought to tell them enough to enable them to expound first principles to the judge. There is one rule which the expert should keep firmly in mind when he gets into Court: he must never act, or even appear to act, as advocate for the party who has called him as a witness. If the judge once gets the idea that a witness is advocating the cause, he is more than likely to discount the whole of his evidence.

Nor should the expert be over-confident. Modesty is at all times becoming. The story is told of a witness who was asked whether Mr. A. B. was not the most eminent engineer in London?

"No," said the witness.

Upon this the judge intervened: "Would you mind telling me *who* is the most eminent engineer in London?"

"I am, my Lord," was the reply.

To someone who subsequently criticised his conduct, he explained that, as he was on oath in the witness-box, he had felt bound to speak the truth!

REFRIGERATING PLANT.

Few loads appeal so directly to the electricity supply engineer as an ice-making plant, for this is an industry which is at its fullest activity in the summer and at its minimum in the winter. Moreover, a considerable

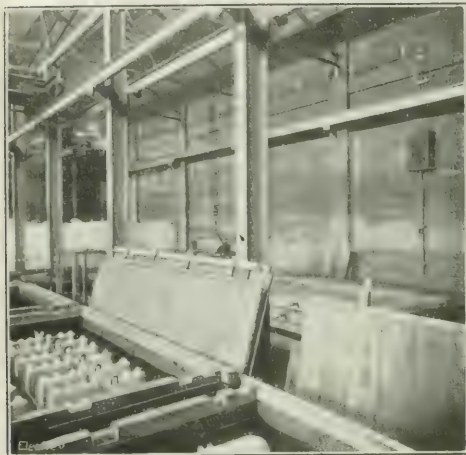


FIG. 1. ICE-MAKING TANKS.

amount of power is required, as will be gathered from the following particulars of a large ice factory in a North-East Coast town.

Power is derived from the Corporation mains at 6,600

volts, 3-phase, 50 cycles, and is transformed on the premises to 440 volts. The refrigerating apparatus work on the direct-expansion principle, and were installed by the Pluperfect Refrigerating Co., of Manchester, the compressors being made by The Light-foot Refrigerator Co., Ltd., London; each of the main compressors is belt driven by a 250-h.p. motor, the actual power required averaging about 200 h.p. When the plant is working at full capacity, the aggregate load averages about 520 h.p., including the power required by the auxiliary compressors, circulating pumps, crushing machinery, &c.

Fig. 1 shows part of the freezing apparatus and the open wiring on the wall, while fig. 2 shows the main switchboard and some of the smaller motor-driven machines, with a snow-clad pipe connected with a refrigerating machine. Here again the wiring forms a noteworthy feature, consisting not of lead-covered cable as might be supposed, but of "C.T.S." cable, supplied by the St. Helens Cable and Rubber Co., Ltd., of Warrington. The use of this class of cable was due to the experience gained in similar circumstances by the Park Electrical and Engineering Co., of Manchester, which specialises in this

class of work, and which designed and carried out the whole of the electrical installation. The conditions of extreme cold which are met with in ice-making installations are very severe in their effects upon cables and wiring, but the Park Electrical and Engineering Co., having used St. Helens C.T.S. cable with satisfactory results in other installations where varying temperatures and severe conditions were encountered, carried out the whole of the wiring with this material, without any further protection than its own sheathing.

Between the transformer and the main switchboard there is a run of about 150 ft. of two cables in parallel, each of which consists of three cores of 0.5 sq. in., and one core of 0.25 sq. in.; these are believed to be amongst the largest C.T.S. cables of this description manufactured up to the present, being $3\frac{1}{4}$ inches in diameter overall.

The lighting installation comprises some 150 points, split between the three phases and the neutral through three single-pole switches and fuses on the main board, and controlled by acid-proof switches provided in the various departments. As shown in the illustrations, the wiring is carried on cleats throughout the installation.

The switchboard is equipped with one 900-ampere main oil switch, and five circuit oil switches which control the circuits running to the various motors.

A few words regarding the process employed may be of interest. No brine is used in this system, anhydrous ammonia being itself the cooling agent. The compressors bring the gaseous ammonia up to a pressure of 140 or 160 lb. per sq. in. At this pressure the gas passes to a condenser in which it is liquefied, the latent heat being removed. The liquid ammonia is then allowed to flow through the expansion coils of the ice-making tanks, where it absorbs heat from the water and again reaches the gaseous state. This gas is again taken

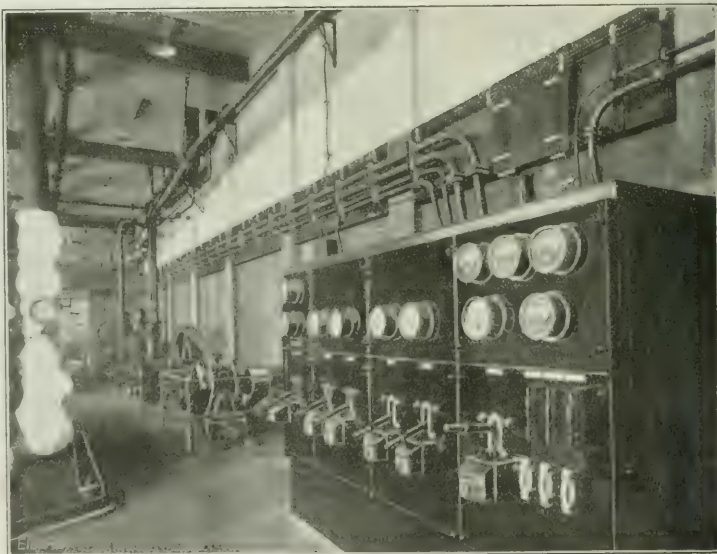


FIG. 2. MAIN SWITCHBOARD AND HEAVY C.T.S. CABLES.

in by the compressor and the cycle is repeated. One advantage which this system possesses over the ordinary brine process is the speed with which the ice blocks can be released and removed. This is effected by reversing the direction of the liquid ammonia through the freezing pipes of the tank, which quickly causes a movement of the pipes away from the ice.

THE FEDERATION OF BRITISH INDUSTRIES.

The Annual Meeting.

THE annual general meeting of the Federation of British Industries was held at the Hotel Cecil on Wednesday, November 23rd.

Sir W. PETER RYLANDS, the retiring president, surveying the work of the Federation during the past year, said he was convinced that the present world-wide prestige of the Federation was attributable to the policy which it had consistently pursued. It had not aimed to achieve its ends by wielding the big stick. They claimed that industry, and consequent employment, was the first interest of the State. They claimed that manufacturers had the greatest practical experience on this subject, and that their views were therefore entitled to serious consideration, if expressed with reason, moderation, and with due regard to the general interests of the community. They could not, however, expect to have it all their own way. Sometimes they might not be right. At others their views might be over-ruled by political considerations, and they might be able to indulge in the cold comfort of being able to say: "We told you so," when the wisdom of their view was proved by the event, and the adoption of a contrary policy attended with misfortune, possibly disaster. Such a case he believed to be presented by the unfortunate financial policy of the Government. The Federation addressed a serious warning to the Chancellor of the Exchequer 18 months ago, when he proposed to increase the rate of E.P.D., and also to institute a new burden upon industry in the form of the Corporation Tax. They were confident that both steps were unwise. He was disposed at the time to think that the Chancellor was inclined to waver on the point, but political considerations were irresistible. No doubt at that time industry had been enjoying a period of remarkable prosperity, and the official mind was disposed to attribute the views of the Federation to unwarranted pessimism. It might be an exaggeration to attribute the nation's troubles to the heavy burden then laid upon industry, but he had no hesitation in saying that the result had been to increase those troubles and to aggravate most seriously the difficulties which would come before the nation in the immediate future. The Government had squeezed industry financially dry, and by the operation of the income tax based on three years' average profits, many companies would be hard pressed to meet their commitments during the next few years, except by inroads into their capital. Nothing could be more calculated to hamper demand and depress trade. The outlook was serious, and in the absence of world-wide trade revival, of which at the present time there appeared but small prospect, the Chancellor of the Exchequer would be well advised to retrace his unfortunate step, as far as possible, and to lighten the burden upon industry at all costs. Taxation must be paid out of production, and with the nation's productions far below the normal level, the taxable capacity of the nation was more than proportionately reduced. Industry was the engine which drove the ship of State, and they could liken it to an internal-combustion engine in that any serious overload was followed by an actual reduction in power. It was no use trying to carry a burden heavier than could be borne. The result must be a reduction in production, and so make the burden even more intolerable. It was wiser to recognise that the country was passing through a period of extraordinary difficulty, and believing it to be temporary only, the safety of the ship of industry was of far greater moment than to carry the cargo into port. These views were widely held by manufacturers who realised better than any the difficulties with which they had to contend in maintaining their output, and they agreed that even at the risk of the charge of being actuated by selfish motives, the Federation should press on the Government the wisdom of pursuing a financial policy which, even if for the moment economically unsound, was in the true national interest and a practical expedient. They should be no less insistent on the need for drastic economy in the Government service. He appreciated the action of the Chancellor of the Exchequer in affording them opportunities of conferring with the officials at Somerset House on points of administration and detail which proved of great help to manufacturers. Of such points possibly the most difficult was that in connection with the valuation of stocks for the purposes of E.P.D., and he hoped that the settlement arrived at of giving all firms an opportunity of re-valuing their stocks as on August 31st was generally regarded as a fair compromise and as removing to a large extent, if not altogether, the great injustice which manifestly must have attended the incidence of E.P.D. in its original form.

Sir Peter referred to the transport problem and to the conferences of the F.B.I. with the Government Department concerned therewith.

In conclusion, Sir Peter Rylands thanked the members of the Federation for their splendid support during his two years of office. The responsibility had been a heavy one, as manufacturers differed in opinion as much as less distinguished people. In laying down his office, he could say of the Federation that it was an instrument of incalculable value for the expression of the views of industry, and if the manufacturers of

the country continued to give to the Federation whole-hearted moral and material support, it would never be again a reproach to this country that the most vital interest—that of production—was alone silent in the councils of the nation.

Col. O. C. ARMSTRONG (Greenwood & Batley, Ltd., Leeds) was unanimously elected president, and among the new vice-presidents elected was Sir Tom Callender.

The annual report was placed before the meeting and adopted without discussion, as was the balance sheet.

After consideration of some matters of purely domestic interest, the remainder of the meeting was taken up with a discussion of two reports by Committees of the Federation. To be more precise, it should be said that the bulk of the time was occupied by a review of these reports by Sir Peter Rylands, and a little discussion. The Federation has appointed two Committees to deal respectively with trade depression and German reparations; regarding the latter it is claimed the manufacturers of the country have a special claim to be heard. The object in both cases is to place recommendations before the Government.

The Committee which is considering trade depression advances the argument that the policy of Great Britain since the war, of a gradual restriction of currency with the eventual object of reintroducing the pre-war gold standard, has proved not to be the right one, and the unhappy position of industry as a result has been still further aggravated by excessive taxation, as mentioned in Sir Peter Ryland's opening remarks. It is urged that the prime necessity at the present time is not so much a return of the world's currencies to any particular standard of value, or even to any particular ratio to gold, as the achievement of stability at the earliest practicable moment. The Committees' views are well stated in the following paragraphs:—

"We believe, therefore, that an effort must be made to arrive by agreement at some interim arrangement which would provide for a reasonable degree of stability of the principal currencies in relation to commodities, even if this stability could only be maintained for a period, and required periodic readjustment. In view of the experience of the conferences and negotiations of the past few years, it seems to us highly improbable that such an agreement can be reached in the near future by any conference between Governments. The interests which they represent are necessarily so varied and so divergent, and the responsibilities of the Governments themselves so complex, that it is difficult for them to arrive at any practical decision until that decision already has the support of a considerable and influential body of opinion.

"We would suggest, therefore, that discussions should be initiated between the manufacturers of the various countries in the hope of reaching some definite suggestions as to policy which could be urged upon the various Governments with the support of the bulk of industrial opinion in the countries concerned. We suggest that these discussions should be initiated between manufacturers, since the fundamental interests of manufacturers in most countries are identical on this question, and because the existence of highly developed and comprehensive manufacturers' organisations in most countries renders consultations between them on the whole easier than consultation between other groups of interests. As a first step we should recommend that consultation should take place between the manufacturers of this country and of the United States, and if these could reach agreement on any policy which would, in their opinion, benefit the industries of the two countries, further meetings might be arranged between British and American manufacturers and the representatives of the manufacturers of the other leading countries.

"We recommend, therefore, that the Federation should at once ascertain the views of the leading American manufacturers' organisations as to the desirability of such a discussion as we have suggested. If these views are favourable a conference should be arranged, either in this country or America, it being understood that the primary object of such a conference would be to endeavour to arrive at some policy which could be advocated by the manufacturers of all countries with a view to a return to stability in the world's standards of value."

For the rest the Committee recommends the Federation to press upon the Government the urgent need for a substantial and immediate reduction of taxation, and has it down that a frank statement by the Government that this will be done would do more to restore confidence in trade than anything else.

The second report, dealing with German reparations, starts with the hypothesis that the Reparation Scheme in its present form is incapable of fulfilment, and that the exaction of the reparations cannot fail to dislocate seriously the industries of Great Britain unless special measures are taken to direct the form of payment. It is asserted that the indemnity will eventually be in the form of goods or service, and certain methods are suggested whereby Germany can be made to pay in a manner which will not dislocate British industries. One

is that claims should be made on all German undertakings and property in the form of mortgages or first preference shares to be handed to the Allied Governments. Another is that there should be no recognition of the classes of goods and services exported to Germany to avoid, so far as possible, injury to the Allies, whilst another method, to which it is thought sufficient attention has not been given, is that of making a special early out constructional works in Allied countries or other countries under Allied direction.

So far as the above is concerned, this report went so far as to suggest that the super-power stations mentioned in the Coal Conservation Committee's Report, which could not now be constructed because of the high cost, might be constructed at a great capital expenditure in this way, and allow electrical energy to be supplied very cheaply. He also mentioned other directions of a non-electrical character, with which this scheme could be operated in a similar manner, such as the Channel Tunnel.

Not unnaturally the meeting found itself unable to discuss these proposals in detail, and after a more or less non-committal discussion the reports received provisional approbation, and the Council of the Federation was authorised to prepare final reports and act upon them in the way it thinks best.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

North-Western Centre.

The Chairman of the above-named Centre, Alderman W. WALKER, delivered his inaugural address at the first meeting of the 1921-22 session at Manchester on November 15th. The following is an abstract of the address:—

The outstanding incident of the past year was the coal miners' strike on account of the effect it had on every branch of the electricity supply industry. At its commencement a few undertakings had ample coal in reserve, many had a little, and others none at all, some of the latter undoubtedly the result of a deliberate decision not to expend money for this purpose, but to rely rather on some Government department's coming to their aid by diverting to them coal belonging to other undertakings. I wish to bring home to those responsible for this policy the exasperation which such action excites. The provision of an ample reserve of fuel is an insurance, although somewhat costly. The cost comprises three factors: deterioration, double handling, and the capital charges on the money which is locked up. For normal-weather deterioration there does not appear to be any radical remedy, nor is the loss from this cause very serious, being 1.2 per cent. for the first year, and 2.1 per cent. for two years. The chief danger is spontaneous combustion, and against this it is necessary to take precautions. Heating is the result of action at the faces of the pieces of coal which comprise the heap, and there is an enormous increase of this area of potential danger as the coal is more and more broken up. Heat generated at the surface of a piece of coal depends largely upon the temperature of the piece, hence the necessity of putting the coal into stock when at a low temperature. The rate of chemical re-action doubles for every 10 degs. F. rise of temperature.

The next item of cost, that of capital charges, cannot be evaded, nor is it subject to any influence exercisable by the engineer. The heaviest item, and the one which in many cases can be reduced, is that of handling. The pneumatic principle has been successfully applied in this country to the transportation of coal, and a parallel development appears to have occurred in Germany during the war, where, however, only small sets of plant have been installed, and some work in the same field has been done in America.

The first plant which was put to work recently by Messrs. Henry Simon, Ltd., of Manchester, at the Bankside station of the City of London Electric Lighting Co., Ltd., with a total output of 120 tons per hour is by far the largest in the world.

The method, which has hampered the progress of the pneumatic plant is its heavy consumption of power. The pneumatic method not only has been employed for the solution of the coal handling problem in this country, it is particularly adapted. It should never, for instance, be adopted as a substitute for a belt system, the efficiency and simplicity of which, within its own range of usefulness, are unimpaired. In the case of the pneumatic method to the handling of coal I have very great faith. Whereas pneumatic coal handling is historically a development of grain handling, and all the plant installed in England and Germany has partaken of this character, the American plant, pneumatic ash handling, has been evolved quite independently and on somewhat different lines. It may fall to power station engineers, having experience of the pneumatic method both as a process and as a means of transport, to make the coal affect to some degree the efficiency of the plant, and the size of the coal must not exceed 2 in. in diameter, and the proportion of coal to the large lump of from 4 in. to 6 in. will pass through without difficulty. On the other hand, fine dust may

cause trouble if it is very wet. Broadly speaking, a pneumatic plant handles most satisfactorily free-running or "lively" materials. Pneumatic plant is now being installed at the Brimsdown station of the North Metropolitan Electric Power Supply Co.

Experience in grain handling work has revealed an astonishing variety of possibilities in the design of such plant to meet special conditions, including a number fixed on ordinary coal trucks and restricted by the ordinary railway gauge. The utility of such apparatus in dealing with scattered storage dumps will be obvious. I am, indeed, confident that time and experience, whilst doubtless revealing limitations, both technical and economic, must also indicate a continually widening scope for the application of a handling system so flexible and adaptable by its very nature.

Another aid to continuous running during a period of coal shortage is the use of oil as fuel. The recent miners' strike caused a great addition to the number of oil-fired boilers, but apparently the system will be retained on only a few now that coal is again available. It is very difficult to reconcile the notes and figures given by some of those who have made the experiment, but to justify a change from coal to oil the selling price of oil must be a little less than double the selling price of coal. The chief engineer of an undertaking having the largest oil installation in the country has written to me as follows:—

"I am sorry that our results have not been sufficiently conclusive to enable me to quote any definite and satisfactory figures regarding the use of oil firing... we have endeavoured to utilise the experience of other users, and also the expert knowledge of all makers of fuel burners, but have had the greatest difficulty in securing consistent results. Sometimes we get a good result equal to a boiler efficiency of 85 per cent., and a little more than 15 lb. of water evaporated by 1 lb. of fuel oil, but more frequently we get inferior results, for which we cannot always obtain a reasonable explanation. The whole thing is a tricky business, but will undoubtedly repay careful testing work."

300 degs. F. lower temperature is obtained if steam is used instead of air for atomising; the same quantity of air is required—the steam being so much loading. This does not necessarily mean that it may not be more economical to use the steam direct for atomising instead of for compressing.

The use of town's gas for steam raising has not made any progress, nor does it appear likely that it will do so until a gas-works has been designed and erected with that idea in view. Such an opportunity may come when the second part of the new Manchester electricity station is required, as by that time the gas department will be ready to develop its plans for the new super-gas-works at Partington, the site of which is conveniently near the electricity station. If the fact of a single coal purchasing department effecting a saving in handling costs, the production of valuable by-products, a reduced area of land, less supervision and labour, and all other factors are dispassionately considered, it ought to be possible to arrive at definite conclusions on this very important matter. It is not so simple a problem as is sometimes assumed; the only chance of success would be to take advantage of the construction of new electricity and gas works so combined as to secure the elimination from each of everything which would be done more economically at the other.

The first successful commercial pulverised coal installation of some 20,000 sq. ft. was made in the U.S.A. four years ago. During the first two and a-half years an additional 200,000 sq. ft. only was put into operation, but during the one and a-half years since then 700,000 sq. ft. of heating surface has been installed for burning pulverised coal. The system introduces an entirely new set of conditions into a station, and increases the number of danger points. It is a very marked advance on any other method of burning coal.

The increased adoption of the system in this country appears to depend largely on the essential preparatory plant being made available at prices much below those which have so far ruled. If this can be done there will be a great expansion, and there does not appear to be anything in the plant itself to warrant some of the high prices which have been asked, but of course costly experimental and development work have had to be done.

The labour conditions within the industry are to-day more settled than they have ever been before. The wages and conditions of service for every man in every undertaking in the country were made the subject of an agreement; the duties of each man were defined, and the former state of chaos was ended. Because of the recent fall in the cost of living it became necessary for adjustments to be made, and at a meeting of the National Joint Council in London, consisting of two employers and two trade union representatives from every one of the 13 districts into which the country is divided, I put a resolution for adopting the report of the Negotiating Sub-Committee, by which the wages of the manual workers in the whole industry are automatically regulated for a long period ahead, and it was passed unanimously.

The national and district members have made provision for the technical staff. The two organisations have justified themselves, and I have been told by members of the Ministry of Labour that the completeness of the organisations, the results obtained, and, more than all, the spirit which prevails, are better than those of any other industry.

Concerning the Electricity Commissioners, the greatest and almost universal note of adverse criticism is of the complicated and costly procedure. As one who has placed in them the most implicit confidence I regret that they have been persuaded to put this barrier of costly and complicated legal procedure between themselves and the management of the undertakings.

The Electricity (Supply) Bill No. 2, it is generally agreed, ought to be got through Parliament without further delay.

The committee which considered the Manchester area decided that a J.E.A. without financial powers would be about as useful as a gun without cartridges, so it has recommended the formation of an Advisory Board. It is certain that the Commissioners will not readily grant powers to carry out developments or extensions against the recommendations of the Advisory Board. The technical scheme is thoroughly good, especially so because it resists the temptation to propose a pyrotechnic display of burning power stations in order to make room for super stations, but suggests going slowly towards the realisation of the goal; every step has been carefully considered and all the conditions fully examined and explained.

For the purposes of power and lighting electricity is firmly established in the area, and need fear no rival. As regards private lighting, however, we do not deserve our success. To walk at night through the streets of Manchester and many other towns in the area will provide ample evidence to justify the immediate electrocution of the contractors who have been guilty of the installations. There are in our principal streets example after example of high-power lamps suspended on flex, close up to the window, at the height of the average person in the street, the filaments unscreened, so that the source of the light is almost directly in contact with the eye of the person wishing to examine the contents of the window—every law of illumination broken, and all without a shadow of excuse, either on grounds of cost or necessity. For one good example of lighting there are twenty bad ones, and the sellers of energy ought to be given powers to prevent the abominable misuse of it.

What things are done in the dark recesses of an installation if crimes such as I have just stated can be committed in full light? It is no use saying that the shop-keeper or the householder is at fault; I have ample evidence to the contrary.

North-Midland Centre.

Mr. W. E. BURNARD, chairman of the above named Centre, delivered his inaugural address at Leeds on November 15th, on which occasion a smoking concert was also to be given. The following is an abstract of the address:—

The "labour question" is of the first importance and, unless solved in a workable manner, it will not only eclipse but practically extinguish most of our other interests.

It is not very cheering to remember that, although we are professedly Christian, the worst of our labour troubles would be impossible if we were really so. Is it possible to reconcile with the first principle of Christianity—to "do unto others as you would they should do unto you"—most of the causes of trouble at the present time?

Trade unions have done much good work in improving the lot of the unskilled and semi-skilled worker, and much good work remains for them to do, but it seems a great pity that through false and unchristian ideas all the good they have done appears more than likely to be undone on account of trade-union rules. If the trade unions will direct some of their energies in a constructive direction there is employment waiting for them in reconstructing and improving their own country so as to tide over the period—which is not likely to be short—that will elapse before our foreign trade gets into its stride again.

That the capitalist does in his way all that labour does, I am bound to agree in some respect, but I put the unions' imitation of and improvements on these practices first as the cause of the troubles of the working class, because, though both are equally selfish, the capitalist does less harm to the State and to the working man himself.

The idea, of course, is to hit the capitalist, and in this I think they are successful, but labour suffers most acutely since these actions increase the cost of necessities and decrease wages.

Were labour to adopt a more enlightened policy and dismiss the incompetents who style themselves leaders and preach a policy of greed and obstruction which is really disguised industrial suicide, we might see labour hiring capital instead of capital hiring labour, and labour choosing and paying its foremen and managers instead of the capitalist doing so.

The managers and foremen being appointed and paid by the workers would naturally study things from the workers' point of view, and would not try to benefit capital at the expense of labour, but would take a broader view of the whole. Also, since the profit beyond a modest amount paid for the use of capital would go to the workers, and the control would be in their hands, the incentive to efficient production would be so direct that real and substantial profits would be made and the workers themselves would then gradually become the chief capitalists. There will be a strong movement that way within 12 years.

It does not follow that capital would suffer more than under

present-day conditions, as in industry capital as a whole is getting no profit at all and is being lost at a much greater rate than it is being made.

The condition of other countries is of vital concern to us, and he is indeed an optimist who can believe in any great revival in these at an early date.

Suppose Germany sells something to us for £1 which would normally cost, say £2. Assuming that this £1 reaches the factory supplying the goods, it will exchange half of this into marks, and will expend the other 10s. outside for raw materials. This factory thus gets, reckoned in its own currency at par value, something like £10 and material of equal value, so the factory prospers on its export trade, even though it has to pay extraordinary prices for raw materials, &c.

But what about the country as a whole? All that goes into the country is £1 or its equivalent, and it has exported goods equivalent to £2, so that it loses £1 on the transaction. Thus, the country as a whole continually gets poorer if a big export trade is carried on. The effect of an adverse rate of exchange is similar to that of a bounty on exports, which may conceivably be a good thing within limits and gives an impetus to exports, but when this bounty increases to 50, 100, or more per cent., the country pays too dearly for the trade thus obtained.

I should not be surprised to find a system of trade by barter, with possibly a limited application of the gold standard, well under way before a really effective medium of international exchange is evolved and utilised. In any case, international trade is crippled for years to come, and in the meantime unemployment remains with us.

There is no one sovereign remedy for this state of affairs, but one of the biggest factors appears to be almost the least utilised—self help. This implies an active personal effort on the part of the worker to look out for and make fresh avenues of employment. Here, again, trade-union policy is purely obstructive. On the employer's part it implies making fresh channels of business, developing inventions, improving plant and the like.

Government action can undoubtedly be of assistance in getting over the present crisis. To rely too much on it, however, is to court disaster with taxes at present rates.

Therefore, above all, we want the principle of self-help and the spirit of Christianity, which, if really and universally prevalent, would soon solve all our financial troubles without devising fresh schemes of payment, Whitley Councils and the like, which are of use in making a little Christianity go a long way and without that little would fail altogether.

We shall develop more on the line of combinations of workers hiring capital and managers, as the fallacies inherent in many theoretical systems become better known. No doubt this may seem in some respects far-fetched, but the day is passing when labour and brains will be controlled by a mentally purblind man seated on a money-bag. Industry has suffered too much through that product of the nineteenth century, the purely "business man" without vision, who has counted as profit all that could be squeezed out of those for the time being under his control. The control of engineering work, for instance, is steadily passing into the hands of men who are engineers as well as money-sorters, to its decided benefit, although if the controlling party loses sight of the ultimate financial side, the last state may be as bad as the first.

In the meantime, it behoves us all as individuals to do what we can to minimise the evils of unemployment and to try to avoid placing the burden on the Government. The best guiding rule is to consider the other man.

The second part of my address deals with relativity, a principle the bounds of which are not yet fixed, but which is having a most profound and widespread influence in the world of physics. It is a great generalization from which many effects, that without it might be obscure and difficult to link up with other effects, can be predicted and defined with ease.

The development of the electron theory concurrently with the relativity theory still further widens the outlook of science on physics. An atom is known to constitute a miniature solar system, an idea which, a few years ago, would have been too far-fetched even to ridicule. About 30 years ago I read a number of so-called occult books. Amidst a lot of loose and many demonstrably wrong statements there was one that occurred in, at any rate, the majority of these books, to the effect—to quote Sinnett's book, on esoteric Buddhism (1885, page 190)—"As it is below, so it is above, wrote the early occult philosophers, the microcosm is a mirror of the macrocosm." (Microcosm means, of course, the minute, and macrocosm the universe.)

Sinnett's book is 36 years old, but the quotation agrees exactly with similar quotations I have seen in much older books, and the original appears to date back to something of the order of thousands of years ago, but is there a clearer summary of the electron theory to-day?

It seems clear that somebody knew something about the subject before we were born, but from the manner in which truth is mixed with fiction, and the absurd with the profound, it appears that some of these early philosophers had interpreters who confused the ideas which they presented and which they did not understand themselves.

The same thing, of course, occurs in modern times.

THE PUBLIC WORKS, ROADS, AND TRANSPORT CONGRESS.

AN I.M.E.A. CONFERENCE.

ON November 23rd the Incorporated Municipal Electrical Association held a conference in connection with the Public Works, Roads, and Transport Congress and Exhibition at the Agricultural Hall. At the morning session Baine W. B. Smith, O.B.E., presided at the chair, and Mr. F. Ayton, M.I.E.E., read a paper on "The Use of Electric Vehicles for Municipal Purposes." At 5.15 A.M. M.I.E.E. presided over the afternoon session, and a paper on "The Application of Electricity Supply to the Municipal Service" was read by Mr. S. J. Watson, M.Inst.C.E., M.I.E.E. *Résumés* of the two papers are given below.

The Use of Electric Vehicles for Municipal Purposes.

By F. AYTON, M.I.E.E.

The principal object of this paper is to correct the prevalent impression that electric vehicles are of low efficiency, complicated, and uneconomical. The usual period for the repayment of loans for the provision of haulage power is seven years; it is therefore necessary that any vehicle purchased should at least have a useful life extending over this time, and that the costs of operation, apart from wages, should be fairly constant. Both steam and electric wagons can meet the first condition, but, as regards the second, variations in the cost of fuel have a much smaller effect upon the "electric's" operating costs than upon those of a steam wagon. The electric vehicle has been shown by extensive practice in America to have a useful life much above the seven-year limit. Figures showing the numbers and ages of vehicles in service in New York indicate that 980 have been employed for eight years; 221 for ten years; 106 for thirteen years; right up to eighteen years for two vehicles. Concerning power costs, the pre-war rates of charge for electricity supply showed an ever-downward trend, and the war did not cause an increase comparable with the increase in the prices of most commodities. It is also to be considered that the demand for power for these vehicles occurs when the load is light, and therefore power is provided merely at the cost of a little extra fuel and oil and repair expenses. It is thus possible to charge a lower rate for this class of supply and still obtain a profit. Evidence of the reliability of the electric vehicle is quoted. Of fourteen of these vehicles at Willesden, running for a full year, one ran without any loss of time; one with only half an hour's loss; one lost an hour; one two hours; and one two-and-a-half hours. The total time lost was only 99.5 vehicle hours, or 0.3 per cent. of the total working time. The "electric" is not so much affected by weather conditions as other wagons; it is as easy to start it when cold as when warm. It is a mistake to think that a vehicle with a low original cost is the cheaper. In Pontypriid a comparison was made between 2-ton electric vehicles and 1-ton Ford vans, and it was shown that the cost per ton of refuse collected was 6s. 5½d. and 8s. 3½d. respectively. Opinions of a number of municipal engineers support this claim of superior economy. Any person of normal intelligence can be taught to drive an electric vehicle in a few hours. This simplicity lightens the repair bill. Although there are more electric vehicles in use in the United States than in this country, comparatively few are employed in municipal service. Mr. J. A. Priestley, Superintendent of Cleansing, Sheffield, says that the history of the progress of electric vehicles in this country is very largely the history of their use in cleansing work. It is also true to say that this class of work is the most rigorous test of any mechanically-propelled vehicle, owing to the frequency with which starts and stops occur. For journeys up to three miles in length horse haulage is probably more economical, but beyond this distance the electric vehicle can be profitably employed. In the opinion of some engineers, however, the electric should be used for all distances. In many cases in which "electrics" have been used for refuse collection the road to the tip has been little better than a morass, and this has resulted in a considerable portion of the energy in the battery being wasted; a good road to the tip should be a prime consideration. The electric is not the best out of a labour-saving machine. It is not a maximum number of hours of working per ton of refuse collected, as is the case in the case of Birmingham, where the electric is the most efficient. The city is divided into districts, and the districts into rounds. Each vehicle has a working list, and commencing on the first house in the list proceeds until it is full. It then returns to the place of disposal afterwards recommencing where it left off. In the summer each round occupies one vehicle for a week, but in winter, when the loads are greater the houses in the area nearest the place of disposal are attended by spare vehicles, which collect the refuse of the previous week. A recent report upon the results obtained by Bootle Corporation in the use of electric vehicles for carting street sweepings and for gully cleansing states that comparative tests revealed that one electric and five men emptied 80 gullies per day at a daily cost of 218s. per gully, as against one horse and one man emptying 16 gullies per day at a daily cost of 26s. per gully. Electric vehicles are employed for street watering, and for the collection of refuse, and for the collection of refuse. The cost of cleansing is reported to be 10d. per ton of refuse.

compared with horsed tanks, this method effects a saving of £20 per week. At Bootle the acquisition of a fleet of 13 electrics to replace horses for refuse collection, street watering and general haulage has resulted in a saving of £1,387 per annum after meeting all charges. Several municipal tramway departments have used electric tower wagons with satisfactory results. A number of municipalities use electrics for coal and ash haulage in connection with their electricity works. Electric omnibuses, which are employed in several towns, while highly economical in working expenses, are lacking in sufficient speed. However, the advent of speedier electric buses is only a question of a short time. In conclusion, it is impossible to give satisfactory estimates of working costs, as conditions differ widely in various localities. The range of the electric vehicle is limited by the mileage capacity of its battery, but with every improvement in battery design the utility of the electric will be extended. Appendix No. 1 is a list of 90 authorities using electric vehicles, giving the number in use, sizes, purposes for which employed, average daily mileage, number of horses displaced by each vehicle, and period of experience with electrics. The most experienced authority is Sheffield Corporation, which has 45 vehicles, used for refuse collection, with an average mileage of 20.25. Each vehicle displaces four horses, and the Corporation has had six years' experience of electrics. Appendix No. 2 gives notes of appreciation of electric vehicles from 37 engineers.

In introducing the paper Mr. Ayton said that one of the greatest obstacles to the successful use of electric vehicles was apathy. One case had come before him in which the owner of the vehicle had expressed his disappointment with the results. That vehicle was returned to the makers, who found that it had been badly neglected for a long time. That was not the way to get good results, and it was unfair to the Electric Vehicle Committee, which had worked very hard.

DISCUSSION.

Mr. J. A. PRIESTLEY (Cleansing Superintendent, Sheffield) said that Sheffield bought its first electric vehicle in 1915, and had been adding to them continually ever since. In addition to 45 electric vehicles used entirely on refuse collection they had an electric tower wagon for tramway purposes and an electric vehicle for taking testing weights, for weights and measures, about the city. Last year they removed 59,000 tons of refuse by electric vehicles at a cost of 9s. 8d. per ton, against 10s. 6d. when the work was done by horses. Last year the vehicles travelled 123,700 miles, and the consumption of electricity was about 1½ units per mile travelled. The charge was 1½d. per unit, and these vehicles were consumers to the extent of 250,000 units, which represented £1,400, a by no means small revenue for the electrical department, especially considering that the charging could go on at a time when the demand from other directions was small. Therefore it paid the electrical engineer to afford facilities for charging these vehicles. The service at Sheffield was maintained at 90 per cent. efficiency. This could not be said of petrol vehicles which had been in use the same length of time.

Mr. A. J. MAKOWER (Messrs. Mossay & Co.) gave particulars of tests carried out by Captain Cable, of the Westminster City Council, with an electric vehicle on refuse collection. Capt. Cable challenged the statement by Mr. Ayton that the electric vehicle had an assured life of ten years, and said that the evidence in support of that was inconclusive. On the figures in the paper the life seemed to be about 6½ years. He agreed with the author regarding motive power, the present conditions were such as to tell heavily in favour of electricity because petrol was in the hands of a monopoly, whereas electricity was not. With regard to the loss of working time, the evidence in the paper that this was less with electric vehicles than petrol was inconclusive. Mr. Ayton claimed in the paper that he had received 37 expressions of opinion favourable to electric vehicles, but if the replies were analysed it would be found that they could be classified as follows: favourable to electricity against petrol, 4; favourable to electricity against the horse, 4; general opinions expressing satisfaction with electric vehicles of no comparative value, 11; non-committal or no past experience, 14; unfavourable to electricity, 3; unfavourable to electricity but no statement as to what compared with, 1; making a total of 37. These opinions were hardly conclusive in favour of electricity as against petrol. Mr. Makower then gave particulars of tests carried out at Westminster. In the case of a petrol vehicle the cost was £1,000 and that of the trailer £200. The working costs per week were 7s. 10½d. per ton of refuse collected. The figures for an electric vehicle were on the same basis, the cost of the vehicle being £1,160 and the trailer £200. In this case the total weekly working cost was £11 11s. 6d., or 8s. 2d. per ton collected, showing an advantage of 3½d. per ton in favour of the petrol vehicle. The Westminster City Council, however, was in the position of being able to get petrol at very low rates, and, also, the conditions were exceptional. These figures could not be applied to other districts, where the conditions were different. Moreover, the price of energy was 2d. per unit in this case, whereas in some districts it would be 1½d.

Mr. H. W. WIGFIELD (Cleansing Superintendent, Islington) said that one of the difficulties was that supply was mostly alternating current, and a large expenditure was involved in putting down the necessary converting and charging plant for electric vehicles. In his borough they had spent £5,000 in building a garage, and another £5,000 approximately for plant for charging 11 electric vehicles. The cost of running this plant was £10 per week, or 18s. 2d. per vehicle, in wages alone. Moreover, motor generators absorbed a large amount of power, and as the Islington Electricity Department charged 2½ p. unit, it was found that each of the vehicles was costing £12 per week without allowing for maintenance, tires, insurance, and driver's wages, or anything else. He had sent out inquiries to other metropolitan boroughs as to their charges and facilities, and found that seven provided facilities for charging at the electricity works, and also on customers' own premises, three provided facilities on customers' premises only, 13 either did not own electricity works or else provided no means whatever for charging vehicles, and four did not reply. The prices charged varied from 1d. to 2½d. in his own district. Under these apathetic conditions on the part of local authorities and electrical engineers it was impossible to compete with other forms of transport. The Electric Vehicle Committee should see that every large borough and city provided means for charging vehicles at a uniform and economical rate before it asked the public to use these vehicles.

Mr. H. G. WHYATT (Borough Engineer, Grimsby) said he spoke, from experience, whole-heartedly in favour of electric vehicles. The Superintendent of Cleansing had told him that in two months he collected 528 loads of refuse, running 1,845 miles, or 3½ miles per load. With electric vehicles they saved, in two months, 1s. 10d. per ton in collection, which was equal to a 2½d. rate. When the whole scheme got into working order he anticipated a saving of something like 2s. 6d. per ton.

Mr. A. W. BLAKE (Borough Electrical Engineer, Willesden) said it was essential for salesmen to exercise caution in approaching prospective users of electric vehicles, and not sell vehicles for work for which they were unsuited. In connection with the size of vehicle, they should remember that a 5-ton van cost no more for garage accommodation or to drive it than a smaller one, and the advantages of having the larger vehicle were enormous. He was running certain 5-ton vehicles and a number of 15-cwt. vehicles for house refuse collection, and on a ton-mileage basis he found that with these 15-cwt. vehicles the energy consumed was 2½ units per ton-mile, but the total was 3½, taking into account the loss in the motor generators. There were 14 vehicles on house refuse collection in Willesden, and the total cost per working day was 49s. 6d., including wages, capital charges, and maintenance all round. The loss of time with petrol vehicles was out of all proportion to that of the electric. Some of his vehicles had been running 2½ years, and he was getting 90 per cent. of the original rated capacity of the batteries out of them to-day. His experience was that it paid to have a large battery capacity on the vehicles. Frequent stops did much damage to the batteries, and in selecting the size of battery attention must be paid to the circumstances in which it was to be used.

Mr. T. P. WILMHURST (Borough Electrical Engineer, Derby) remarked that very little had been said about the initial cost of the vehicles. It seemed to him that the initial cost was far too high, and he asked battery makers and chassis makers to see if they could not produce something which was far more competitive in price with the petrol vehicle. He saw no reason why an electric 'bus should not be got out for short routes which would compete with the petrol 'bus. Then there was need in municipal service for a cheap runabout which would compete with the Ford car, for town work only. He had six vehicles on refuse collection, and his experience was the same as that of previous speakers. The consumption was from 1 to 1½ units per mile, according to the nature of the road.

Mr. LL. ROBINSON (Borough Electrical Engineer, Hackney) said that it was very difficult indeed, until they got some work to do, to make a charging station anything but an annual loss; the charging station could not be a paying proposition until there were something like 100 vehicles to deal with. To find the space for that number of vehicles to stand for six or eight hours was an expensive matter in London, and the manufacturers must try and get out a type of battery that could be charged alone and exchanged. At present the vehicle was nearly always charged at its home garage, but it would be very much more economical if vehicles could be provided with suitable batteries and with motors suitably wound so that they could be charged off the standard pressure of the district, by means of resistances, and so avoid wasteful motor generators.

Baillie SMITH (Glasgow), who presided, commented on the backwardness of this country with regard to the use of electric vehicles. In 1913, in Chicago, there were 3,000 electric broughams in use, and there was no reason why such vehicles should not find a ready application here; they could be charged in their own garages during the time they were not in use.

Mr. AYTON, replying to the discussion, said that he was sure Captain Cable would be on the side of the electric in a year or two. Mr. Wigfield had good cause for complaint of the prices that were being charged in his borough, and he seriously commended to the Islington Electricity Committee the desirability of doing something to push forward its business on strictly business lines. His experience was

that the lead battery, under severe service, would last three years. It was hoped, however, that the cost of electric would come down, as with every other engineering product, but there was no margin to-day to do it, on a profit-making basis. When the demand came, prices would come down also. Electric 'buses were slow, but an electric battery 'bus could be built which under normal conditions, not in hilly districts, would give speed enough for ordinary conditions. That was using the lead type of battery, which must be used to get good results. With regard to a cheap runabout, he hoped they would be able to get it, but it must be remembered that any new type of vehicle involved a great deal of expense in design, &c. He believed in the future, however, they would get a vehicle which complied with Mr. Wilmhurst's requirements.

The Application of Electricity Supply to Municipal Service.

By Mr. S. J. WATSON, M.Inst.C.E., M.I.E.E.

To obtain definite information upon the subject of this paper circulars were sent to 198 local authorities, representing a population of 20,103,000; owing to the short time available for reply only 108 answers were received. The electric lighting of streets, public buildings, schools, and housing schemes is first considered. Good street lighting is a powerful advertisement for an electricity undertaking, and should be the authority's first care, every advantage being taken of each definite improvement. The gasfilled lamp now appears to be the most suitable for street lighting, and the suspension of lamps in the centre of roadways is a step forward in illumination. An important feature of electric street lighting is the ability to centralise the control or switching points; by means of automatic time switches a considerable saving of labour can be effected. One of the reasons for the retardation of changing over lighting to electricity has been the inaccessibility of distributing cables. In many towns there exists an understanding that as the cables are extended the street lighting shall be changed. In two of the towns from which answers were received there are no electric street lamps; in twelve others the lighting is all electric. In the aggregate the figures show that 1,873 miles of streets are illuminated by 55,632 electric lamps consuming 22,501,000 units per annum, while there are 8,635 miles lighted by 245,724 gas lamps. As regards public buildings it has been ascertained that the 108 authorities who furnished details use or occupy 2,307 separate buildings, of which 1,640 are lighted electrically, and the remainder by gas. In 42 towns the whole of the public buildings have electric lighting. So far as schools are concerned the figures received show that of 3,244 schools 1,158 are equipped with electric lighting. Many replies indicate that, as soon as the mains are available, additional schools will have electric light. Statistics regarding electric lighting in new housing schemes are difficult to obtain, but it is seen that in 84 towns no less than 41,663 new houses are or will be, lighted electrically throughout. It is stated that the average consumption per house is expected to be 104 units per annum. It is questionable whether this will cover the cost, but costs might be reduced by employing overhead distribution systems or by the introduction of a tariff which would encourage the use of electricity for purposes other than lighting.

The next point considered is the motor power used by public utilities. In towns where both the gas and electricity undertakings are in the hands of the local authority there is a willingness to co-operate to mutual advantage. In 33 gasworks owned by local authorities there are in use 236 motors, having an aggregate capacity of 4,620 h.p., consuming 1,918,525 units annually. These are used in connection with machinery for charging and discharging retorts, gas compressors and boosters, crushers and elevators, mechanical boiler stokers, &c. The supply of water was among the first to be provided on a communal basis. In most pumping stations low-speed steam engines are used to raise water, but while these have rendered excellent service there are many defects in them. They occupy a great deal of space, buildings are of necessity large, and replacement of parts, although seldom necessary, is expensive. It is not possible, however, to give definite particulars to show where a steam plant has been replaced by an electric pumping plant, although several schemes of this kind are contemplated. Motors to the number of 72, with an aggregate of 3,189 h.p., are used in the waterworks departments of 28 of the authorities circumscribed. Tramways are, of course, large consumers of electricity. The 1918-19 edition of "Garcke's Manual" summarises as follows: Number of tramways: local authorities, 171; companies, 103; total, 274. Capital expenditure: local authorities, £57,994,000; companies, £24,849,000; total, £82,843,000. Route miles: local authorities, 1,705; companies, 1,015; total, 2,720. Annual consumption (units): local authorities, 452,260,000; companies, 115,840,000; total, 568,100,000. Seven authorities employ 55 railless trolley cars, using about 1,000,000 units per annum. In addition to the transport side, a large amount of electrical plant is used in car-sheds for maintenance and repair purposes, as well as for rail welding and grinding, &c. In the car-sheds of 52 towns there are 302 motors, totalling 3,130 h.p., and using 1,762,000 units annually.

In addition to these main uses of electricity in municipal service there are numerous smaller applications. Development in the treatment of sewage is of comparatively recent

growth; electric motors have been adapted to a large extent for the driving of pumps, street, air compressors, lime crushers, cranes, etc. It is possible to give details of the experience of two authorities in this connection. These authorities must be the gas companies, having a total of 388 h.p., to take the place of steam engines and boilers. The annual consumption is now 864,000 units and 100 tons of fuel, as against 3,050 tons previously. Various other savings, such as in wages, repairs, ash removal, etc., have been effected. Allowing for a charge of 1½d. per unit and fuel at 40s. a ton, the cost now amounts to £2,850, as compared with £6,100. Fifty-six of these works are using electricity, there being 289 motors, totalling 5,851 h.p., installed, with a consumption of 4,522,422 units annually. As regards ice manufacture and cold storage there are 18 authorities using 131 motors, with a total of 2,780 h.p.; annual consumption, 3,473,000 units. Seventeen authorities have public bakeries, using 285 motors, with an aggregate of 1,667 h.p. and an annual consumption of 679,794 units. In connection with streets and refuse departments, town's yards, etc., the total number of motors installed is 847. These have a total capacity of 1,395 h.p., and are used for pulverising, brick making, and multifarious other purposes. The annual consumption of energy is 2,653,901 kWh. Electric motors are also used by fire brigades, in public baths, and in other municipal departments. Summing up, the aggregates shown are: motors, 1,881; horse-power, 26,780; units consumed, 90,638,160. These figures are, of course, exclusive of lighting and tramways. The paper concludes with some statistics of gas and steam power employed by local authorities, electric and non-electric vehicles, and electricity supply.

Mr. Watson said that since writing the paper he had received a reply from the engineer of a large urban district council, in which it was stated that, owing to the high value of the refuse in that district it was possible to generate between 4 and 4½ million units per annum and sell this energy to the power company which operated in the borough. In 1919 one unit of electricity was generated for 8 lb. of refuse; there were some undertakings in the country where it would be difficult, with the plant available, to generate one unit for 8 lb. of coal. The amount of refuse burned in the case mentioned was between 25,000 and 26,000 tons.

DISCUSSION.

Mr. F. M. Long (City Electrical Engineer, Norwich) said that electric pumping was being used now instead of gas producer plant for the pumping station. It was the intention to use the motor during the night and on Sunday and make it entirely automatic, so as to save wages, and it had been decided to replace the d.c. motor with a three-phase motor, to be supplied from the 6,600-volt supply. It was estimated that this would effect a saving of £1,162 per annum. The charge for power was 1d. per unit, and this would be a very useful load for the power station, especially as the pumping could be stopped at the time of the peak in the winter. A good deal of electric power was being used at the gas works at Norwich, although the works did not belong to the Corporation. Until recently the works had generated its own power, but the works had been almost entirely rebuilt, however, and the electricity department had been asked to supply. He did not believe in the electricity and gas people keeping at arm's length; they could be very good competitors and at the same time very good friends. The consumption of the gas company was about 40,000 units a year. It was difficult to deal with housing schemes because the demand for electricity was very small; it was probably less than 100 units per annum in Norwich for the small houses. The method adopted in Norwich was to collect 1s. per week with the rents. That was just about sufficient to cover the ordinary use for lighting. There was a risk of its being abused if people had unlimited use, and therefore meters were being installed, so that after 100 units per annum the consumer was charged at the rate of 1½d. per unit, and if the consumption was less than 100, then a rebate was allowed.

Mr. ALLSOPP (Sales Manager, Bradford) said that all the 600 houses under the housing scheme in Bradford were electrically lighted. The charge was on the basis of 25 per cent. of the rateable value and 1d. per unit. Tenants were gradually being induced to use electricity for other purposes, and 1d. per unit was a profitable charge. The gas works took about 200 units from the electricity supply, and it was a gratification to know that it was obtained without any pressure from the department. There was also 200 h.p. of electric motors at the refuse destructor works for concrete making and in connection with the Corporation, etc. The sewage works also used power, and in the driving of a tunnel two miles long for an extension of the sewage system small electric locomotives were used.

Mr. P. C. Watson (Borough Engineer, Grimsby) spoke of the conversion of the Grimsby sewage pumping station from gas to electricity. The present cost was £2,453 per annum, but a scheme had been submitted whereby it was hoped to effect a saving of £1,062. The work of conversion was in course of progress, one of the pumps having been at work two months and the other now being fixed. The price of electricity was 1½d. per unit, and 1d. per unit, and the total charge for power in October came out to exactly 1½d. per unit. But the householder was given one service for four houses. The houses were decorated with gas copers and gas fires in two bedrooms, but the demand was regarded as likely to be so small that the gas company would not lay

mains. Meters were installed in these houses, and a charge of 1s. per week was made in the summer and 1s. 9d. in the winter, but above a certain consumption the charge would be by meter, as mentioned by Mr. Long.

Mr. A. W. BARMAN (Borough Electrical Engineer, Watford) said that some years ago his Council started a housing scheme with 30 or 40 houses, and there was one service to all the houses and a current limiter to each house; a charge of 3d. per week was made. The owners, however, were putting in cookers and radiators, and a current limiter of 60 or 100 watts capacity was not of much use, and the Council had been compelled to lay services to each house, with a five-ampere meter. He hoped in this way to increase the supply to these houses, but he thought it would be nearer 60 units than 100 units per annum, as mentioned in the paper. He hoped to hire out apparatus, and he was working on the Norwich system, 20s. fixed charge plus 1d. per unit.

Mr. WATSON, replying to the discussion, read a letter which he had received from Mr. Fedden, of Sheffield, in which some information was given of the developments in Sheffield with regard to sewage disposal. In an experimental plant at Sheffield it was found that the load factor was over 70 per cent., and a very large scheme had been prepared for Sheffield, in which two motors of a total of 1,000 h.p. would be used, and the consumption was estimated at between 5 and 6 million units per annum. At the Sheffield gas works there were motors of 461 h.p., and a scheme involving the use of a further 242 h.p. was in progress in connection with the installation of vertical retorts. Mr. Watson agreed that the number of units per house mentioned in the paper, viz., about 100, was high, and in 24 replies received since the paper was written the average was 78. At Bury the system of wiring was to lay the mains round the back of the houses attached to the framework, under the eaves. One service was run to every two houses, as they were semi-detached, and that led to a great saving. There had been considerable controversy with the Housing Commissioner with regard to putting in electric lighting and gas cooking apparatus, but eventually both were installed. Considerable economy had been effected by putting in a fireplace in only one upstairs room. In the other two rooms plugs were installed for electric radiators, and this had resulted in a saving of £30 per house, the plugs costing 22s. 6d. each. The Corporation had agreed to keep a stock of radiators for the tenants. A compound system of charging and meters for these houses were essential in order to check wastage.

REVIEWS.

Elements of Illuminating Engineering. By A. P. TROTTER. Pp. xi+103; figs. 63. London: Sir I. Pitman & Sons. Price 2s. 6d. net.

This work is a distinct acquisition for those requiring a treatise on the subject dealing only with theoretical considerations. It is usually well written and arguments are succinctly stated: there is no pretence that it is exhaustive, but frequent reference is made to books of greater volume, so that one interested in a particular point and wishing to obtain further information thereon is carefully guided to the proper source. It must be recognised, however, that the practical side of the subject and the possibilities arising therefrom are not dealt with, and it is to be hoped that the distinguished author will supplement the present volume so that a complete and handy reference of theory and applications will be within the reach of all. The size of the book is but small, but therein lies its extreme utility, and Messrs. Pitman's are to be congratulated on producing a series of works which will appeal to those who desire a technical book which may be carried in the pocket without undue bulk, so that it may be digested on odd occasions.

At the outset, Mr. Trotter places before the reader the fundamental definitions and laws relative to the subject, and while some refer to matters highly theoretical, the clarity of expression might be well taken as a pattern by other writers. Vision and glare form the next subjects dealt with, and again one is impressed by the manner in which information is condensed without the omission of salient points. In the following pages, which treat upon the emission of light from a source, there are statements which might be better phrased, especially is this the case with the paragraph at the foot of page 20: there is no reason, however, that should prevent one's obtaining a full understanding of polar curves. The chapter relative to sources of light makes interesting reading and contains much information which is of considerable assistance, though usually omitted from other books on the subject: comparisons are made in an unbiased manner and invite confidence. It may not be out of place to mention here that trade influence is conspicuous by its absence, an unusual feature in a technical work on this subject.

We must confess that the chapter on reflectors and shades left us somewhat disappointed, and we do not always agree with the statements made. For example, the average "reflecting power" of porcelain enamel steel appears to us to be highly stated (page 43): a dispersive distribution is not, to our mind, the same or similar to an extensive distribution: so far as the positioning of the lamp in a "semi-in-

direct" unit is concerned, we have always found that the lamp is best placed so that the filament is level with the rim, the resultant illumination may be very slightly less than the best obtainable, but the general appearance of the ceiling and room is greatly enhanced. Photometers and photometry are handled in a very able manner, without the introduction of details of ultra-scientific and little used instruments. The chapter on planning enables the beginner to appreciate the many methods available for the calculation of illumination, and, at the same time, he will realise the futility of making elaborate calculations when the means at his disposal to convert the paper results into practice are limited by commercial exigencies. After an elaborate exposition relative to the planning of a layout, the author candidly states "of course, in practice, the spacing would be accommodated to suit the arrangement of tools and gangways." The curve (fig. 54) showing the total hours of lighting is capable of misconstruction: if the directions given are followed, the advent of summer-time would appear actually to shorten the hours of darkness!!

There are other minor errors, but generally they are so obvious that they are not likely to be misleading, and so no doubt be corrected in future editions: they do not detract from the work, which we can thoroughly recommend.

Electric Bells, Alarms and Signalling Systems. By H. G. WHITE. Second edition. Pp. 115; figs. 75. London: S. Rentell & Co., Ltd. Price 3s. 6d. net.

This little book, which is essentially of a practical nature, is mainly intended for the use of the wireman and maintenance man, and therefore only describes the apparatus used in sufficient detail to enable its functions to be clearly understood.

Commencing with the simplest bell circuits, the author goes on to describe the more complicated arrangements in use in hotels and other large buildings. The more modern installations show clearly the influence of the telephone engineer in their design, mechanical indicators being replaced to a great extent by relays and signal lamps, which permit of much greater flexibility in duplicating signals and meeting special requirements.

Only the simplest fire alarm systems are described. A full description of any one of the arrangements in use for public fire calls would occupy the whole of the book, and as these systems are almost invariably installed by the firms who specialise in them, the information would not be of much general interest.

The chapter on Mine Signalling Systems has been entirely rewritten for this edition and now includes the most modern practice. Owing to the new regulations, introduced in 1914, which make it compulsory that the engine man shall receive a visual indication of the nature of the signal, most of the shaft-signalling systems have had to be reconsidered, and at the same time, improvements have been introduced. The author gives a short description of the important features of the principal systems. It is noticed that diagram No. 54 does not agree with the letterpress, which states that a signal given at one point will be repeated at all the other points, whereas with the arrangement in the figure, only the answering signals will be repeated at all the sections.

There is a chapter giving very sensible and practical hints on the best methods of locating faults, and general precautions to be taken in carrying out the work of installation.

The book as a whole is clearly written in simple language, is well illustrated and can be confidently recommended to those interested in the erection or maintenance of the systems described.

Modern High-speed Influence Machines. By V. E. JOHNSON. M.A. Pp. vii + 278; 93 figs. London: E. & F. N. Spon. Ltd. Price 11s. net.

From the title of this book one might be tempted to conclude that the influence machine had ceased to be a scientific toy, and had become a practical engineering proposition. Such a view obtains but little support from the contents. With one or two exceptions, the machines described are very much on the lines with which we are familiar. Improvements have been made in construction and in selection of suitable materials, and also by the substitution of power drive for the handle and pulleys of the early types, but much remains to be done before the influence machine can be considered as a serious rival to the induction coil for the production of high-pressure electricity.

The first part of the book consists of a description of the early machines of Wimshurst, Holtz, and others, and describes simply the principles on which the action depends. The author then proceeds to describe and illustrate a number of experimental machines which have been made by him during a series of years.

When the amount of work involved in the construction of these machines is taken into consideration, one cannot help feeling that more valuable results might have been obtained by exact experiments on a smaller number of models. It is very difficult to ascertain from this book what are the real outputs and efficiencies of the different types described.

It is true that there are considerable difficulties to be over-

come in the measurement of very small currents at high potentials, but even in the case of the power required to drive the machines, which could easily be determined exactly, this does not appear to have been done. An illustration is given of an electrostatic motor which is claimed to develop one-eighth of a horse-power, but the only confirmation of this claim is the statement that it could not be stopped by pinching the axle between the finger and thumb.

The author gives a number of illustrations of practical applications to which influence machines may be put, such as electrotherapeutics, electroculture, wireless telegraphy, &c. He describes at some length an invention by a doctor who proposes to insulate the gas pipes in dwelling houses and use influence machines for maintaining a positive potential at the gas jets, the object being to ionise the air in the rooms.

The first-mentioned applications are being fulfilled at least as well by the induction coil as they could be by the influence machine, and it appears unlikely that there will be a wide field for either in the ionisation of gas jets.

A considerable amount of information is given as to the most suitable materials to be used in the construction of these machines, and the book will prove useful to those who wish to become conversant with the elementary theory or to construct model machines for teaching or experimental purposes.

Modern Central Stations. By CHARLES W. MARSHALL, B.Sc., A.M.I.E.E. Pitman's Technical Primers, No. 36. Pp. 115; illustrated. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

This little handbook aims at giving the reader a brief survey of the salient features in connection with the design, construction, and operation of modern steam-driven power stations. The author is careful to point out that in a volume of this size, it is quite impossible to deal adequately with any of the numerous details which are inseparable from a modern power house, but in the reviewer's opinion, the author has certainly succeeded in condensing a remarkable amount of information within the 115 pages forming the volume.

The book is conveniently arranged in nine chapters, dealing successively with factors affecting the choice of plant and site, the coal- and ash-handling plant, the boiler house, the engine room, control gear, and protective gear. The remaining three chapters deal with station operation, power-house plant testing, and an interesting chapter describing the new Dalmarnock power station of the Glasgow Corporation.

In the chapter on coal- and ash-handling plant, the importance of close attention to design to ensure reliability is rightly emphasised, although the problem of coal and ash plant for a modern capital station using low-grade coal on a daily output of, say, even a million kWh, is hardly so easy to solve with inland stations, as is indicated by the author.

With regard to engine-room plant, the driving of the condenser auxiliaries is carefully considered, and alternative methods are put forward, but the system of half-duty units has not been mentioned by the author.

In discussing the question of alternator excitation, no mention of battery excitation has been made with regard to alternative methods.

The chapter devoted to protective gear is a most useful résumé of modern practice, and the reviewer feels that it greatly enhances the value of this little volume.

The pages devoted to the operation of central stations and power plant testing should prove of interest even to engineers of ripe experience, and it is pleasing to note that the boiler house comes in for its fair share of attention in these days of costly fuel.

The description of the Dalmarnock power house should prove useful, as its design incorporates most of the salient features of British practice in connection with a modern capital station.

The volume concludes with a page devoted to the bibliography of the subject, but the references can hardly be considered complete with the omission of "Power House Design," by Sir John F. C. Snell.

Altogether the work is an excellent résumé of modern British practice, and is well illustrated from photographs of actual plant, whilst the diagrams leave very little to be desired. The book should certainly find a place in the library of both students and trained engineers engaged in the supply branch of the industry.

An Electrical Winding Engine.—Messrs. Fullerton, Hodgart & Barclay, of Paisley, are making two large electrical winding engines for the Powell Duffryn Steam Coal Co., Ltd., South Wales. The total weight of each winding, exclusive of the motor, is 120 tons; it will be one of the largest in South Wales. The drum-shaft, which when completed, weighed 15 tons, was forged at the works of Messrs. Beardmore. The motor for driving the winder is of the British Thomson-Houston Co.'s make, and can take a peak load of 2,980 h.p. The depth of the mine shaft for which the winder is required, is about 1,860 feet, and five tons of coal will be taken up every wind in about 72 seconds. The winder is also designed for raising 8½ tons of rubbish during sinking operations.

(NOT YET PUBLISHED.

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- 20,663. "Devices for containing electrical conductors, &c." H. H. Long. November 8th. (170,570.)
20,702. "Electro-magnetic driven generator and switching arrangement." F. E. Elmer. D. E. Evans, H. Morgan, and A. H. Williams. November 8th. (170,576.)
20,706. "Electric engine and compressor." B. Petersen. November 8th. (170,580.)
20,718. "Control circuit." W. Larwater and Singer Manufacturing Co. November 8th. (170,592.)
20,732. "Electric switch holders for electric lamps." C. G. Bennett. November 8th. (170,606.)
20,752. "Electric fuse carriers, &c." W. T. Henley's Telegraph Works Co. November 8th. (170,626.)
20,754. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). November 8th. (170,628.)
20,756. "Multiple fuse." P. G. U. Buch and Jensen Trading Co., Ltd. Aktiengesellschaft. November 8th. (170,630.)
20,777. "Electric installations." J. Bethened. November 8th. (France, November 8th, 1920.) (170,651.)
20,793. "High-tension cable with paper insulation." Allgemeine Elektricitäts Ges. November 8th. (Germany, November 8th, 1920.) (170,663.)
20,800. "Electric production of gases." S. O. Cowper-Coles. November 8th. (170,670.)
20,848. "Electric cables." N. J. Austin. November 9th. (170,688.)
20,865. "Electric conductors." W. B. Sayers. November 9th. (170,705.)
20,868. "Motor-driven electric engine." A. Ruck. November 9th. (170,708.)
20,874. "Dynamoelectric machines." J. H. St. H. Mandel. November 9th. (170,714.)
20,880. "Fish-plate tramway, &c., rails." J. Osborne. November 9th. (170,720.)
20,882. "Systems of electric distribution." British Thomson-Houston Co., Ltd. and F. P. Whitaker. November 9th. (170,722.)
20,883. "Huminating devices." British Thomson-Houston Co., Ltd. November 9th. (170,723.)
20,884. "Electric circuit-breakers." British Thomson-Houston Co., Ltd. (General Electric Co.). November 9th. (170,724.)
20,895. "Apparatus for supplying electricity to instruments or circuits." A. E. Angus. November 9th. (170,725.)
20,900. "Signalling in wireless telegraphy." L. G. Preston and G. Shearing. November 9th. (170,730.)
20,929. "Electric adaptor fitting." L. M. Waterhouse. November 10th. (170,759.)
20,973. "Carriers for electric storage batteries." J. C. Blake. November 10th. (170,803.)
20,979. "Thermionic valves." H. St. J. de A. Donisthorpe. November 10th. (170,809.)
20,989. "Insulating elements." British Thomson-Houston Co., Ltd. (General Electric Co.). November 10th. (170,819.)
20,993. "Means for mounting and driving magneto-electric machines." J. White. November 10th. (170,823.)
20,997. "Dynamo-electric machines." G. S. Stein. November 10th. (Italy, November 10th, 1920.) (170,827.)
20,999. "Means for controlling, &c." R. D. Lee and Best & Lloyd. November 10th. (170,829.)
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20,999. "Slings for supporting conductors." H. I. Halton and H. W. H. Jones. November 11th. (170,833.)
20,999. "Dynamo-electric generators." J. J. Nevett. November 11th. (France, March 3rd, 1920.) (170,834.)
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20,999. "Clamping arrangement for sheet-metal stator teeth of electrical machines." Maschinenfabrik Oerlikon. November 11th. (Switzerland, November 11th, 1920.) (170,846.)
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15,367. "Tuning instruments for use in wireless telegraphy and telephony." H. N. S. "Patent 240,121." (170,876.)
16,631. "Dynamo-electric machines." Siemens Schuckertwerke Ges. November 10th, 1914. (143,968.)
16,795. "Magnetic work-holders." O. Loradi & H. Graf-Buchner. June 19th, 1919. (145,471.)
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17,732. "Electric connecting-devices and lamp-holders." C. J. Marsallier. February 19th, 1918. (139,587.)
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17,874. "Magnets for ignition purposes." E. A. Layton-Smith. June 30th, 1920.
22,627. "Methods of and apparatus for wireless telephony." Dr. E. F. Huth, Ges. & S. Loewe. November 28th, 1916. (Addition to 149,312.) (149,313.)
22,628. "Means for breaking and reclosing at the sending station, message-transmission telegraphic devices." J. H. Rind. Ges. October 25th, 1914. (148,316.)
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22,939. "Reception of wireless signals." H. J. Round. July 30th, 1920. (170,914.)
22,761. "Synchronous motor for polyphase current." Maschinenfabrik Oerlikon. August 26th, 1919. (149,975.)
22,762. "Method of dynamo-electric machines." K. Nobuhara. July 31st, 1920. (170,936.)
22,941. "Thermionic valves." A. K. Macrae & H. Morris-Avey & S. R. Mullard. August 3rd, 1920. (170,953.)
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23,045. "Combined rectifying and motive-power producing apparatus." W. H. Glaser & W. H. Glaser. Ltd. August 4th, 1920. (170,969.)
23,046. "Manufacture of manufacturing electric insulators." P. J. H. Bernard. August 18th, 1920. (170,980.)
24,262. "Electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co.). August 20th, 1920. (170,984.)
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24,901. "Electric distribution system." British Thomson-Houston Co., Ltd. (General Electric Co.). September 16th, 1920. (171,009.)
27,022. "Electric switches." D.M.G.R. De La Pichardais. September 23rd, 1919. (151,013.)
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30,986. "Motor-control systems." Ignacio Electric Co., Ltd. (Culter-Hammond & Co.). November 11th, 1920. (171,037.)
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1921

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THE UNEMPLOYED PROBLEM.

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It is a matter for deep concern that with the Christmas season so near at hand, and with winter approaching, there are so few indications of any increase of employment. Indeed, the last figures circulated show an actual increase of unemployment for the week ended November 18th, the number of unemployed persons growing from 1,789,432 to 1,817,000. But it does not do to judge the situation merely by weekly comparisons or by statistics only. If we go back to June in our reckoning we find that the unemployed persons numbered 2,177,899. Many influences are at work making for trade revival and more employment due to other causes, and we shall not be surprised if the situation improves considerably within the next six months. The improvement between now and the spring-time is likely to be slow, but it should be sure now that factors making for reduced cost of production and of building and the general cost of living are coming more effectively into play. The present terribly heavy burdens of taxation, both personal and industrial, are a serious restriction on enterprise, and any hints from high quarters that these may be lessened at the end of the financial year kindle hopes that new enterprises now impossible will become worth while. The present indications of falls in cost of transportation, general travel, the cost of coal, and even the price of the Christmas turkey, are all to the good in making for hopefulness. But while according to a German motto "Hope is the poor man's bread," hope will not keep industry alive and provide employment wherewith a man may purchase, through the sweat of his brow, substantial bread, rather than depend upon national unemployment allowances.

It is worse than useless to imagine that the Government alone can put an end to unemployment by providing work for all, and that it is its duty to meet the need for work by supplying money for maintenance to anyone who cares to ask for it from the boundless resources which the Government is supposed to have at command. That "the Government" as such has any money or financial resources is, of course, known by reasonable people to be untrue. The State has nothing except that which can be extracted from the pockets of the taxpayer. Again, to continually suggest that the Government must find work is mischievous in the extreme, as leading to the belief that some kind of relief work, engineered and managed by Government officials, is the only palliative for unemployment.

Having said this much, we are fain to confess that it is not easy to suggest, much less to provide, a remedy. We conceive, however, that in order to get into the proper frame of mind to consider a remedy it is best to look at some of the causes of the disease, and see whether any of those causes can be removed. We do not propose to enumerate them all; but there are three of outstanding importance. First, the Great War and all its sequelæ; second, the fact that the trade unions continue to insist on their demands for short time and high wages; and third, the artificial

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maintenance of wages through the medium of Trade Boards. The war, of course, is the chief of these. It paralysed trade for a number of years, ruined many of our foreign customers, taught people abroad to do without our goods or make them for themselves, and last, but not least, it gave an impulse to foreign competition. We believe that the British taxpayer has been, and still is, ready and willing to bear his fair share of the burden of providing for the unemployed in so far as the present position was brought about by the war; but he is entitled to demand that organised labour and the workers themselves shall do their share. If, therefore, the Government has recourse to the payment of further doles, or to the establishment of relief works in order to tide over the present difficulty, the trade unions should consent to relax their rules, and the workers should agree to the suspension of those regulations which now compel employers to pay a minimum wage. It is not easy to see how the trade unions can be compelled to relax their rules. They did this, to their credit be it remembered, during the war, under the stress of a great national emergency. But they do not seem to realise that the effects of the war are still severely felt, and that, so long as wages are maintained at too high a level, and the worker is encouraged to refuse to do a full day's work at a reasonable wage, it is impossible for the country to recover its trade. In our view, however, something can be done by Government to compensate the taxpayer for the burdens which will have to be imposed upon him if further moneys are to be extracted from him. The rules which restrict hours of labour and impose minimum wages must be relaxed in order to make it possible for employers to carry on business at a profit. For it is time that those who make such rules came to realise the position of a man who, whatever else may happen, is called upon to find, at the end of each week, a large sum in ready cash to hand over to his workpeople.

Reports of the cases which are heard from time to time by Courts of Referees make it plain that there are two causes at work to promote unemployment. The first of these is the minimum wage; the second, the eight-hour day and the disinclination of the trade unions to allow overtime. As regards the minimum wage, it operates thus: An employer who is unable to pay it is on the horns of a dilemma. If he dismisses his workmen and closes his works he throws people out of work. If he pays less than the minimum, even by agreement with his workpeople, he is liable to be heavily fined, and the Ministry of Labour justifies its action in insisting on observance of the law by saying: "If one employer disregards the minimum wage, it is unfair to others who conform to it." It is all very well to prescribe a minimum wage if it be certain that the conditions prevailing at the time when the wage is fixed will continue; but events of recent months have shown that what was a reasonable minimum a short time ago has now, in many industries, become wholly unreasonable. But the minimum operates in another way. It tends to make the employer dismiss the adult and employ the child in his place. Moreover, the fact that he will have to pay more when the "child" passes the age of 18 leads to the dismissal of a number of persons who are nearing that age.

With regard to restriction of hours, a frequent cause of discharge is that a man will not work overtime either with or without payment for time worked in excess of the maximum, whatever it is. Cases from the Courts of Referees show that a worker will sometimes refuse on his own initiative; but he is more often urged to this course by his trade union, whose officials adopt the mistaken view that the less overtime is worked the more employment there will be for new hands. It is to be borne in mind, too, that all these rules as to minimum wage and restricted hours are at the present time being directly enforced by the Government in this way: that if a man is offered work at wages below the minimum rate he is justified in refusing it, and can claim unemployment benefit. Similarly, if a man is dismissed because he will not work more than the statutory number

of hours, he loses his job through no fault of his own, and is entitled to sign on at the Labour Exchange and draw 15s. a week for doing nothing.

In answer to the suggestion that these restrictive rules should be modified or repealed it will, of course, be argued that they were imposed to prevent sweating and other evils; but those are ills of a bygone age which have long disappeared. It will be said, too, that to remove restriction is to compel men to work for less than a living wage; but we venture to think that there are thousands of genuine unemployed who would rather work for a small sum than be kept from starvation by a mere dole which they can have for nothing, and which they attend to receive cheek by jowl with wasters who have never worked and never mean to work.

Industrial Welfare.

We believe that there is at the present time a certain amount of impatience with welfare work, and it is manifested both by employers and by workers. It always happens that, when a movement is started amidst almost universal approval and popularity, there is some reaction after the first few years. This reaction is generally due to the natural feeling of disappointment that more has not been accomplished than can be shown. There is a feeling at first that faith should move mountains bodily; but it is at least open to question whether the first and most noticeable effect of a lively faith ought not to be a quickening of the spirit of work towards the end desired. The faith is, that by work certain results can be accomplished.

The first few years of any project are the most difficult. It is not very long since industrial welfare began to assume its rightful place as a laudable and worthy object in commercial business. The Industrial Welfare Society held its third annual general meeting on November 3rd, 1921, with H.R.H. the Duke of York presiding. He expressed a good deal more than a merely conventional and polite interest in the work, and afforded one more proof, if that were needed, that in the present King and his house we have a family of workers who have the true interests of all classes of the nation at heart, and who seek to advance them by every means in their power.

The Treasurer of the Society, Sir Charles Wakefield, a former Lord Mayor of London, referred to our domestic industrial troubles, which are, he said, of a more permanent nature than the transient post-war difficulties which, for the time, complicate them. Their permanence constitutes a feature which makes the "patient policy of permeation and persistent propaganda" (as Sir Charles, with a highly successful attempt at explosive alliteration, puts it) of such unique importance.

Lord Invernairn, whom our readers may more easily recall as Sir William Beardmore, thought the Society might well be more aggressive and less apologetic. That is very likely. There are other societies which would do well to bear this counsel in mind. No good ever came, as we said a few weeks ago, from hiding one's light under a bushel. However, that is by the way. Lord Invernairn hopes that there will shortly be held a large meeting of employers to consider the possibilities of the welfare movement in industry, and that the Duke of York will also preside over that meeting.

It is by patient effort on the part of employers, staff, and manual workers, each endeavouring to see and appreciate the others' points of view, that progress will be made. Each must push with his available strength, however small, in the right direction, and the movement that will result will be cumulative. Impatience will not help. It is of no use to discontinue your efforts, or to neglect the payment of your subscription because the benefits to be obtained appear to lie in the rather distant future. They may be rather nearer than they seem, and those will participate in them who have shown their worthiness by continuing their efforts in spite of discouragement.

TESTS ON INSULATING VARNISH.

By W. S. FLIGHT, A.M.I.E.E.

INTRODUCTION.

PAINTS and varnishes have been employed for various purposes in many industries for hundreds of years. In course of time it was found out, largely by the method of trial and error, which particular mixture of gums, oils, &c., produced the best result in each particular case. A perusal of the catalogues of any large paint and varnish manufacturer will show how many different classes of varnish are still manufactured for the different industries which he supplies. Even for the electrical industry, varnish manufacturers do not appear to be contented unless they can list from 12 to 20 different varieties. Although these are almost always accompanied by a description of their properties and uses, the would-be purchaser is often unable to decide which varnish is really the best for his particular purpose. As the selection of insulating varnish demands a knowledge of the functions which it is to perform, as well as the properties of the varnish itself, the electrical engineer is often in a far better position to make the choice than the varnish manufacturer.

To ascertain the true properties of the varnish, tests are necessary, and these can almost always be carried out on a laboratory scale with a small sample of the varnish. As very little has been published on the subject of testing insulating varnishes it is hoped that the following results will be of interest and use to many.

Insulating varnishes required by the electrical industry may be roughly divided into the following classes:—

1. *Baking Oil Varnishes.*—These require drying for three to eight hours at a temperature of about 95 deg. C. (203 deg. F.). They have, as a rule, a very high dielectric strength, great flexibility, and do not become brittle by prolonged heating at high temperatures.

On account of their high dielectric strength and good ageing properties, these varnishes are very largely employed in the manufacture of all classes of electrical machinery.

2. *Air Drying Oil Varnishes.*—These are similar to No. 1, but are specially prepared to hasten their drying properties, so that baking is not necessary. They usually require about twenty-four hours to become perfectly dry in ordinary atmospheric conditions. They have not as good ageing properties as No. 1, and consequently should only be used when it is impracticable to bake the material. This often occurs in connection with repair work, and on large apparatus which, on account of its weight, cannot be conveniently baked. These varnishes are also extremely useful on moulded insulation, &c., which would soften if subjected to the baking process required for the baking oil varnishes.

3. *Air Drying Spirit Varnishes.*—These usually consist almost entirely of gums dissolved in methylated spirits, and will air-dry in two or four hours under ordinary conditions. They are more brittle than either No. 1 or No. 2, and should only be used on stationary parts of electrical machinery, and on apparatus which is not subject to extreme variance in temperature.

TESTS FOR INSULATING VARNISHES.

Although the properties of the above three classes of insulating varnishes are in many respects very different, the same tests may often be used for each type so long as the results obtained are interpreted in relation to the functions which the varnish is required to perform.

Some of the tests about to be described are only required when a very thorough investigation is to be carried out, or when some special property of the varnish is to be ascertained.

1. *Drying.*—For this and other tests different experimenters have employed different materials on which to place the varnish. Copper foil, cotton cloth and various papers have been often used in this connection, but as the object of the tests is to ascertain the properties of the varnish it is very desirable that the films of the varnish should form the greater part of the materials being tested. It is also desirable that the varnish should be tested on fibrous materials, as it is on these materials that it will be used in practice. For these reasons 0.001 in. Japanese paper has been found to be a very suitable material when used in this connection.

When the varnish is supplied by the varnish manufacturer it is usually thicker than is required by the electrical industry, and in order that its viscosity may be reduced to a good working value the neat varnish should be thinned down by the addition of a thinner recommended by the varnish manufacturer.

When the varnish has been thinned to the required viscosity pieces of jap. paper about 4 in. square are dipped into it, hung up in the air and allowed to dry. They should be so placed that they are free from draught, but should not be boxed in as an abundant supply of air is necessary to oxidise the varnish, and so convert it from a liquid to a solid state. If it is known that the varnish is an air drying one, the sample should be examined every half-hour, and the time recorded when the varnish about the centre of the paper becomes dry to the touch. If the varnish is a baking one there is little object in carrying out the test in air, except that it is easier to examine the samples than when they are placed in an oven. With baking varnish, however, a test should always be made in an oven and the samples removed at the end of each hour, cooled to air temperature and examined, until dry to the touch. The temperature of the oven for these tests should, of course, be as near as possible to that of the ovens in which the electrical apparatus is to be baked. If comparative tests only are required, a temperature of 80 deg. C. has been found to be the most convenient for laboratory investigation.

2. *Ageing Test.*—Pieces of jap. paper should be treated as for test No. 1, dried for the length of time found necessary by that test, and then given a second coating of varnish, draining the pieces in the opposite direction to the first. After drying the second coat of varnish the paper should be suspended in an oven maintained at a temperature of 80 deg. C. to 90 deg. C. It is most essential that this oven, and also the oven employed for ascertaining the time of drying, should be so constructed that a slow but continuous flow of air may pass through it. A metal oven containing a number of $\frac{1}{4}$ -in. holes, evenly distributed over the top and bottom, and having electrical heating units placed in the bottom, has been found satisfactory for carrying out these tests.

From the time required for the varnish to dry it can be predicted whether the ageing is likely to be a matter of hours or of days. If the former, the samples should be examined every hour, but if the latter, daily examination will be sufficient. For the purpose of this examination the samples are removed from the oven, cooled to air temperature, and then bent over through 180 deg., so that the paper is flat on itself. At first the bending will have no effect whatever on the samples, but in course of time the varnish will become so brittle that when the paper is doubled over and pressed together it will break in two pieces. When this occurs the varnish is said to be "aged," and the extra time of heating beyond the time required for drying is taken as the time to age. In order that the paper shall never be bent twice in the same position, a small piece should

be cut from the sample and the bending test performed on that rather than on the main sample.

3. *Dielectric Strength.*—As the dielectric strength of all insulating materials depends largely on the thickness of the material, pieces of the 0.001-in. jap. paper should be cut, dipped in varnish, dried, and re-dipped a number of times until the total thickness is increased to 0.005 in. The pieces should always be drained in the opposite direction to that in which they were drained after the previous dipping; this will then produce a uniform film of varnish on both sides of the paper. Although the dielectric strength of freshly dried varnish is of importance, it is even more important to know the dielectric strength of the varnish after it has been subjected to extra heating such as it will experience in an electrical machine. Two batches of papers should, therefore, be treated for the dielectric strength tests, one batch being tested immediately after drying and the other after heating the paper at 80 deg. C. for about half the time of ageing of the particular varnish.

The dielectric strength test is usually carried out by laying the varnished paper on a flat sheet of brass, and using a piece of brass about 1 in. in diameter as the top electrode. About 1,000 volts should be applied and maintained for one minute and then increased to 2,000 volts, which again should be increased at the rate of 1,000 volts maintained for one minute until breakdown occurs. In order that reliable figures for dielectric strength may be obtained, at least five, and preferably ten, breakdowns should be obtained on both the dried and the partly-aged papers.

4. *Acidity.*—The oils and gums used in the manufacture of insulating varnishes are liable to contain organic acids, some of which readily attack copper, although they do not appear to have as destructive an action on fibrous materials. It is difficult, and of no practical value, to ascertain the acidity of liquid varnish, and it has been found most convenient to determine the acidity on the pieces of jap. paper after the above tests have been carried out. During the ageing test the varnish is continually taking up oxygen from the air, and consequently its chemical composition is changed. This often results in a decrease in the acidity, and for this reason it is usual to conduct acidity tests on both the freshly-dried and on the aged papers.

The acidity test is carried out by cutting a known weight of the varnished papers into pieces about $\frac{1}{4}$ in. square, and boiling these for four or five hours with water or methylated spirit. (If the latter is used a blank titration has to be made to allow for the acid in this spirit.) The percentage organic and inorganic acids are determined by titrating with a standard alkali, employing the usual indicators for the organic and inorganic acids.

5. *Oil-resisting Properties.*—If the varnish is intended for use on oil-immersed apparatus, it is of the utmost importance that the varnish should be capable of withstanding the action of hot insulating oil. The resistance of the varnish to hot oil depends on (a) the ingredients from which the varnish is made, and (b) the extent to which the varnish has been oxidised. Most of the baking linseed oil varnishes will withstand hot oil provided they are thoroughly dried before being immersed in the oil. On the other hand, even the best oil-resisting varnishes will give bad results on the oil tests if the varnish is not thoroughly dried before the samples are immersed in the oil. For the purpose of this test, the most reliable results are produced by winding a small coil (say, about 2 in. cube) and dipping in varnish while hot. After being thoroughly dried the coils are immersed in insulating oil and maintained at a temperature of 80 deg. C. for 100 hours. While still immersed in the oil they should be removed from the oven, cooled to air temperature, and the oil and coil carefully examined. If the varnish has satisfactory oil-resisting properties, the oil should still be clear and the coil free from any deposit or roughness. In certain cases it has been found that, due to chemical action between the oil and the varnish, the coil has become covered with a thick film of deposit, almost like a bac-

teria growth, which in places may be as much as $\frac{1}{4}$ in. thick.

It is essential for this test that non-sludging transformer oil should be employed, and even with these oils the heating will produce darkening in colour. In order that there may be no doubt as to whether any deposit or darkening in colour is due to the oil or to the varnish, a blank test should be run consisting of oil only, without the addition of any coil or insulation. The results can then be judged with reference to this control.

6. *Sticking Qualities.*—The insulating varnish is often relied upon to cement the wires and insulating material together. This property of the varnish can be ascertained by winding a small coil as for the oil-resisting test and dipping it, after thorough drying, into the varnish. After baking for the required period, the coils should be cooled to air temperature and then cut in half with a hacksaw. If the sticking qualities are good the cutting can be done without seriously deforming the coil, and, after the coil is sawn in half, the adhesion between the various layers and turns can be readily ascertained. The test also enables the extent of the penetration, and also the internal drying properties, to be determined.

7. *Softening Temperature.*—Varnishes which are required for use on armatures and other rotating parts must not soften at the operating temperature of the machine or they will be liable to be thrown from the winding during service. When it is required to ascertain if the varnish will be satisfactory in this respect, a piece of copper weighing about 1 lb. should be coated with the varnish, dried for the required time and then placed in a 100-deg. C. oven for half an hour. It should then be removed and examined with a knife blade to see if the varnish is soft and tacky or still firm and hard.

8. *Thermal Conductivity.*—Another of the functions of insulating varnish is to assist in the transmission of heat from the inside to the outside of the coil. For this test a coil should be wound as for test No. 5, and dipped in the varnish after being thoroughly dried, and the varnish dried as usual. During the time the varnish is drying, an unvarnished coil should also be placed in the same oven so as to drive off any moisture it contains. As soon as the coils have been cooled to air temperature after this drying, they should be connected in series and a current passed through them of such a value as to raise their surface temperature to approximately 80 deg. C. When a steady temperature has been reached the ohmic resistance of each coil should be obtained, from which the temperature rise can be calculated.

RESULTS OBTAINED.

In order that the suitability of the varnish for any particular purpose may be determined from the above tests, a number of results are given below, which will enable other results obtained in like manner to be more easily interpreted.

1. *Drying.*—Air-drying linseed oil varnish, when tested in the manner described, usually takes from 12 to 24 hours to become dry to the touch. Spirit varnishes are dry as soon as their volatile solvent has been evaporated, which usually takes from one to three hours.

Baking oil varnishes require from three to six hours heating at 80 deg. C. for the jap. paper to become dry to the touch.

2. *Ageing.*—Baking oil varnish should not age in less than 100 hours. The results of a number of tests on varnishes of this description are given in Table I.

Air-drying oil varnish should not age in less than 10 hours.

Spirit varnishes are often brittle as soon as they are dry, and no satisfactory ageing tests can be carried out on varnishes of this type.

3. *Dielectric Strength.*—Table II shows a large number of results obtained on different insulating varnishes, from which it will be noticed that the dielectric strength varies from about 2,000 to about 200 volts per mil. A baking-oil varnish cannot be considered satisfactory unless its dielectric strength when tested in the manner described is at least 1,000 volts per mil.

Air-drying oil varnish has usually a lower dielectric strength, particularly after ageing. Its dielectric strength, however, should not be less than 800 volts per mil. As spirit varnishes are so easily cracked it is very difficult to obtain consistent figures with this class of varnish, but if the tests are carefully carried out the

TABLE I.

RESULTS OF DRYING AND AGEING TESTS ON INSULATING VARNISHES.

Class of varnish.	Description.	Time to dry at 18-22° C.	Time to dry at 30° C.	Time to age at 30° C.
1. Baking ...	A clear cloth varnish ...	18 hr.	3 hr.	75 hr.
"	" " " " No. 1 ...	18 "	3 "	340 "
"	" " " " " 2 ...	18 "	3 "	170 "
"	" " " " " 3 ...	40 "	3 "	230 "
"	" " " " " 4 ...	14 "	3 "	54 "
"	A black " " " " 1 ...	12 "	2½ "	59 "
"	" " " " " 2 ...	200 "	12 "	1000 "
"	" " " " " 3 ...	500 "	12 "	900 "
"	" " " " " 4 ...	14 "	8 "	300 "
"	" " " " " 5 ...	70 "	7 "	500 "
"	" " " " " 6 ...	43 "	1½ "	160 "
2. Air drying	A clear coil varnish No. 5 ...	24 "	3 "	200 "
"	" " " " " 6 ...	18 "	3 "	200 "
"	A black " " " " 7 ...	12 "	2 "	5 "
"	" " " " " 8 ...	14 "	3 "	3 "
"	" " " " " 9 ...	12 "	3 "	3 "
"	A clear core plate varnish ...	24 "	3 "	126 "
"	A black " " " " ...	14 "	3 "	3 "
"	Hard drying copal varnish ...	10 "	3 "	300 "
3. Spirit ...	Black finishing No. 1 ...	3 "	10 min.	1 "
"	" " " " 2 ...	3 "	15 "	2 "
"	" " " " 3 ...	3 "	10 "	4 "
"	" " " " 4 ...	14 "	1 hr.	3 "
"	Shellac varnish ...	2½ "	10 min.	2½ "
"	Anti-sulphuric enamel ...	12 "	1 hr.	3 "
"	Mica sticking varnish ...	1 "	5 min.	1 "

results should show a dielectric strength of not less than 700 volts per mil.

4. *Acidity.*—In Table III are given the acidities of a considerable number of varnishes of each of the three classes mentioned. From the electrical point of view, the acidities should, of course, be as low as possible, but as varnish makers do not appear to be able to make a satisfactory insulating varnish without some acidity,

TABLE II.

RESULTS OF DIELECTRIC STRENGTH TESTS ON INSULATING VARNISHES.

Class of varnish.	Description.	Dielectric strength.
		Before ageing. After ageing.
		v./m. v./m.
1. Baking ...	A clear cloth varnish ...	1,610 1,550
"	" " " " No. 1 ...	1,490 1,500
"	" " " " " 2 ...	1,210 1,770
"	" " " " " 3 ...	1,770 2,000
"	" " " " " 4 ...	1,140 870
"	A black " " " " 1 ...	1,440 660
"	" " " " " 2 ...	1,060 1,430
"	" " " " " 3 ...	1,370 510
"	" " " " " 4 ...	1,000 1,200
"	" " " " " 5 ...	1,580 1,960
"	" " " " " 6 ...	1,250 1,680
2. Air Drying	A clear coil varnish. No. 5 ...	1,360 1,330
"	" " " " " 6 ...	1,280 1,500
"	A black " " " " 7 ...	640 680
"	" " " " " 8 ...	1,250 260
"	" " " " " 9 ...	280 280
"	Clear core plate ...	870 870
"	Black ...	1,360 1,610
"	Hard drying copal ...	1,580 1,780
3. Spirit ...	Black finishing. No. 1 ...	250 250
"	" " " " 2 ...	840 840
"	" " " " 3 ...	117 117
"	" " " " 4 ...	1,250 260
"	Shellac varnish ...	750 700
"	Anti-sulphuric enamel ...	140 140
"	Mica sticking varnish ...	1,300 970

it would appear reasonable to accept as suitable varnishes which do not have a higher acidity than the average figures given in Table III.

5. *Oil-resisting Properties.*—Provided the coils have

been well baked before being placed in the oil, the oil containing the coil should be just as free from sediment after the heating test as a sample of oil which has been subjected to the same heat and has not had any contact with varnish. The baking-oil varnishes are usually found to be the best oil-resisting varnishes. The air-drying and the spirit varnishes are not as a rule so satisfactory in this respect, although some of these two classes of varnishes are suitable for use in oil-immersed apparatus, provided the temperature of the oil does not exceed 50 deg. C.

TABLE III.

RESULTS OF ACIDITY TESTS ON INSULATING VARNISHES.

Class of varnish.	Description.	Organic acidity in terms of 80.	
		Before ageing.	After ageing.
		%	%
Black oil varnishes.	Clear coil varnish. No. 3 ...	2.1	1.4
	Black " " " " 3 ...	1.1	0.8
	" " " " " 4 ...	0.5	0.3
	" " " " " 5 ...	1.1	0.6
	" " " " " 6 ...	1.1	1.3
	Average ...	1.2	0.9
Air drying oil varnishes.	Clear coil varnish. No. 7 ...	2.8	1.7
	Black " " " " 8 ...	1.9	0.9
	" " " " " 10 ...	0.7	0.5
	Hard drying copal ...	1.8	0.84
	Average ...	1.8	1.0
Spirit varnishes.	Black finishing. No. 1 ...	4.6	3.7
	Shellac varnish ...	3.12	3.12
	Mica sticking varnish ...	2.7	2.2
	Black finishing. No. 5 ...	7.5	7.4
	Average ...	4.5	4.1

6. *Sticking Qualities Test Results.*—With the baking-oil varnishes it is always difficult to thoroughly dry the varnish which has penetrated beyond the first coil. This is due to the fact that the oxidation of the film of varnish on the outside of the coil prevents the varnish inside from taking up oxygen, and so prevents it from changing from a liquid to a solid state. It has often been found that the quicker the varnish dries outside, the slower it dries internally. After cutting the coil open in this test the adhesion can be readily ascertained, and is best compared by a parallel test on some insulating varnish which is known to be satisfactory in this respect. Air-drying oil varnishes and spirit varnishes have usually better cementing properties than the baking varnishes.

7. *Softening Temperature.*—Shellac and many of the gums employed in varnishes have a softening point of about 70 deg. C., and consequently varnishes made from these gums are not satisfactory for use on rotating parts. There are, however, other gums having higher softening points, which when incorporated with suitable oils form a varnish capable, when thoroughly dried, of remaining firm at a temperature of 80 deg. C.

TABLE IV.

THERMAL CONDUCTIVITY TEST RESULTS.

Current through coil.	Temperature rise.		Percentage difference.
	Unvarnished coil.	Varnished coil.	
1 ampere	175° C.	165° C.	5.7
2 "	77° C.	70° C.	9.0
2.5 "	123° C.	110° C.	10.5

8. *Thermal Conductivity.*—Table IV shows the results of some tests carried out in this connection, from which it will be seen that suitable varnish materially assists in reducing the temperature of the coil. The actual percentage difference between varnished and unvarnished coils depends upon the size and type of the coil employed, and the results of this test are best interpreted by comparing the figures with other figures obtained on an exactly similar coil with an insulating varnish which is known to be satisfactory so far as thermal conductivity is concerned.

ARMATURE BANDS.

By L. BURSTOW.

STRANGE as it may seem at first, there is no doubt that considerably more than half the number of armature-band failures are traceable to the bands being made of wire too large in diameter.

The reason that such wire is frequently used, especially on high-speed machines, is probably due to the fact that in putting bands on the armature to prevent the windings rising, due to centrifugal force, one is apt to overlook the fact that the stress on the bands due to the centrifugal force is not only not the only stress, but, in addition, is not the greatest, especially on small and medium-size machines.

On these armatures the greatest stress is that due to bending the banding wire round the armature, and as, on a given armature, the stress increases as the diameter of the banding wire, it will be seen that it is possible to put on a wire which is stressed beyond its elastic limit before any additional stress due to centrifugal force is thrown on it, and it is obvious that any wire so stressed and subject to alternate heating and cooling, as a banding wire is, is bound to have a limited life, and sooner or later must fail. It is, therefore, the writer's intention in this short article to show how the most suitable diameter of banding wire for a given armature can be found—that is to say, the diameter of wire which will give the lowest total stress.

- Let D = mean dia. of winding in inches;
 W = weight of copper in winding in lb.;
 N = revs. per minute of armature;
 d = dia. of banding wire in inches;
 L = total width of bands in inches;
 $W.L$ = weight of copper per 1 in. of band = w ;
 D_1 = dia. of core in inches; and
 L/d = number of wires in bands = n .

Now centrifugal force = $\cdot 0000141 D W N^2$ and area of one wire = $\pi d^2/4$;

therefore, the stress tending to burst the band must equal

$$(\cdot 0000141 D W N^2) / \left(\frac{\pi d^2}{4} \times 2 \pi \times \frac{L}{d} \right);$$

and this equals $\cdot 000000283 D W N^2/d$;

that is to say, with a given armature with a certain width of bands, the stress per square inch grows as the diameter of the banding wire becomes smaller. Then, in bending a wire around the armature the outside is increased by and the inside decreased by d/π ; that is to say, that in $(D_1 + d)\pi$ there is a stretch of d/π , and, as d is very small compared with D_1 , we can, for all practical purposes, say that this stretch takes place in $D_1\pi$; that is to say, in D_1 there is d stretch.

Now, the stretch or extension is a measure of the stress, and steel wire stretches about $\cdot 0009$ in. per ft. per ton; therefore, the stress = $(2,240 \times 12 d)(\cdot 0009 D_1)$ in pounds. This equals $(30,000,000 d) D_1$.

There is one other stress: that due to its own weight.

The weight of a single turn of wire is equal to $\pi d^2/4 \times D_1 \times \pi \times \cdot 283$, so the centrifugal force equals

$$(\cdot 0000141 D_1 \times \frac{\pi d^2}{4} \times D_1 \times \cdot 283 \times N^2) / \left(\frac{\pi d^2}{4} \times 2 \pi \right),$$

and this equals $\cdot 0000002 D_1^2 N^2$.

Now, taking the max. speed of a banded armature as 9,000 ft. per minute or 150 ft. per sec., at this speed $D N = 34,000$. Therefore, at this speed the stress

$$= \cdot 0000002 \times 34,000^2 \\ = 2,400 \text{ lb. per sq. in.,}$$

and this can be neglected, as at this speed the bands would from other sources be stressed to at least 100,000 lb. per sq. in., and, as can be seen, this is under $2\frac{1}{2}$ per cent. of that figure; therefore, all we have to concern ourselves with is the other two stresses.

Although the breaking strain of the best banding wire is about 300,000, the elastic limit is about 150,000 lb. per sq. in., and this must not be exceeded; in fact, the total stress, where possible, should be kept under 100,000.

We have already shown the stress due to centrifugal force, and I think it is obvious that the tension put on the wire when banding must be greater than the tension set up in the wire due to the centrifugal force, otherwise directly the tension due to centrifugal force exceeded the initial tension there would be movement of the coils owing to the bands stretching, and once there is movement (other than that due to heating and cooling, which one cannot control) of coils then, especially in a machine which changes speed frequently, such as a crane motor, it is only a matter of time before the insulation breaks down.

In order to be quite on the safe side, it is advisable to make the initial tension about one and a-half times the tension due to centrifugal force; this will then allow for the machine speeding up slightly for various causes, such as light load, &c.

The total stress then becomes

$$\cdot 00000425 D W N^2/d + 30,000,000 d/D_1,$$

and the stress will be found to be lowest when these two are equal. Now, taking a number of standard machines by various makers, I find that the weight of copper per 1 in. of band approximates very nearly to D : therefore, making use of this, we get, if we take D equals D_1 ,

$$\text{total stress} = \cdot 00000425 D_1^2 N^2/d + 30,000,000 d/D_1,$$

and noting that $D_1 N$ for 80 ft. per sec. (which is about the highest peripheral speed a standard machine would be expected to stand without increasing the bands) is 18,300,

$$\text{we get } \cdot 00000425 \times 18,300^2/d + 30,000,000 d/D_1 \\ = 1400/d + 30,000,000 d/D_1,$$

and the stress will be found to be at its lowest when these two are equal—

$$\text{that is, } 1,400/d = 30,000,000 d/D_1;$$

$$d^2 = D_1/21,400; \quad d = \sqrt{D_1/21,400} \text{ approx.};$$

then $\sqrt{D_1/21,400}$ gives best dia. of banding wire for standard machines. This gives a stress of 125,000 at 80 ft. per sec. on 10 in. dia., and this stress will be greater on diameters smaller than 10 in. So when the speed exceeds 80 ft. per sec. the width of bands should be increased to suit, and when this cannot be done the band should be put on in two or more layers to get the required number of turns, taking care that each succeeding layer is put on with a tension less than the previous one, otherwise the inner layers become slack, and the whole tension due to centrifugal force is thrown on the outer one. A very good rule is to drop the tension 20 per cent. on each layer.

Of course, all the remarks only apply to the final bands and not to the preliminary bands, which are put on to bed the winding well down. These, of course, can be larger, and the initial tension can be as large as the wire will allow. I think if the points brought out were kept in mind when getting out bands for high-speed machines, we should hear very little of band failures.

"Leader" Cable for Aircraft.—Admiral Fournier has communicated to the Académie des Sciences an account of successful tests of apparatus for the guidance of aeroplanes to their aerodromes by night or in fog carried out at Villacoublay by Lieutenant Loth, of the French Navy. Lieut. Loth has devised a similar device to the "Leader" cable for aeroplanes which adds less than 10 lb. to the weight of the machine. On the ground there is a guiding cable with an alternating current of 600 cycles per second. In the machine there are three receiving devices. One of them records a deep and loud musical sound—which the pilot hears with the aid of ear-pieces fixed in his helmet—so long as the machine is flying parallel with the cable. The sound diminishes when the direction of the machine makes an angle with the cable, and ceases altogether when the direction is at right angles to the cable. The second spiral records its loudest sound when the machine is flying at right angles to the cable and ceases to record when the aeroplane is going parallel. The sound recorded by the third spiral varies according to the distance of the machine from the cable, but it stops the moment the machine crosses the cable. The sounds can be caught as high up as 10,000 ft. and for a mile and a half on either side of the cable.—*The Times*.

"HANDS OFF" THE ELECTRICAL INDUSTRY.

Sir Peter Rylands's Speech on German Super-Power Stations for England.

WE had not before us last week, when our leading article on "Hands off" the Electrical Industry" was written, a verbatim report of the speech delivered by Sir W. Peter Rylands at the meeting of the Federation of British Industries. A very full account of the proceedings appeared in the *Bulletin* of the Federation, and in view of the extreme importance of the subject, we are now placing on record below the parts of the speech in which Sir Peter's "dangerous suggestion" was described. We also quote the views expressed by *The Times* Trade Supplement, and extracts from a speech by Herr. Rathenau follow. In our concluding paragraphs we quote from an important speech delivered by Sir Robert Horne, the Chancellor of the Exchequer, on Monday last, in which Sir Robert showed that the danger to the electrical industry was recognised by, at any rate, some of our political leaders now in authority.

Sir Peter Rylands had been delivering a lengthy speech dealing with the objections to the indemnity in its present form, and the need for the form of Germany's payments to be controlled, and he proceeded to discuss ways in which German energy might be diverted into what he regarded as useful channels. He continued as follows:—

I suggest that if we could impose on Germany, by agreement with our Allies, the obligation to build railways under our direction and control—docks, harbours, or any scheme of development which had reasonable prospects of being self-supporting in the near future and could be handed over under some terms to the country benefiting—I suggest that by this policy we should be diverting German energy into a channel which might be of enormous benefit not only to Great Britain but to the world at large.

I know suggestions of that kind have been received with a little doubt because it has been thought that they would give Germany opportunities of peaceful penetration into some new country, but I submit that if that course were found practicable, and if we could carry out such work under the direction of the Allies, by Allied engineers and to the Allied specifications, it would redound much more to the credit and the moral benefit of the Allied nations than to the hewers of wood and drawers of water—the Germans who would be performing the work. I do not want to particularise too closely, but one cannot shut one's eyes to the fact that Russia is a country of enormous potentialities, one of the granaries of the world, a country with almost boundless possibilities, a country whose development has very largely been arrested by the failure of its Government in the past. It is true that at the moment the political position of Russia is very ambiguous, but there are reasons for thinking a change is taking place, and I do not despair entirely of the possibility of the Allies taking some portion of Russia in hand, with the consent of the Government, and developing it, always having in view the object of the rehabilitation of Russia, not exactly as a political nation, but as a source of supply of food and agricultural produce of all kinds. That is a line of thought as to the possibility of developing the waste places of the world in connection with this indemnity in directions in which, as I suggested, there is no early probability of the work being put in hand in a normal way.

Now we come to the reflection whether there is not something we could do to cheapen our own cost of production to our own friends. It must be admitted that in almost any work, whether it be of the character I have been hinting at, or in the direction upon which I now propose to speak, it would be possible for British manufacturers to suggest that work is being done which they themselves were not incapable of performing. I would beg that we do not examine this problem with too particular a criticism of that kind. Always let us bear in mind the converse of the proposition—the alternative that we have to face. If the reparations are uncontrolled, we have to face competition from Germany in iron, steel, machinery, electrical plant, textiles; every single commodity which it makes, and in which we too are interested, will be flooding the world, at prices which must defy competition as a natural economic consequence of the situation. So supposing it is a fact that certain of these alternatives might be considered to involve the use of commodities which we ourselves are capable of producing, we must always remember

the alternative of the peril which British industry would run from the absolute uncontrol of German payments in goods.

I will put my dangerous suggestion first. Some two or three years ago a Committee was appointed by the Government to consider the question of electrical power, and it was reported—and I believe that all of us manufacturers are sensible that it is so—that it was a lamentable fact that throughout the whole of industrial Britain the power units were small in size, very many in number, and widely divided in control; that there was no real efficiency in the production of power. It was recommended that it would be desirable to consolidate these plants; in some way to erect in each district a great super-power station which would enable the manufacturers of that district to obtain their power at the lowest possible cost at which power on the largest possible scale of production could be made. That recommendation was received, generally speaking, with approval, but it was obviously open to very serious objections. One of the objections, perhaps the most serious, was that it would involve the scrapping of such an enormous amount of plant that the capital loss involved would more than outweigh the benefits of the new installation. That was perfectly true, and a not altogether unfair criticism, but there was always this further difficulty: that whether that were so or not, the cost involved was so heavy that under existing conditions it was quite inconceivable that any local authority, the Government or anybody, could provide the millions of money that we required in order to advance a scheme of the magnitude which was in mind.

Now, gentlemen, I am confident that there was a great deal in the suggestion that if we could arrange that the power that was produced in any particular industrial centre over a large area was centrally produced with the greatest economy of fuel and the most efficient production, it would be possible for us to have our power at a very much lower cost than it costs us to-day. This problem has come to the forefront all the more because of our anxieties with regard to coal. The price of coal is undoubtedly excessively high, and with the high cost of railway transport the cost of our power is correspondingly exaggerated, and, speaking for myself, I should be prepared to go as far as this: I should be prepared to say that it would be in the interests of this country for the Government to lay down in every industrial centre in this country, the very best super-power station at the complete expense of Germany, and with a zero capital cost to this country. I believe that if any of us who are dependent upon power in this form could imagine the whole of the existing municipal and other plant in our own district scrapped and its place taken without a penny of extra charge, by a super power station of the magnitude contemplated, I am satisfied we would feel an enormous sense of relief both from the point of view of the probable cost of that power to ourselves and that of the advantage of having an indefinitely large supply always open to us in case of need. Now it is possible that certain electrical interests would at once protest. In reply to that I would like to suggest, first, that there is no earthly prospect of this thing being carried out otherwise under existing conditions, if ever. On the other hand, supposing it were carried out, and the benefit which we are promised accrued, electricity would become the cheapest power in this country, and every manufacturer would at once order motors in order to avail himself of the cheap power that had been provided.

I suggest, gentlemen, that this is a field of inquiry well deserving of examination, and I mention it because it seems to me it would involve very large sums of money, and if the same policy were pursued by France and other of the Allied nations, I can conceive that the amount of orders that would be placed with Germany in satisfaction of requirements of this kind might reach such magnitude that it would make a large hole in the moment that it has to pay. The result would be that instead of German competition making an addition to our difficulties, it would be a German force that would reduce our own cost of manufacture, and contribute to that extent to our prosperity. I mention the electrical question without desiring to dogmatise. I am not an electrician, nor an electrical engineer. I use electrical power, and as a user I appreciate very highly the importance of low cost per unit, just as I denounce most seriously the present extraordinarily high price that I have to pay. If I can see, by any arrangement of this kind, a reduction of the unit cost to something like the figure I think it ought to be, I am satisfied it would pay my firm very well to use electricity more than it does to-day.

Once you have accepted the principle, providing the advantage to the manufacturer is sufficient to outweigh any disadvantages resulting from the possible loss of business, it does open other possible avenues. For instance, one might mention the Channel Tunnel.

Some discussion followed, and in his reply thereto Sir Peter Rylands thanked those present for their sympathetic reception of his statements, and said that the useful comments made would be carefully considered by the Reparations Committee.

He quite appreciated that there was a distinction between work to be done in Germany and the actual work of erection. The labour in relation to the material would obviously vary very much in different jobs. It was doubtful whether it would be consonant with the wishes of the people of this country that the Germans should come over here and do the work. The method adopted would be, in the case of electrical installations, which he had instanced by way of illustration, to order the machinery from Germany, but leave the installation to the labour on this side, as the labour cost would be small in comparison with the cost of the plant. On the other hand, if a railway were being put down in some distant part of the world where the labour cost was high in relation to the material, it would seem advisable to impose upon the Germans the ordinary contractor's liability of arranging for the payment of the people employed. That payment would have to be made out of export of goods from Germany, but it would be a direct charge on Germany so far as the material was concerned, which at all events would employ a certain amount of the German exportation, and *pro tanto* liquidate their liability under the reparation. It would not seem desirable to lay down hard and fast suggestions or to go into too much detail, but it would be reasonable to demand that where any work of this nature was undertaken, the interests in this country which were likely to be affected by it should be consulted in order to obviate any charge that British interests had been neglected.

The Times Trade Supplement, in its leading article on "Reparation Payments" (December 3rd, 1921), makes the following comments on the above matter:—

"Sir Peter Rylands, the outgoing President, suggested central super-power stations and the Channel Tunnel. . . . It is urged that unless subsidised in this form many excellent and ultimately profitable enterprises will be indefinitely postponed, and it has been argued that the erection of the plant, the preparation of sites and other work incidental to such projects would find employment for a great mass of British labour. Against this argument there is the obvious objection that to divert the industrial capacity of our late enemy into activities connected with the manufacture of engineering and electrical installations would tend to foster in Germany those very industries most likely to be useful to her in the event of another war. Already our own engineering trades are finding it difficult to secure enough contracts to keep a portion of their plant and staff occupied. Indeed, the Government, to a chorus of general approval, recently decided to set aside £25,000,000 for the purpose of assisting enterprises which had as their object the erection of reproductive works which in the present state of finance would not otherwise be undertaken, and this policy was deliberately adopted for the relief of unemployment. Yet however attractive it may appear to get something for nothing, the Government will indeed be shortsighted if it does not take into account those ultimate consequences which in the life of a nation far outweigh in importance immediate advantages. *Timeo Danaos et dona ferentes*. The lessons learned in the fourth form room seem to have been forgotten by many of riper years. . . . When the scales fell from the eyes of the British nation in the opening months of the war men recognised the past subtlety and ingenuity of the German rulers, not only in regard to their military policy, but in the steps which had been taken to undermine the industrial position of their neighbours and particularly of the British Empire. Men saw then what would have been the real cost to our commerce of cheap dyes and chemicals from Germany; they recognised that even cheap ocean freights, if granted with the design of driving the British mercantile marine off the seas, would have brought about our undoing; they saw at last why Germany had secured the monopoly of such key industries as the manufacture of hosiery needles, magnetos, and optical instruments. What is blinding them now?"

In those days of stress everybody realised the sinister purpose of Germany's commercial policy. To-day the depreciation of the mark is undermining British trade. Many persons believe that the financial policy of Germany since the Armistice has been designed with no other object. Last week the discovery of 150 new guns in Germany was announced; this week a further 400 new howitzers have been reported. Can such evidence be safely ignored? . . . The safety of the realm must be the first consideration of all patriotic citizens; and however great the temptation to secure reparation from Germany by enabling her to rehabilitate her most formidable industries we trust that there are still sufficient men of character and intelligence among our Ministers to resist the proffered gifts and to refuse to entail upon our descendants the legacy of future strife."

It may be interesting if we reproduce here from the *Economic Review* of October 14th part of an address delivered by Herr Rathenau at a largely attended meeting of the Association of German Industries held in Munich on September 24th. He was speaking on his recent conference with M. Loucheur at Wiesbaden with reference to Germany's payments in kind. The following report appeared in the *Kölnische Zeitung*, September 24th, 1921:

"It is to our interest not to have to obtain further gold values on such a scale, but to deliver material values. The

problem for us is one of replacing payments in gold by payments in kind. On the other hand, it cannot be a matter of indifference for us as to what industries are to undertake the heavy tasks demanded by French reconstruction. It goes without saying that the French industries will secure for themselves a considerable part of the work. Their capacity, however, has its limits. The French Minister for the liberated districts has pointed out to the French industries that they would be injuring themselves were they to devote all their energies to the work of reconstruction, since in that way they would vanish from the world's markets. It would appear that the French industries have recognised this, and that they intend to leave us a large share in the reconstruction. For us this question is very important, not only because by such services economic relations are engendered and extended, but also because it is still difficult to predict what amount of employment there will be in the industries of Europe during the next few years. At the moment we have no unemployment; on the other hand, the factories are not in a position to satisfy all claims made upon them. That is due to the terrible depreciation of the mark. When once internal conditions have again been stabilised, and should the mark rise again, it will be impossible to foretell whether we shall still have the same amount of employment. In view of the peace conditions and of the ultimatum, the amount of employment in foreign countries for the next few years will be extraordinarily small. Our economic system is busily employed to-day and we shall make technical advances, such as only a busily employed economic system can make. For that reason a mutual agreement with our neighbour States is essential. The idea which has dominated the agreement with France with regard to payments in kind is that in the domain of special goods required, of machinery, of plant on a large scale, free trade shall prevail, and that only a system of reckoning shall be created which will make it possible for French manufacturers to purchase from German manufacturers on the basis of free agreements, and to book the goods thus acquired to the reparations account. . . . No greater service can be done to Germany's economic system than by producing from home raw materials. Whoever enables us to dispense with foreign raw materials deserves the civic crown. This point should be seriously considered by our economic leaders. Germany won her great economic position not by wealth, not by her geographical situation, but by forces which are still operative to-day: organisation, discipline, scientific knowledge, work, and a strong sense of duty. If we retain these forces our economic system will revive, no matter what burdens other nations to-day threaten to impose upon us. In the long run it is not wealth and political power that decides but moral power and moral will."

The Chancellor of the Exchequer (Sir Robert Horne), speaking at a meeting at Manchester on Monday, commented on the case against payment in kind as follows:—

"It was suggested that Britain should, like France, obtain some portion of her reparations by means of payment in kind. That was the principle of the Loucheur-Rathenau agreement. But we were in a very different position from France in regard to this. The payments in kind which were to be made by Germany to France were connected with the devastated regions, and there was work to be done, in restoring villages, which were wiped out of existence, which could not be accomplished in any near period of years, though all the labour in France were devoted to the purpose. Accordingly it was possible for Germany to make payments in kind to France without interfering with the ordinary course of French employment."

"The situation was very different with us. For the most part the things Germany could give us in the shape of payment in kind would be just the kind of articles we could make ourselves. There were one or two commodities like potash or sugar from which we could obtain a certain amount of reparation by payment in kind, but all that those articles would yield was a mere bagatelle in relation to the amount due. We would be offered payments in kind in such things as electrical machinery, locomotives, rolling stock, and so on. But what was going to be the effect upon our own trade and employment under these circumstances? (Cheers.) These were the very things which we ourselves manufactured and upon which the very existence of many of our workpeople depended."

THE HELSBY TWIN WIRING SYSTEM.

In view of the interest that is taken in the subject of metal-sheathed wiring systems it is not inappropriate to point out that the advantages claimed for the twin wiring system of British Insulated & Helsby Cables, Ltd., are that it is (1) inexpensive; (2) easily and rapidly erected, fittings are few; it is adaptable and substantial, loose screws and small loose parts are practically eliminated; (3) neat in appearance and does not detract from that of existing decorations; (4) that efficient electrical continuity of the metallic sheathing of the cable is secured by the use of a bonding clamp of the same metal; and (5) that no special tools are required to aid erection.

The system is suitable for either a d.c. or an a.c. supply, and comprises single, twin, or three-core cable, together with a range of fittings and accessories. The single wire is of circular section, but the twin and three-core cable is of flat section, and the overall dimensions have been kept small, so as to assist unobtrusiveness when erected on the surface.

The metallic sheathing of the cable is composed of a special alloy of sufficient strength to provide, it is said, a good protective covering for the cable without impairing its flexibility, and, at the same time, to prevent it sagging between properly-spaced points of support. Moreover, it is claimed that the whole system can be quickly and cheaply erected with a minimum of labour and without the use of special tools; that it presents a neat appearance when installed, and complies fully

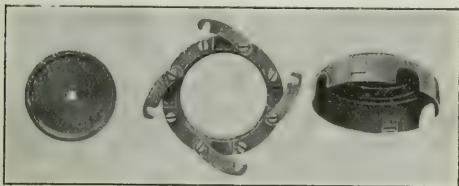


FIG. 1.—THE HELSBY JUNCTION BOX.

with the requirements of the I.E.E. Wiring Rules, fire insurance companies, and electricity supply authorities.

The high-conductivity tinned-copper conductors are insulated with pure, vulcanised, rubber and taped so as to possess distinctive colours; the cores are sheathed with a solid-drawn tube of special metal alloy, and the test pressure employed is 1,000 volts alternating for 15 minutes after 24 hours' immersion in water at a temperature of 60 deg. F. The three types of cable named above are made in a variety of sizes, their approximate overall dimensions varying from 0.208 to 0.58 × 0.976 in., and their weights from 3.2 to 34.85 cwt. per 1,000 yards.

Generally, tinned brass fixing clips and saddles are used, but for cleating cable in damp situations it is recommended that a metal strip of approximately the same composition as that of the cable sheathing should be used. The junction box is illustrated in fig. 1, and comprises a tinned brass back-plate and cover and an annular bonding clamp. The back-plate is placed inside the latter, and the whole is secured to the wall by means of a screw through the hole in the plate. The bonding clamp is provided with four slots, so that it may be used as a two-, three-, or four-way fitting, and continuity of the metal sheathing of the cable is secured by screwing down the small clamping pieces on to the sheath. The metal alloy of which the bonding clamp is made is of the same composition as that used for sheathing the cable, and when it is necessary to

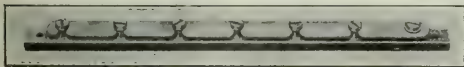


FIG. 2.—THE HELSBY BONDING BAR.

use a larger cable than 7/029 in. flat twin, the slots can be easily enlarged without the aid of special tools, a pocket knife being all that is necessary. The fitting is supplied with all the loose screws and parts assembled, and it is never necessary to remove any of them completely; the long nuts embedded in the bonding clamp practically obviate the trouble experienced with stripped screw threads, while the cover for the fitting is simply sprung on to the base portion.

The universal bonding clamp is similar to the annular one, but it has no back-plate or cover. It is suitable for use under wood pattresses, the latter being specially recessed for the purpose, and have an imitation walnut finish. Porcelain insulated connections are used with the junction box, and the bar for bonding the metal sheaths of cables together at distribution boards, which is illustrated in fig. 2, normally has six spaces for cables, but may be cut up and used in shorter lengths when necessary. The earthing clips are suitable for fixing to metal pipes or a similar medium, and are adaptable to any size. For securing clips, saddles, &c., to any sort of material, Rawplugs are used, while it is recommended that a protective steel covering should be placed over the cable in situations where there is a risk of mechanical damage, and to support it where it crosses ceilings, &c.

THE EAST MIDLANDS ELECTRICITY DISTRICT.

THE above-named district was preliminarily delimited by the Electricity Commission about a year ago* in connection with the proposed re-organisation of the supply of electricity therein, and we understand that a conference of the authorities concerned has made considerable progress during the last few weeks with the consolidation of a scheme covering a wide area of the East Midlands and affecting jointly the public authorities of Nottingham, Leicester, Derby, Burton-on-Trent, Loughborough, Mansfield, Long Eaton, and Newark, the project providing for the establishment of four main generating stations, one at each of the first four named places, with possibly a fifth station of smaller size at Newark; the whole providing for plant approximately of a total capacity of 500,000 kW. After long preliminary discussion between representatives of the several bodies concerned, an application has now been submitted to the Electricity Commissioners for the establishment of a Joint Electricity Authority. The Nottingham Corporation, which has obtained the consent of the Commissioners for its own scheme of independent supply, involving the construction of a large generating station in the neighbourhood of a colliery and contiguous to the river Trent at Clifton, close to the municipal boundary, has expressed approval of the joint scheme, being satisfied that it cannot adversely affect the city's interests, and it is proposed to accord it support at the local inquiry which is shortly to be held, provided that the interests of the Corporation are not adversely affected by any proposed amendment.

It has been suggested as an outcome of conferences between the several authorities, that the Joint Authority shall consist of 20 members, 12 to be appointed by local authorities supplying electricity in the district as follows: the cities of Leicester, and Nottingham, the county boroughs of Burton-on-Trent, and Derby, two each; the boroughs of Loughborough, Mansfield, and Newark, and the urban district of Long Eaton, one each; one member each to be appointed by the County Councils of Derbyshire, Leicestershire, and Nottinghamshire; one member to be appointed by the companies supplying electricity in the district, viz., the Derbyshire and Nottinghamshire Electric Power Co., and the Leicestershire and Warwickshire Electric Power Co.; two members to be elected by the railway companies purchasing electricity from the Joint Authority or one of its constituent members, and two members to be elected by other large consumers of electricity. In addition to the proposal as to the erection of new main stations, provision is made by the scheme for the existing stations in the smaller towns to continue in operation until it is economically practicable to replace them by a bulk supply from a main station. In the first instance it is not proposed that the Joint Authority should take over any of the stations, but as the demand for electricity extends in the area between the several main stations, it may be necessary for the Joint Authority either to take over a station or stations, or to link up such stations to enable them to give a supply of electricity in the intermediate area. As to distribution, it is proposed that the areas of distribution of local authorities shall be extended considerably beyond their present boundaries, and that the Derbyshire and Nottinghamshire Electric Power Co., and the Leicestershire and Warwickshire Electric Power Co., shall continue to be the distributing authorities in the areas covered by their respective provisional orders. It is also intended that the Melton Mowbray Electric Light Co., Ltd., shall continue to be a distributing authority within its present area, and that the Joint Electricity Authority shall exercise distributing rights in those parts of the district which are not served by any of the before-mentioned authorities. The area which the committee suggests, should be the extended area for the supply of energy by the Nottingham Corporation is as follows: The urban districts of Arnold, Beeston, Carlton, Hucknall, and West Bridgford, and parts of the rural districts of Basford, Stapleford, and Bingham. When sanction was given by the Electricity Commissioners to the Nottingham Corporation for the erection of the new generating station on the banks of the Trent, it was made a condition that the Corporation should, if required by a Joint Authority and if so directed by the Electricity Commissioners, transfer such station to the Authority upon the terms mentioned. The scheme further provides that the expenses of the Joint Authority shall be met and defrayed by (1) the proceeds of the sale of electricity and revenue derived from the business of the Joint Authority; (2) grants from the Imperial Exchequer made upon the recommendation of the Commissioners, and (3) such contributions as may be made by constituent authorities. Provision is also made for capital and revenue accounts, borrowing powers, &c.

The Nottingham Guardian points out that Ald. E. Huntsman, chairman of the Nottingham Electricity Committee, is also chairman of the conference which has submitted the scheme.

*ELEC. REV., November 5th, 1920; p. 591.

Foreign Glassware.—The Times states that the forthcoming inquiry into the application of the glass industry for protection under Part II of the Safeguarding of Industries Act is being awaited with much interest. Selling prices of foreign glassware in London are said to be equal to, and in some cases below, British labour costs.

JAPAN AFTER THE GREAT WAR.

The following is a summary of certain portions of the report on Japan by Mr. L. T. Crewe (Commercial Counsellor), and Mr. G. B. Salmon (Commercial Secretary), at Tokio, to which reference was made recently in our editorial columns.

During the years 1914-18, while other countries were consuming capital wealth and piling up colossal debts, Japan, thanks to successive favourable trade balances and a virtual monopoly of the carrying trade on many routes, developed from a debtor into a creditor country. The total increment of wealth derived by her from international transactions is estimated at from 2,500 to 3,000 million yen, say £250,000,000. The amount of money, whether in currency or credits, was more than trebled, but there was not a corresponding increase in the volume of commodities produced or imported for home consumption, but was there any sensible enlargement of services (e.g., communications) as distinct from goods. The consequence was an increase of prices to about three times their pre-war figure, and a speculative boom which lasted into 1920.

The story of the subsequent and rapid collapse is too well known to need recapitulation. Depressed conditions persisted until June, 1921, when some signs of recovery became apparent. Complete recovery must depend, as did the depression, to a large extent upon the conditions in Europe. It was not due to any fundamental defect in Japan's economic position, but arose from an excess of money which could not be turned into goods. The inflation in Japan, though accompanied by the same evils, was not of the same nature as the inflation in European countries, for it represented a real increase in wealth, and not an artificial creation of credits.

The Governor of the Bank of Japan recently urged that this wealth should not be hoarded, that costs of production should be reduced so as to stimulate export trade, and that stocks bought at war prices should be written off.

The Metal Trades.

No line was more overdone than metals, and many firms who had had little experience in this direction made huge speculative purchases. For this reason, and owing also to a great increase in domestic output, stocks have continued very heavy.

The Imperial Steel Works at Yawata have been producing satisfactorily as far as quantities go, but at too high a cost, and as reductions in price have had to be made in order to allow of competition with imported goods, the works are said to be once more running at a loss.

Japan suffered from the need of iron very badly during the war, when her shipbuilding yards and many other plants were held up for lack of necessary materials. The profits to be made out of iron at the prices then ruling seemed so attractive that a great many works were started, some of them on a very extensive scale.

Many works have gone under, so that, on the whole, the outlook for Japan's iron and steel industry is not promising, and yet, if Japan wishes to attain a position of eminence in the manufacturing world, she must have cheap iron.

Notwithstanding this fact the authorities consider that it is necessary to encourage domestic production, and have accordingly increased the tariff to an *ad val.* duty averaging about 15 per cent. Drawbacks, however, will be granted on iron and steel used in shipbuilding and other specified industries.

Great results are expected from a new invention for making pig-iron from iron sand, which has recently been patented by a Japanese scientist. The laboratory experiments are said to have satisfied the military authorities, and it is alleged that work on a commercial scale will be commenced soon. It is estimated that from this iron sand, of which there are enormous deposits, pig-iron can be produced at a cost of 30 yen per ton.

The Market for Machinery.

In spite of the increased production of machinery, especially of electrical machinery, in Japan, the import continues to grow, and it is safe to prophesy that the more her industries develop the more machinery she will purchase from abroad, as it will be a long time before she is in a position to supply all her requirements. In 1918 and 1919 she bought machinery and parts to the value of £100 million each respectively, and for the first time in 1920 she imported less than a year's worth, so that the returns for the whole year should undoubtedly register a record.

In 1914 the United Kingdom enjoyed nearly 50 per cent. of the business, and Germany and America shared most of the balance between them.

The following table shows how the business was divided in 1914, 1919, and 1921.

	1914	1919	1921
United States	1,000 yen.	73,536	39,418
United Kingdom ..	844	28,425	21,031
Switzerland	2,455	2,262	1,613
Other countries	14	575	905
Total	844	76,800	62,967

Department of Commerce and Industries, Japan, 1921, page 28

It will be seen that the British share is gradually advancing.

Switzerland and Sweden, who figure so prominently, owe their place chiefly to the machinery required for the big hydro-electric plants, in which there has been a great boom in recent years. Japan is very well supplied with rivers, and in view of the advance in the price of coal, it is only natural that the attention of power consumers should have been turned to water.

The water turbine machinery for the various plants executed and on order since January, 1920, up to the end of June, 1921, amounts to about 230,000 b.h.p. machinery ordered abroad, and 150,000 b.h.p. machinery made in Japan. In addition to this another 250,000 b.h.p. was to be ordered during this year, including the 190,000 b.h.p. plant of the very big Formosan Hydro-Electric Co., a scheme which is of a semi-Government nature, and which will supply power to the whole of Formosa.

Proposed Electrical Amalgamation.

One of the most interesting features of the year has been the large number of amalgamations of electric companies that have taken place. The Minister of Communications is said to be in favour of a proposal for bringing under one management all the electric companies in Japan. If this were possible the concern would be one of the largest in the world. As a preliminary step a great many minor mergers have already taken place of companies operating in different districts. The Associated Electric Power Co. (capital 100 million yen) is composed of three leading companies, and will absorb three more, thus having control of Central Japan. The Tokio Electric Co. will take over four or five more companies, and will increase its capital to nearly 200 million yen. In the Hokkaido the Fuji Electric Co. has absorbed five other companies. In Kyushu an amalgamation of all the big and small companies operating in the island is under consideration.

Electrification Schemes.

The Government's railway electrification plans have been modified owing to financial stringency. Under the original scheme a semi-official electric power company was to be formed in Tokio with a capital of 100 million yen. The programme has been approximately halved. The work now contemplated will take about five years, and will be looked after by an electric bureau, which has been newly created in the Department of the Imperial Railways.

The present electric tramways, which are under the Imperial Railway Department, have a mileage of only 53 miles, but a further 177 miles will be electrified by 1926. There is also a scheme for the construction of a high-speed electric railway between Tokio and Nikko.

Public Contracts for the Netherlands East Indies.—The Commercial Secretary to H.M. Legation at The Hague has submitted to the Department of Overseas Trade a report on the subject of tenders for public contracts in the Netherlands East Indies. In the case of contracts for materials for public works, railway material, dredging plant, cables, constructional iron and steel and the like, foreign firms may lodge tenders with the Colonial Office at The Hague without the necessity for local representation in Holland. As regards contracts for the supply of general merchandise, and articles of miscellaneous description, however, public tenders are invited by the Colonial Establishment at Amsterdam, and are accepted only from firms having properly accredited representatives in the Netherlands. For the purpose of this regulation it is sufficient for the firm to have in Holland an agent of good standing, that is to say, that the foreign firms tendering need not be actually "domiciled" in the Netherlands. The Commercial Secretary adds that this limitation of the field of acceptance is intended to serve as a protection, in the case of dispute and to ensure, as far as possible, the enforcement of penalties in the event of breach of contract. The Netherlands Government does, nevertheless, from time to time, invite foreign firms having no agent in the Netherlands, to tender directly for miscellaneous goods. These tenders are called private tenders, to distinguish them from public tenders, the rules governing which are outlined above. The Department of Overseas Trade will be pleased to suggest suitable agents to United Kingdom firms not represented in the Netherlands and to accept of details of their requirements, quoting the reference number 11,962/FW.

Concerted Action to Safeguard the Electrical Industry.—The Electrical Section of the Newcastle-upon-Tyne Chamber of Commerce has discussed the Safeguarding of Industries Bill, and passed the following resolution: "This Committee recognises the necessity of some strong concerted action to safeguard the electrical industry as a means of helping to cure the present serious unemployment, and to counteract the effect of unfair competition arising out of the depreciated currency of certain European countries, and of the importation of goods below the cost of production."

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Hall-Mark" Copier.

The production of blue prints, which is an essential function of large engineering firms, and especially electrical concerns, can be a very tedious process. A means of printing which combines speed with efficiency is, therefore, to be welcomed. Such a means is provided by the "Hall-Mark" printing machine, designed and made by MESSRS. B. J. HALL & CO., LTD., Chalfont House, Great Peter Street, S.W.1. Fig. 1 is an end-view of the machine, which gives a good idea of the main features. A "Hall-Thorkelin" lamp is made to move to and fro in a glass bend or trough. Passing under this trough is an endless canvas sheet stretched tightly over three rollers. The printing paper and tracing are inserted between the canvas and the glass, and are taken through at a speed adjustable to a fine degree. The motive power for both the lamp and the canvas is provided by a 1-h.p. motor. The speed of the canvas is adjusted by two methods. First there is a two-speed gear box operated by a gate lever. On this the higher speed is twice the lower. Fine variations are made by altering the position of the driving belt upon two conical pulleys. A countershaft in the base of the machine is rotated by means of the enclosed gear, and from this shaft a double chain extends to a sprocket wheel at the other end of the machine. A stud on this chain forms a limit to the travel of the lamp, and when it reaches the wheel, the direction of travel is changed by a simple but ingenious reversing movement. The "Hall-Thorkelin" lamp, which forms a part of this machine, is worthy of special mention. As will be seen from the line drawing, fig. 2, it has a scissors-type arc, giving a powerful shadowless light with a current consumption of about 10 A., enclosed in a glass globe approximately 8 in. in diameter. The carbon-feeding movement is actuated by a solenoid, which moves a counterweight attached to the holders. By this means a feed of four or five inches is obtained. In addition to these main features several refinements are embodied in the machine. A chest at the rear contains a roll of printing paper, and this may be brought up to the point of entry through a slot. When it is desired to clean the lamp or to

ing out method is not new, but it is claimed that the fitting of a double hinge is new. This eliminates the possibility of the fuse element near to the hinge becoming smashed in swinging. The angle-iron frame is web-jointed, and not

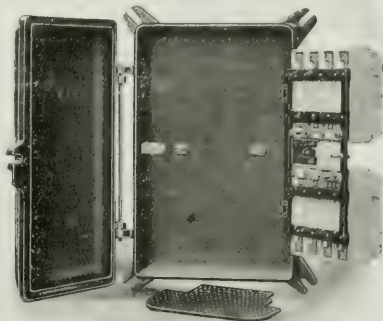


FIG. 3.—THE "VINCENT" FUSEBOARD.

vulnerable to climatic conditions. These boards are at present made with from 2 to 12 ways, double and triple-pole, from 15 to 100 A per way, also with "pull and push" type switches. The London agents for this apparatus are the Enterprise Manufacturing Co., Ltd., and others are located in various parts of the country.

A New Lamp Guard.

In a new lamp guard recently patented by Mr. ROBERT EMERSON, "Glenmay," West Crescent, Darlington, the usual

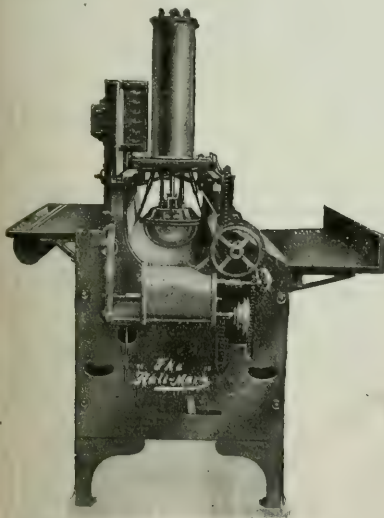


FIG. 1.—THE "HALL-MARK" COPIER

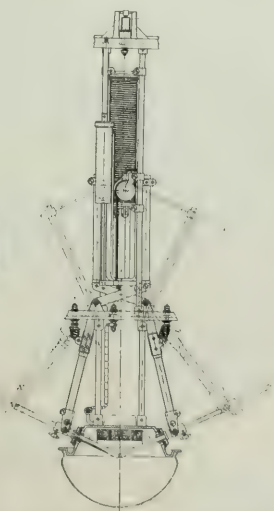


FIG. 2.—THE HALL-THORKELIN ARC LAMP

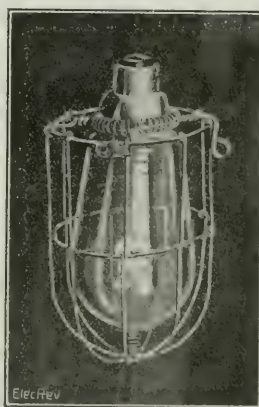


FIG. 4.—A NEW LAMP GUARD.

renew carbons, an extension of the runway in which the lamp moves is provided at one end, so that the lamp can be brought out clear of the machine, and all parts are accessible. The overall (floor space) dimensions of the machine are, roughly, 7 ft. by 5 ft. With electricity at 5d. per unit it is calculated that from 50 to 120 or more double-elephant prints can be made in an hour at a cost of 10d.

The "Vincent" Fuseboard.

T. H. VINCENT SWITCHGEAR MANUFACTURING CO., Balsall Heath, Birmingham, is manufacturing a hinged fuseboard. This fuseboard (fig. 3) is made up of the well-known "Vincent" fuse element, of the Home Office pattern, having all live parts well shielded with best English porcelain. These elements are mounted upon an angle-iron frame, which is fitted by means of a double hinge to the iron case, and can be easily swung out by the removal of one screw. This swing-

ing out method is not employed. As will be seen from fig. 4, the guard is attached to the lamp itself. This arrangement, apart from the convenience of placing the lamp in, or removing it from, the holder, acts as a protection for the lamp at all times. The construction of the guard is amply illustrated in fig. 1. Any size of lamp can be provided for.

The Blackburn Electric Locomotive—CORRECTION. With reference to our note on page 705 of our November 25th issue on the above subject, in which it is stated that the locomotive derives its energy from a "Chloride Battery" we are informed that the accumulators are of the "Exide Ironclad" type, specially designed by the Chloride Electric Storage Co., Ltd., for locomotive work.

CORRESPONDENCE.

Letters received before 5 p.m. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be considered unless we have the writer's name and address in our possession.

A Disputed Meter Reading.

In October, 1921, I had my house wired for electric light; the wiring, on completion, was tested and passed as correct, and the Corporation fixed the meter.

The following are the readings of energy consumed per quarter:—

	Quarter ending March.	Quarter ending June.	Quarter ending Sept.	Quarter ending Dec.
1920	65	28	32	85
1921	71	30	30	—

The energy consumed was only used for lighting purposes. I have never had any electrical appliances in the house.

Obviously there was something wrong about the 90 units registered by dial on the meter for the quarter ending June, 1921.

I complained that the meter was wrong to the Corporation, and they undertook to test it, on my signing a form, in which I was to pay the cost if the meter was found correct; if it was wrong, they bore the cost of testing. The Corporation took the meter out and fixed a new one on July 29th, 1921. The result of their test is as follows: it was carried out on a "Ferranti" d.c. meter, 5 amperes, 230 volts, constant 13.44, registering current, 0.1 ampere:—

Three test loads.	Meter readings.	Test meter.
1 ampere	start ... 0430843	0127.640
	finish ... 0431.834	0128.640
		9% slow
2.5 amperes	start ... 0431843	0128.650
	finish ... 0432828	0129.650
		1% slow
5 amperes	start ... 0432837	0129.660
	finish ... 0433810	0130.660
		2% slow
Total	...	31% ÷ 3 = 17% slow

I next looked for an earth, getting the firm that did the wiring to test it; the result was "positive to earth 30 megohms; negative to earth 35 megohms."

Our downstairs lamps are 60-W Osram; never more than three lamps are on constantly after dark, i.e., two in the sitting room and one in the kitchen, and during meals two in the dining room, but then the two in the sitting room are out. The bedroom lamps are 40-W Osram. No lights are left on except in occupied rooms downstairs; in bedrooms only whilst going to bed. Only two bedrooms are constantly in use. No hall or landing light is left on. During the quarter ending June, 1921, there was no illness in the house, and on some nights we went to bed by daylight; yet for the quarter of 92 days, the meter recorded 90 units used.

The Corporation are very nice and polite about it, as most Corporations are, taking their stand behind an Act of Parliament, which states "that if any difference of opinion as to quantity of current consumed arises, the meter shall be tested, and if found correct, the figures as given by the meter shall be taken as final." On this they press me for the charge for testing the meter and the cost of the 90 units.

Can any reader of the ELECTRICAL REVIEW throw light on the cause of the meter's jumping about 62 units, and then when tested being fairly correct?

Is it possible that the error did not occur all at once; also that the test (which was over 3 periods, at various loads as given above) did not cover the faulty spot in the mechanism of the meter? Any information on the above will be greatly appreciated by

Perplexed.

December 3rd, 1921.

Village Electricity Supply.

I should be greatly obliged if, through the medium of the Review, some one would suggest the best means of protecting two d.c. generators (230 volts) both supplying the same bus-bars.

Briefly, the situation is this: the village in question has hitherto been supplied from one generator (compound wound) driven by a water turbine of 15 b.h.p., controlled by an oil pressure governor. No accumulators are used.

The plant is loaded to its utmost capacity, and it is proposed to increase the supply by using an old type overshot water-wheel of about 7 b.h.p., some 1,000 yd. distant from the plant at present in use. The suggestion is to yoke a generator to the water-wheel and connect up to the original turbine generator, and feed by overhead mains.

The water-wheel is automatically controlled. It is to be brought into commission each night, when the load has almost reached the capacity of the turbine plant, and cut out again before the morning when the load has decreased within the capacity of the turbine. It is expected that when the two generators are in use together, although the generators are not in parallel, the load will be shared, and the water-wheel will be able to run at its full capacity, therefore, the total capacity will be increased.

What would be the best protection for the generators in case either of the prime movers or generators should fail to function when at work? And also, when cutting in with the water-wheel plant, when the turbine plant is in need of assistance?

Water-Wheel.

December 3rd, 1921.

The Durability of Lead-covered Wiring.

For over 15 years I have often advised the use of lead-covered wires for certain work; and neither my clients nor myself have ever had cause to regret this advice; but after following the controversy in your columns, it would appear that everybody has not had the same happy experience. Might I, therefore, suggest that you publish a table giving the numbers of those who have written "for" and "against," and the branch of the business to which they belong? Those such as "A Layman" could go under as indicating the value of their opinion.

London, S.W.

Haydn T. Harrison.

December 3rd, 1921.

Repairing A.C. Motors.

I am obliged to "Tanner" for his letter on the above subject in your issue of November 25th, 1921, the more so as I gather from it that, while he has not met with similar trouble, he has been good enough to think the problem out. My letter was written rather hastily, and possibly I did not make it plain that the stator stampings were meant.

Provided that the motor is of the slip-ring type, and that a suitable supply is available, "Tanner's" method is worth trying, and I shall certainly do so should the opportunity occur.

The views of four leading repairers may be of interest:—A considered that there was no workshop method of determining iron losses, and judged each case by its appearance. B had never come across the trouble.

C was of the opinion that a.c. motors in which the stator stampings had been rubbed usually ran hotter after a re-wind. He added (and the writer cordially agrees with him) that people who never dream of using a thermometer will, after a repair, take the temperature as often as that of a fever patient.

D thought much the same as A, and mentioned that whenever it could be done, he had found that an extra turn per coil, when re-winding, was helpful.

Although very few people appear to have met this trouble, it is likely to become more common in the future, as in the present-day a.c. motor the iron, copper, and air gap are often cut as fine as possible.

London,

December 3rd, 1921.

Jaques.

One Solution of the Frequency Problem.

In outlining an alternative scheme to Mr. Sutton's interesting idea for the provision of different frequencies, Mr. Dorey appears to have overlooked the principal feature.

In Mr. Dorey's arrangement, employing a standard turbine, he would have difficulty in obtaining from two machines coupled in tandem on its shaft, periodicities of, say, 50 and 60; and incidentally, assuming a speed of 3,000 r.p.m., he would not get satisfactory results from a d.c. generator, should this be required.

With Mr. Sutton's idea, however, the fact that two different speeds can be obtained with the Ljungström turbine makes it possible to get these frequencies, and perhaps it is in cases where the periodicities are such that a common speed is out of the question that Mr. Sutton makes his claims.

Birmingham,

December 6th, 1921.

A. L. Firth.

The Installation and Use of Electricity in Coal Mines.

Mr. Travis has raised, in my opinion, a very important matter, and one that is as important in its application to any industrial installation as it is to mining service. The question of installing sufficiently large oil switches, I know from experience, is one that appears to be overlooked by many consumers connected to large generating stations.

The policy mentioned in Mr. Travis's letter of taking the risk of a switch exploding in order to save initial capital outlay is, I should say, usually very risky, and certainly not in harmony with our present-day "Safety First" cry.

It should be the policy of all consumers connected to large capacity mains to carefully investigate the conditions under which their plant will operate, and obtain, if necessary, advice on the question of proper and adequate switchgear for their service.

R. T. Norton.

Birmingham

December 6th, 1921

Mr. Travis writes to point out that his initials are T. G. F. G. as printed on p. 746. [Eds. ELEC. REV.]

BUSINESS NOTES.

The "Electrical Review" issue for December 23rd.—The attention of advertisers and readers is directed to an announcement appearing in our advertising pages to-day respecting the dates for sending in "copy" for our issues of December 23rd and 30th. Will correspondents and other contributors take note that for the issue of December 23rd all editorial matter for publication must reach us a day earlier in the week than usual?

Bankruptcy Proceedings.—THOMAS DRIFFIELD WARING, 35, Walgrave, York, electrical engineer.—The first meeting of the creditors was held on November 29th at the Official Receiver's Office, Duncombe Place, York. The ranking liabilities were returned at £52, and there was a deficiency of £24. Debtor attributed his failure to bad trade and lack of capital. "It appeared that he started his present business two years ago with £10 capital, having previously been in business at Waterloo Place for two years. When he went there he had no capital, and the business was not successful. The matter was left in the hands of the Official Receiver as trustee."

J. GLASS WILLIAMS, electrical engineer, 4, Blaenmant Street, Duffryn, Cymmer, Port Talbot.—Receiving order made November 30th on debtor's own petition.

T. HYDE, electrician, 180, London Road, Croydon. Last day for proofs for dividend December 19th. Trustee: T. Gourlay, 29, Russell Square, W.C.1.

Company Liquidations.—W. G. C. HAYWARD & Co., LTD.—Winding up voluntarily. Liquidator: Mr. E. H. Hawkins, 4, Charterhouse Square, E.C. Particulars of claims must be sent to the liquidator by December 30th.

THE PREMIER ACCUMULATOR CO., LTD., Cattle Market Road, Northampton.—This company is winding up voluntarily for the purposes of reconstruction to cope with the necessary increase of business. The name of the new company will be the Premier Accumulator Co. (1921), Ltd., and the business will be carried on as usual under the same management. Liquidator: Mr. A. L. AIRS, 2a, Sheep Street, Northampton. A meeting of creditors is called for December 14th.

AQUA ELECTRIC CO., LTD.—Winding up voluntarily. Liquidator: Mr. R. Manners, 14, Hanover Square, W., who is authorised to consent to the registration of a new company to be named the "Aqua Electric Co., Ltd." Meeting of creditors, December 16th, at 85, Gracechurch Street, E.C.

RAILLESS ELECTRIC TRACTION CO., LTD., and R. E. T. CONSTRUCTION CO., LTD.—Meetings of members, January 3rd, at 28, King Street, Cheapside, E.C., to hear an account of the winding-up from the liquidator, Mr. A. Page.

ALLIES ELECTRIC LAMP REPAIRING CO., LTD.—A petition for winding-up has been presented to the High Court by Mr. L. Kessler, consulting mining engineer, of Oakwood, Bexley, Kent, and will be heard in London on December 13th.

PRITCHETT & GOLD AND ELECTRICAL POWER STORAGE CO., LTD.—With reference to the notice appearing in our last issue regarding the liquidator's final meeting of this company, our readers are, of course, aware that this old-established business, under its new title, Pritchett & Gold and E.P.S. Co., Ltd., is unaffected by the liquidation of the old company. The directors were advised that liquidation of the old company and formation of the new would be the best means of giving effect to certain necessary alterations, amongst which was the reduction of four classes of shares (set up as a result of absorption in recent years of the Electrical Power Storage Co. and Peto & Radford) to two classes.

Dissolutions of Partnership.—MOSELEY INSTALLATION CO., electrical engineers, 176, Alcester Road, Moseley, Birmingham.—Mr. D. A. Capewell and Mr. R. B. H. Gossage have dissolved partnership. Mr. Capewell retiring. Debts, &c., will be attended to by Mr. Gossage.

CHARTERMAN MANUFACTURING CO. and LEWIS EASTWOOD & Co., art metal workers, transport contractors, and electricians, Stafford Street, Birmingham.—Messrs. L. Eastwood and G. A. Day and Lizzie Winchurch have dissolved partnership. Debts will be attended to by Mr. L. Eastwood and Lizzie Winchurch, who will continue the business.

CAMPFIELD CO., electrical engineers, 312, Deansgate, Manchester.—By an indenture dated November 25th between J. V. Gil and H. S. Harker, the goodwill of the business has been assigned to the latter, and he will attend to debts, &c.

Trade Announcements.—We understand that arrangements have now been concluded whereby Mr. L. M. WATERHOUSE, M.I.E.E., A.M.I.C.E., resigns his directorship and retires from the board of Messrs. Tube Investments, Ltd., Simplex Conduits, Ltd., and Credenda Conduits Co., Ltd., manufacturers of electrical conduits and fittings, art fittings and signs, and electrical heating and cooking apparatus. Mr. Waterhouse is starting in business at 19, Rathbone Place, W., and is specialising in the sale of electric heating and cooking apparatus generally, which will include the well-known "Creda" make, and art fittings and signs of "Simplex" manufacture.

THE JACKSON ELECTRIC STOVE CO., LTD., has appointed as its agent for Ulster Mr. Robert Garmany, of 1, Union

Street, Belfast, where a range of samples and small stoves will be held.

MESSRS. TREVELLYAN & Co. have opened a new London office at 40, Newman Street, Oxford Street, W.1, where they are carrying stocks of "Trevan" lampholders, switches, &c. Mr. Emlyn Phillips is their new representative. Telegraph address: "Trevan" OX. London. Telephone No. 1 Museum 1352.

MR. J. S. CHILD, until recently joint sales manager to the Edison Swan Electric Co., Ltd., has opened temporary offices at 187, Wardour Street, London, W.1. Telephone No. 1, regent 6161. Telegraphic address: "Jassessan" OX. London. He desires to receive manufacturers' catalogues.

THE WESTMINSTER TOOL & ELECTRIC CO., of Westool Works, Putney, S.W.15, states that it is now able to supply its Westool electric portable drills in sizes up to 2 in. holes, fitted with 4 universal motors, rendering them suitable for use either on direct- or single-phase alternating-current circuits.

On Monday next, MESSRS. JOHNSON & PHILLIPS, LTD., of Charlton, are opening a branch office and warehouse in Liverpool at 57, The Albany, Old Hall Street. Stocks of their cables, flexibles, and fittings will be held there. We understand that the demand for these products has increased so greatly in Lancashire during the past three years that the business cannot any longer be handled adequately from their Manchester branch.

Catalogues and Lists.—BRITISH INSULATED & HEATSEALING CABLES, LTD., Plescot, Lancashire.—Illustrated and priced pamphlet (H.37), fully describing the Helsby twin wiring system, which employs rubber-insulated metallic-sheathed cable.

THE EDISON SWAN ELECTRIC CO., LTD., Ponder's End, Middlesex.—A catalogue giving prices and illustrations (many coloured) of silk shades for various types of lighting fittings.

THE A. & A. ELECTRICAL CO., LTD., 13, Farringdon Road, E.C.1.—A price list giving full particulars of 2 and 3-phase motors, ranging from 0.7 to 150 h.p.

ELECTRIC FIRES, LTD., King Street, Norwich.—An illustrated and priced booklet of electric fires, garage heaters, grills, boiling rings, &c.

MESSRS. L. G. HAWKINS & Co., 116, Charing Cross Road, W.C.2.—Two leaflets describing "Universal" toasters, kettles, grills, and other heating and cooking appliances.

MESSRS. WALKER, CROSSWELLER & Co., "Dane's Inn House," 265, Strand, W.C.2.—A pamphlet illustrating and describing "Arkon" full-scale draught and pressure gauges.

THE RUMBAKEN MAGNETO CO., LTD., Cheetwood Lane, Derby Street, Manchester.—Five illustrated leaflets dealing respectively with a petrol gauge; an automobile headlight-dimmer; a spark indicator and amplifier; a double sparking plug; and an aluminium piston.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—List No. 1, giving illustrations, descriptions, and details of working of the firm's centrifugal pumps. An aerial photograph of the Charleroi works is included.

THE DOWSING RADIANT HEAT CO., LTD., 91 and 93, Baker Street, W.1.—A very complete catalogue of electric cooking and heating devices; giving illustrations, descriptions, and prices.

THE ENTERPRISE MANUFACTURING CO., Gun Street Electrical Works, Bishopsgate, E.1.—A list of current prices of electrical goods and apparatus, including switches, lampholders, ceiling roses, plugs, kettles, irons, toasters, &c.

MESSRS. R. O'BRIEN & Co., 66, Mosley Street, Manchester.—An illustrated and priced catalogue of "Luna" decorative glassware for lighting purposes.

MESSRS. GENT & Co., LTD., 25, Victoria Street, S.W.1.—Folder 57, giving illustrations and particulars of electric motor sirens.

MESSRS. WILLIAMS & WILLIAMS, LTD., Sardinia House, Kingsway, W.C.2.—Two pamphlets illustrating "Reliance" standard fittings, including metal window frames for various kinds of buildings.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—A leaflet giving views of the new Blackburn power station, for which the company supplied plant. Views are also given of electrical machinery in use for various purposes.

THE JEARY ELECTRICAL CO., LTD., S. Lambeth Hill, Queen Victoria Street, E.C.4.—Two priced leaflets dealing with electric bells, bowl fires, torches, &c.

Private Meeting.—H. HUNT (trading as H. Hunt & Co.), 6, Cooper Street, Bury, Lancs; electrical engineer.—A meeting of the creditors in this matter was held on November 29th, when it was reported that the liabilities amounted to £496, all due to unsecured creditors, while the assets were estimated at £203. The debtor was formerly in partnership, but it was understood that his partner had now gone away. The debtor was anxious to continue the business, and was of the opinion that if he were allowed to do this, the business would show a

fair profit. The meeting was eventually adjourned with a view to the debtor bringing forward the offer of composition suitably guaranteed. The following are creditors:—

	£		£
General Electric Co.	40	Falk Steelmann & Co.	17
Power & Lighting	27	C. F. Bury & Co.	37
J. C. White	24	Aer & Motors, Ltd.	18
Park Electric Co.	92	T. Harwood	186
W. D. Roberts	26		

A French Rumour.—A rumour having been circulated that the British Thomson-Houston Co. proposes to absorb the manufacturing of the Compagnie Generale Electrique of Nancy, it is stated on behalf of the former that no discussions are proceeding on the matter between the two companies at present.

"Ageekay London."—We have been called by other names at many stages of our career. But "What's in a name?" when "a rose by any other name would smell as sweet"? The ELECTRICAL REVIEW is stolidly indifferent to the alteration of its final letter, but what happened to those who bear the honoured names of Alabaster and Gatehouse, and to all others at "4, Lubjapy Hill," when a Belgian letter arrived addressed as under, may, as the budding journalist would say, be "better imagined than described":—

Electrical Review

H. Alabapner, Gapehofe Cie

4, Lubjapy Hill

London, E.C.

Local Electrical, &c., Exhibition.—At the West of England Health and Home Exhibition, being held in Plymouth from December 7th to 17th, THE FALKIRK IRON CO., LTD., is displaying a large selection of cooking and heating apparatus. A large part of the company's stand at the recent Public Works Exhibition, which included a large electric double-oven range and a cooker similar to those supplied to the Glasgow Corporation, has been transferred to Plymouth.

The Decimal Association.—The annual general meeting of the Decimal Association was held on November 30th, when the chairman (Mr. Theodore McKenna) gave a résumé of the principal events of the past year, specially drawing attention to the action of the Ministry of Agriculture in printing metric scales on all small-scale maps, and the decision of Japan to put the metric system into force next year. After the election of the executive committee, Mr. E. C. Barton put forward his proposals for a step-by-step policy in dealing with weights and measures, and the following resolution was passed: "That this association, while adhering to the policy of adopting the metric system of weights and measures, recognises that its object can best be obtained in steps, and that the first step should be the dealing with weights."

Mr. Alcock referred to his proposal for dealing with the coinage by a method which would have the advantage of retaining the present values of all the coins from 1s. upwards, and a resolution was passed approving of the scheme proposed by which the present values of the £ and the shilling would be maintained, but the shilling would be divided into 10 pence instead of 12, thus increasing the token values of the existing copper coins (pence, half-pence and farthings) by 20 per cent.

British Industries Fair (Birmingham).—We understand that, notwithstanding the present adverse conditions, the interest which is being shown in the British Industries Fair (Birmingham), which will be held at Castle Bromwich from February 27th to March 10th, 1922, is very gratifying to the Fair authorities. Manufacturers would do well to avoid the temptation to refrain from exhibiting at a show of this nature because times are bad. The credit facilities afforded by the Government under its recent legislation should be of great value to overseas buyers at the British Industries Fair. A bureau will be established at the Fair by the Export Credit Department of the Department of Overseas Trade. Thus overseas buyers can, under one roof, inspect the best of all classes of British goods, and if agreements to purchase are likely to be made, the exhibitors can arrange liberal terms of credit in view of the assistance provided for under the Trade Facilities Act, the sole object of which is to facilitate the resumption of the ordinary means whereby traders and others can obtain facilities from their bankers to enable them to finance their export trade.

Continental Glow Lamp Interests.—A Vienna newspaper published a report last week that all the shares in the Westlicht- und Metall-Filament- & Glow-Lamp Co., of Vienna, had passed into the possession of the Osram Co. and the Philips Glow Lamp Co. It appears, however, that these companies are only indirectly interested in the Vienna company, through their shareholdings in the Swiss Aarau Glow Lamp Works, which has a large participation in the Vienna company.

Trunk Telephone Cables.—Within the last few months British Insulated and Helsby Cables, Ltd., have supplied, laid and jointed 320 miles of multiple twin telephone cable for the British Post Office, and at the present time they have in hand 150 miles of the same type of trunk cable. The company has recently completed the supply, laying, and jointing of a multiple twin telephone cable between Luxembourg and Dinslaken, a distance of 35 kilometres.

Magneto Manufacture.—The "Combination" Metallic Packing Co. (1921), Ltd., of Hillgate, Gateshead-on-Tyne, has acquired the sole licence for the manufacture of the "Combination" super-magneto, which has been developed by Mr. E. Harrison, of Benwell, Newcastle-on-Tyne. The machine generates, from one armature, both direct and alternating currents, used respectively for lighting and ignition.

Employment in Sweden.—According to a report issued by the Swedish Economic Department, the number of electrical manufacturing works in operation has declined from 30 to 28 between September 1920 and October 1st, 1921, while the number of workmen employed has receded from 7,480 to 4,236 in the same period. The competition of Switzerland is being experienced specially in steam turbines, and lately Denmark has appeared as a rival to Sweden in electrical machinery and cables.

Calendars and Almanacs.—The first almanac for 1922 to reach us is "The Abdulla," received from Messrs. Abdulla & Co., Ltd., 173, New Bond Street, London, W.1, the cigarette people who, as usual, offer 10,000 copies for sale at 1s. 6d. each for the benefit of the British Red Cross Society. It is a handsome production, with twelve monthly sheets adorned by coloured illustrations by special artists.

New B.T.H. Showrooms.—We reproduce herewith a photograph of one of the showrooms opened at Manchester



A B.T.H. SHOWROOM, MANCHESTER.

recently by the British Thomson-Houston Co., Ltd. Every class of lighting is represented, and contractors and dealers are invited to call or send their clients to the new showrooms.

Book Notices.—"Patents and Chemical Research," by H. E. Potts. Pp. ix+198. Liverpool: University Press of Liverpool. Price 8s. 6d. net.

"The Bulletin of the Hydro-electric Power Commission of Ontario," Vol. VIII, No. 4, July-August, 1921. Toronto: The Commission.—The articles in this number include one on the power-factor problem, a comparison of rates charged for electricity by municipalities in the province; and "Merchandise Possibilities in Hydro-Municipalities."

"Applied Calculus," by F. F. P. Bisacre. Pp. xiv+446. Illustrated. London: Blackie & Son, Ltd. Price 10s. 6d. net.

"Directive Wireless Telegraphy," by L. H. Walter. Pp. xii+124, figs. 57. London: Sir I. Pitman & Sons, Ltd. Price 2s. 6d. net.

"Bulletin of the Cleveland Technical Institute," Vol. I, No. 2, November, 1921. Middlesbrough: The Institute.—These are abstracts of recent technical and scientific articles, printed on one side of the paper only for filing purposes. Technologic Paper No. 202 of the U.S. Bureau of Standards, "Results of a Survey of Elevator Interlocks and an Analysis of Elevator Accident Statistics" (30 pp.). Washington: Government Printing Office. Price 5 cents.

"The Framework of Wireless Telegraphy," by R. C. Galletti di Cadilbag. Pp. vi+48. London: Crosby Lockwood & Son. Price 3s. 6d. net.

The Alby United Carbide Co.—A Reuter dispatch from Christiania says that M. Blakstad, director-general of A/S Tyssedalene, who has arrived there from London, states that the Tyssedalene will take possession of the Alby factories at Odda, the Alby United Co. owing the Tyssedalene a large sum of money. The factories will be put up for public auction in January, and the Tyssedalene Co., together with the English syndicate to which M. Blakstad has transferred his interests, intends to re-start the factories within six months for the production of ammonium sulphate. With regard to the statement that the Tyssedalene Co. will take possession of the factories at Odda and put them up for sale, the directors of the Alby Co. inform Reuter's Agency that,

following the purchase by an English syndicate from M. Blakstad of the control of the Tyse Power Co., they were approached by Mr. A. E. Barton with proposals for the formation of an important company to develop the Claude process for the manufacture of sulphate of ammonia. These proposals involved the re-organisation of the Alby Co., and the general terms were agreed verbally with Mr. Barton on November 8th, but difficulties have subsequently arisen in arranging finance, and Mr. Barton has, in consequence, withdrawn from the negotiations.

Electrical Progress in Argentina.—The port authorities at Buenos Aires lately called for tenders for the supply of about 20 electric cranes and motors. Over 10 firms tendered, and the estimated cost of the articles ordered exceeds 800,000 pesos m/n. Whereas Argentina was formerly a leading market in South America for foreign-made electrical devices, several local factories have lately been established, and are fast providing domestic requirements, which is calculated to lessen importations of such goods very considerably. Many factories are now turning out dry batteries, carbon brushes, and insulated-conduit (Bergmann type). The manufacture of incandescent lamps has also been commenced, but so far the business has proved unsuccessful. In Argentina there are three well-established organisations devoted to engineering, of which two are purely electrical. These are the Instituto Sud-Americano de Electrotécnicos y Mecánicos, and the Asociación Argentina de Electrotécnicos. The members of the former are principally wiremen and station operators, and the institute, therefore, is in a good position to disseminate practical information where it will effect the most good.

The Asociación Argentina de Electrotécnicos is composed almost entirely of graduate engineers, who are in private practice, or in the employ of large companies, or of the Argentine Government. Regular meetings are held, at which papers are read upon subjects of current interest, while frequent visits of inspection to local electrical works are arranged. A French engineering company has been granted a concession by the Argentine Government for the erection and operation of a radio station for direct communication with France. The concession is for a period of 30 years, and the company is allowed three years for preparation before commercial service is demanded. By the terms of the agreement the company's wireless messages will be forwarded over the State telegraph lines, and the rates of messages will be fixed by the National Government.—*Reuter's Trade Service* (Buenos Aires).

The Future of India.—The great and far-reaching changes which are taking place in the Constitution of India—the most important market for United Kingdom engineering products—will re-act on her commercial relationships with the United Kingdom and other countries to such an extent that a volume which aims at presenting within its covers a complete résumé of the facts of the position and the various factors which may modify that position in the future appears at an opportune moment. This is the object of His Majesty's Senior Trade Commissioner in India and Ceylon in his "General Review of the Conditions and Prospects of British Trade in India during the Fiscal Years 1919-20 and 1920-21." (H.M. Stationery Office, 5s. 5d. post free), issued by the Department of Overseas Trade. The review, which is revised to October last, is of particular interest to the engineering industry, if only for the fact that it contains a full account of the position in regard to the purchase of Indian Government supplies and the detailed proposals for the new Indian Stores Department. There has been a growing feeling for many years among all sections of Indian opinion, and particularly among Indian industrialists, that the Government should adopt a more liberal policy for the purchase of such articles as can be manufactured in the country. Under this influence the Stores Rules were modified in 1909 and 1913, but the greatest effect came as a result of war conditions. Under the Amended Stores Rules, drawn up by the Government of India (they are not yet in final form, however) plant and machinery may be purchased from branches established in India of British manufacturing firms borne on the list of the India Stores Department, London. Thus the many British engineering firms who have maintained branches in India for years, staffed with qualified engineers and commercial men, and who, although remarkably successful in the industrial field, have hitherto been handicapped in quoting for Government orders under the Old Stores Rules, seem likely at last to come into their own. With this subject is to be studied the new status acquired by the Provincial Governments under the Amendments to the Government of India Act (usually known as the Reforms Scheme). These amendments, which became law at the end of 1919, and are now being generally worked, place the development of provincial industries under popular control. Mr. Ainscough considers the personnel and organisation of the various provincial departments of industry. He provides a list of directors of industry, the executive head of the provincial department and keystone to the whole scheme and calls the attention of agents, representatives and travellers of British firms engaged in the manufacture of industrial plant and machinery, to the desirability of establishing friendly relations with them, feeling sure that they will appreciate such attentions. Besides statistical records, there are many other sections of special interest in this review, such as the development of agriculture as it affects the supplier of plant, and the development of the hydro-electric power resources of India.

The Trade Commissioner states in the latter connection that the position of United Kingdom firms is changed for the better since the Preliminary Report of the Hydro-electric Survey, published in 1919, recorded that British manufacturers of pipes, turbines, generators and switchgear were content to take small orders only, leaving the large ones to countries specialising in water-power plant.

For Sale.—Dundee Corporation Electricity Department has surplus generating plant for disposal, including two 2,000-kW turbo-alternators, several generating sets, boilers, stokers, pumps, &c.

By Direction of the Disposal Board, Mr. A. H. DAVIS will sell by auction on December 13th and following days, at the National Filling Factory, Park Royal, N.W., surplus electrical plant and machinery, &c. (See our advertisement pages to-day.)

Copper and Lead Prices.—MESSRS. F. SMITH & Co. report, December 7th: Copper (electrolytic) bars, £76 10s. (5s. dec.); ditto sheets, no change; ditto wire rods, £92 10s. (5s. dec.); ditto h.c. wire, no change; selenium bronze wire, no change.

MESSRS. JAMES & SHAKESPEARE report, December 7th: Copper bars (best selected), sheet and rod, no change; English pig lead, £26 15s. (5s. decrease on last week's prices).

Theatre Lighting.—The Margate Hippodrome has recently been practically re-constructed to serve the dual purpose of cinema and theatre. An entirely new lighting scheme was installed of which we are able to give some details by the courtesy of Mr. W. C. C. Hawtayne, M.I.E.E., the consulting engineer. The auditorium is illuminated by five large ceiling fittings. Of these, the centre fitting is 6 feet in diameter, the remainder being 3 feet in diameter. These fittings, which are shown in the accompanying illustration, were manu-



THE AUDITORIUM, MARGATE HIPPODROME.

factured by the General Electric Co., Ltd., to the consulting engineer's plans, to replace the old type pendants with their clumsy and unsafe lowering gear. The wires are tubed right up to the lampholders, and every lamp is easily replaceable from above. The red and white lights are on separate circuits, kept well apart, and efficient and well graduated dimming arrangements are provided. Hinged panels in the fittings allow them to be cleaned both inside and outside from above without difficulty.

Cause of Capital Increases in Germany. Contrary to what is generally thought in England, says a correspondent, the depreciation of the currency and not overbounding prosperity, is the cause of the great increases in the capital of German electrical companies recently. This is shown by figures published by the *Elektrotechnische Zeitung*. In 1914 only seven electrical manufacturing firms, two share companies, and five limited companies raised their capital, the first by 12,000,000 marks, and the last by 754,000 marks; in the following five years there were twelve cases of increases to a total of 6,120 million marks. In 1920, however, there were 43 share companies with 709,625 million marks, and 37 limited companies with 4,508 million marks. Account should here be taken of the fact that the creditor postings in the balances of the companies had greatly increased in the case perhaps of the majority of the share capitals. Dividends had, too, been increased in the major number, if not in every case; how far this had regard to the depreciation of the currency remains to be seen; but when it is remembered that the greater part of the capital was subscribed in gold, while the dividends were paid in paper, it will be recognised that these favourable figures of capital increases assume quite another appearance. The effects of the prevalent inflation is only further enforced by a recital of the higher disbursements made under the headings of salaries and wages. In the Siemenswerke balance sheet, for instance, for 1919-20, they rose from 236 million to 496 million marks, as compared with 70 million marks in the last peace year.

The Rating of Electricity Undertakings and Factories.—

Discussing the subject of "Rating and the War," at a meeting of the Architects' and Estate Agents' Institute, held in London, Mr. P. Michael Paraday said that in the case of electric light companies and similar companies, the cost of coal and the additional cost of labour were factors which had risen altogether out of proportion to the increased price obtainable for the service. Hence there were deficits, and the companies, in order to make both ends meet, were seeking to reduce their local ratings, and rightly, as the law now stood. The local authorities needed the money to carry on the services they were compelled to provide in the interest of the community, and it seemed to him that the solution was to be found in a policy under which the spending authorities must spend as little as possible commensurate with providing essential services, in order that the ratepayers might not have to pay more than they could possibly afford. Otherwise, we reached the breaking point, and his experience showed him that a large number of companies could not possibly pay the rates they did in 1914, as their profits would not permit of such a contribution. There was, perhaps, no class of property more difficult to deal with than factories. Since the war the burden had been anything but light, and it was increasing, and the old-time amiability of the owner-occupier of an industrial concern had given place to a desire for something more correctly interpreting the law as it was written than the old assumption that a business man stood ready to pay 5 per cent. in perpetuity upon capital invested over a long period of years. The owner-occupier was beginning to understand what the words "beneficial occupation" meant, and was inclined to point out that a man might sink and lose money in the pursuit of a certain trade, but that to make him pay 5 per cent. per annum on the money he had lost savoured of "rubbing it in," and did not properly interpret the law of rating as the owner-occupier thought it should be and hoped it was. If the conditions under which each several industry was working were not carefully considered and their effect on the industry properly appraised, it was impossible to estimate correctly the change that had taken place in the value of the occupation of a given works to the tenant, whether it be up or down, by reason of the war. In a similar manner new factories, workshops, and new industries were created during the war to such an extent that the relative position of former factories had been completely changed. The capacity for production in many lines of trade had enormously increased, and this sudden introduction of such a large proportion of productive capacity laid out on modern lines must have a very serious influence on the beneficial occupation to be derived from the new subjects themselves, and a far greater influence on those of an earlier date. It was a truism that value was measured by the laws of supply and demand, and it should be a rating truism to say that the value of beneficial occupation could only be fairly estimated by a thorough and intelligent analysis of any changes that had taken place to affect the demand for a particular class of hereditament, due consideration being given, of course, to the question as to whether the change in the demand for the class of hereditament was of a temporary or a permanent nature. As a result of the conditions created by the war we must do one of two things—change the law of rating as it stood to-day or apply our minds to understand thoroughly the effect of the new conditions. Only by so doing could we avoid creating grave injustices and inequalities which must inevitably lead to expensive and unproductive litigation. The time-honoured rule-of-thumb methods must give place to considered thought upon the new problems, and we must bear very strongly in mind that this country earned its living by its industries, and though they might seem a good target to shoot at when more money was needed for local rates, the killing of the goose that laid the golden eggs had never been lauded by the thinking man. It seemed very clear to him that one of the greatest problems in rating that had arisen directly from the war was how industrial undertakings were to be treated.

Patent Applications.—Application has been made by Curt Stille for the restoration of Patent No. 9,061, of 1913, for "Improvements in optical receivers for facsimile telegraphs."

Henri Francois Etienne, Sylvain, Dusserre, has made application for the restoration of Patent No. 20,210, of 1911, for "Improvements in means for converting a continuous rotary movement into a step-by-step rotary movement."

Application has been made by Paul Gerhardt Tismet for restoration of Patent No. 9,411, of 1914, for "Improvements in and connected with fine-inspection devices for internal-combustion engines."

Correction.—We regret to find that in our reprint of the report prepared by the committee of the proposed N.E. Coast Trading Association credit was given to the wrong gentlemen. The circumstances of the case are such that we cannot conscientiously blame the printer (in accordance with long-established custom), or we would do so. It would not be uncomplimentary to say that the written signatures on the report were not in the clearest copper-plate handwriting that we have seen, for has it not been characteristic of some of our most noted men of science, authors, financiers, and others, that their autographs were conspicuous for originality of form? Our tender heart functions incline us to exonerate the

printer for having rendered A. Albrecht (chairman) as C. H. Merz, and Samuel I. Ellis (hon. secretary) as Samuel C. Davis.

Russian Industrial Property.—The following information has been received by the Department of Overseas Trade from the British Agent at Moscow. "The matter" was briefly referred to here last week. According to a decree dated May 17th, 1921, issued by the Russian Soviet Government, and subsequent rulings of the Supreme Council of National Economy, all undertakings in Russia which were not *de facto* nationalised prior to that date are to be considered as denationalised and the owners are immediately to be re-instated. In bringing the above information to the notice of the Department, the British Agent points out that the term "*de facto* nationalised" is considered to include all undertakings where a specific resolution of nationalisation has been passed by the Central Department or District Council of National Economy concerned, and where any of the following events has occurred:—

1. The undertaking was actually taken over, keys being taken from the owner and an inventory made.

2. A works manager was appointed and a plan of production laid down.

3. The expenses of running or protecting the undertaking were included in the estimates of the corresponding Central Department or District Council of National Economy.

4. The process of taking over started before May 17th, 1921, and the documents show that part of the property was actually taken over prior to that date.

In view of the possibility that certain British-owned undertakings may fall within the scope of the decree of May 17th, any British firms or persons who have reason to believe that none of the conditions mentioned above would apply to their works, and that these in consequence may be regarded as not having been *de facto* nationalised up to May 17th, 1921, are invited to communicate the facts to the Department of Overseas Trade in order that the necessary inquiries may be made through the British Agent.

United States Exports of Electrical Goods.—The Department of Commerce reports that the exports of electrical goods during September were valued at \$4,878,883, as compared with \$7,308,093 in the corresponding month of 1920. The total exports for the nine months ended September 30th, 1921, were valued at \$81,349,928, an increase of \$13,678,947 over the figures for the same period in 1920. Details of exports in September 1921, compared with the corresponding month in 1920, are as follows:—

ELECTRIC MACHINERY AND APPLIANCES (EXCEPT LOCOMOTIVES).

	Sept., 1920.	Sept., 1921.
Batteries	\$607,936	\$471,232
Carbons	119,233	42,402
Dynamos and generators	461,613	855,419
Fans	70,489	21,129
Heating and cooking apparatus	95,986	95,690
Insulated wire and cables	635,641	270,145
Interior wiring supplies, including fixtures	241,042	55,761
Arc lamps	\$1,053	\$455
Incandescent, carbon filament	4,402	2,448
Incandescent, metal filament	244,047	76,187
Magnets, spark plugs, &c.	271,177	66,509
Meters and measuring instruments	190,331	191,411
Motors	1,250,408	517,558
Rheostats and controllers	33,309	45,304
Switches and accessories	281,635	159,690
Telegraph apparatus, including wireless	38,093	65,563
Telephones	246,841	262,552
Transformers	208,493	353,033
All other	2,326,304	1,506,876

Total electrical machinery, &c. 7,308,093 4,878,883

Reuter's Trade Service (Washington).

New German Company.—Under the style of Bauunion G.m.b.H. Kommanditgesellschaft a new undertaking has been formed, with offices at Berlin and Munich, out of the electric railway department of the Siemens & Halske firm. The other parties in the new company are the Elektricitäts Aktien Gesellschaft, formerly Schuckert & Co., of Nurnberg, and the Berlin Siemens Schuckertwerke. The capital of the new company is 20,300,000 marks. Its scope of operations will comprise electric railways and water-power stations, and haven, river and armoured cement operations. The new company will not only carry out works for the parent firm, but also for third parties.

The Welsh National Exhibition.—Arrangements for the exhibition which is to be held at Cardiff from May to October next year, are well in hand. A substantial guarantee fund is being prepared and is being liberally supported. The work on the exhibition, on which a large number of men will necessarily be employed, is commencing forthwith under the direction of Sir Charles T. Ruthen, president of the Society of Architects, and it is anticipated that the exhibition will be ready for opening on May 1st.

Wages in the Iron and Steel Trades.—Under the sliding scale adopted by the Board of Conciliation and Arbitration for the manufactured iron and steel trades of the North of a further wage cut of 10 per cent. became operative last week, reducing the wages to 87½ per cent. above the standard. At the beginning of the year wages were 23½ per cent. above the standard. *The Times.*

Christmas Holidays.—The Midland Railway workshops at Derby, in which about 10,000 men are employed, will be closed for a full week for Christmas.—*The Times*.

Price Reduction.—With reference to the reduction in price of the Willys light and power set mentioned in our last issue, we are now informed that the change will take place not from December 1st, but from to-day, December 9th.

The Tokio Peace Exhibition.—The Tokio Peace Exhibition will be held from March 10th to July 31st, 1922. A complete pavilion will be set aside for British exhibits. The arrangements for the British exhibits are in the hands of a well-known firm of British engineers and contractors in Tokio, Messrs. Arthur Buckley & Co., with whom the Federation of British Industries is now co-operating in London. The Federation has secured stands in the British section for the display of catalogues, literature, &c. The foreign section is being well supported, particularly by American and German firms.—*Eastern Engineering*.

LIGHTING AND POWER NOTES.

Australia.—**WESTERN AUSTRALIA.**—The annual report of the Government Electricity Supply Undertaking shows a total revenue of £92,312. Working expenses amounted to £74,978, leaving a gross surplus of £17,334. After the payment of capital charges, there was a net loss of £3,310. In the previous year there was a net profit of £4,046.

Beckenham.—**LOAN.**—The Council's engineer (Mr. J. E. Tapper, M.I.E.E.) states, with reference to the note which appeared under the above heading in our issue of November 25th, that the amount of £5,349 applied for was not in excess of the estimate of the cost of new plant, but the balance of the sum originally applied for but only partly sanctioned.

Birmingham.—**NEW POWER STATION.**—Progress has been made in the construction of the Corporation electric power station at Nechells, and the hope is entertained that the first section of the new installation will be brought into use early in the new year.

Blackpool.—**ELECTRICITY EXTENSION.**—The Electricity and Tramways Committee has decided to apply for sanction for the extension of the mains outside the borough boundary into the rural district of Marton.

Brackley.—**ELECTRICITY SUPPLY.**—The Town Council has under consideration a proposal for the installation of electric lighting in the town.

Bradford.—**WATER POWER.**—Arrangements are now complete for generating electricity by the water power provided at Angram, in higher Niddersdale, for driving the cranes and other contractors' plant engaged by the Bradford Corporation in the construction of the new Scar House reservoir, in the West Yorkshire highlands. The plant will also light the Angram model village. The installation was formally inaugurated on Wednesday last.

Canada.—**NEWFOUNDLAND.**—The *Liverpool Daily Courier* recently reported an interview with Mr. H. D. Reid, who has been in this country to raise capital for a large hydro-electric scheme. He plans to use the Humber River falls to develop about 235,000 h.p. The power will be used principally for special industries, such as the production of paper and pulp, and possibly for dealing with aluminium and nitrates.

Carmarthen.—**FIRE.**—A fire burned out the generating station early on the morning of the 2nd inst. The town is supplied with electricity by the Carmarthen Electric Light and Power Co. (the engineer being Mr. A. Preston, A.M.I.E.E.); some 900 consumers are connected to the overhead main, and the whole of the streets within the borough are lighted electrically. The generating plant consists of two suction gas engines, one horizontal and one vertical, two vertical Diesel oil sets, and a 750-Ah battery.

It is customary to shut down the generating plant at mid-night, and leave the battery to meet the demand until the morning, and it appears that about half an hour after the last man had left fire broke out near one of the compressed-air containers, which seems to have burst under the heat pressure, and in bursting displaced two fuel oil tanks immediately above it, emptying their contents over the roof and the building generally. This was followed by the fire reaching a number of lubricating oil barrels, which assisted in feeding the flames until the whole of the engine room was one mass of flames and the roof fell in, entirely destroying the switchboard and at least three of the four generating sets.

The fire brigade arrived and, with the aid of the electrical staff, succeeded in saving the battery room intact; one of the Diesel sets, it is hoped, can be repaired in the course of a few days, and a partial supply resumed, but a great deal of temporary work must be done before this can be effected. The application of water to extinguish the fire assisted in the destruction of three of the generators, but one Diesel set escaped serious damage in a remarkable manner.

It is gratifying to note the enormous number of offers of assistance and sympathetic telegrams that Mr. Preston has

received, and the company is fortunate in possessing the goodwill of the residents and the Corporation itself, so that every assistance is being rendered the company to help it through a very critical period.

Cheshunt.—**EXTENSION OF SUPPLY.**—The North Metropolitan Electric Power Supply Co. has decided to extend the area for the supply of electricity to Cheshunt. Work is to be commenced at once, and the installation will probably be completed by January next.

Chesterfield.—**STAFF WAGES.**—The Corporation has notified the National Joint Board for the Electricity Supply Industry that unless a revised scale of salaries is put into operation before February 1st, it will withdraw from the Board.

China.—**HONG-KONG.**—The Hong-Kong Electric Co. is laying new cables in connection with the installation of a new distributing system throughout the city. Two new 5,000-kW generators are being added to the installation at North Point, bringing the capacity up to 13,000 kW. When this work is completed the station at Wanchai will be dispensed with and the present 100-V system will be gradually changed throughout the Colony to 200 V. It will take between two and three years to complete the transformation.—*Eastern Engineering*.

Continental.—**FRANCE.**—La Société d'Energie Electrique du Sud-Ouest is increasing its capital from 30,000,000 to 50,000,000 francs for the purpose of erecting the necessary high-pressure mains for the supply of electricity to the French wireless telegraph stations at Croix-d'Hins and Arcachon, and to meet the increasing demand for electricity for lighting and power purposes. The company, which was formed in 1906, supplies energy to the greater part of Bordeaux and to a number of electric tramways and railways in the district. It possesses three hydro-electric generating stations on the River Dordogne, and a steam-operated plant at Floriac, near Bordeaux, the total capacity being about 75,000 h.p.

TURKEY.—According to the report of the Société Ottomane d'Electricité, of Constantinople, the output of the company's generating station during 1920 reached a total of 29,583,900 kWh, an increase of 3,892,400 kWh, over 1919, notwithstanding the fact that during part of the year the running of the tramways was held up and that certain industries were greatly depressed. At the end of 1920 the company was supplying energy to 17,207 consumers, as against only 12,894 at the end of 1919, the biggest increase being in the lighting department. The company's mains now extend to a length of about 186 miles. Owing to the depression in trade and industry generally, the demand for electricity, particularly for power purposes, has not this year been maintained, the output for the six months ending June last showing a falling off. Notwithstanding this, the plant at the power station is being increased by two new boilers and a 10,000-kilowatt turbo-generator, which, however, are not expected to be put into operation until the spring of next year.

NORWAY (CHRISTIANIA).—There was a serious fire at the electricity works last Friday, and the central parts of the city were without power and light all day. It is expected that several weeks will be required for the complete repair of the damage.—*Reuter's Trade Service* (Christiania).

Credition.—**ELECTRICITY SUPPLY.**—A canvass is to be made of prospective consumers of electricity with a view to a supply being obtained from the Exeter Corporation power station at Cowley Bridge.

Electricity District.—**SOUTH-EAST LANCASHIRE.**—The Electricity Commissioners are to hold a local inquiry at the Town Hall at Manchester on January 17th, 1922, at 10.30 a.m., and on following days, with reference to the above-named area, and to consider a scheme that has been submitted by the South-East Lancashire Electricity Committee for the establishment of a joint board.

Guernsey.—**NEW PLANT.**—In order to meet increased demands the Guernsey Electric Light & Power Co. is to install new generating plant at its St. Peter Port and St. Simpson's stations. The engines will be of the Diesel crude-oil type, aggregating 700 h.p., made by Messrs. Mirreles, Bickerton and Day, Ltd. The generators are being made by the Electric Construction Co., Ltd.

Guildford.—**REVISED CHARGES.**—The Town Council will adopt the following scale of charges for electricity as from December 31st: Lighting, up to 10 units per quarter, 10s.; next 1,000 units, 10d. per unit; beyond, 9d. Power and heating, up to 1,000 units per quarter, 4d.; next, 3,000, 3d.; beyond, 2d. Prepayment consumers, 1s. per unit. Theatres and kinemas, up to 100 units per week, 8d.; beyond, 5d.

Lancaster.—**LOAN SANCTIONED.**—The Town Council has received sanction to borrow £7,600 for extensions to the electricity works.

Lowestoft.—**YEAR'S WORKING.**—The accounts of the Corporation electricity undertaking for the year ended March 31st last, show a total income of £39,808, as compared with £29,601 in 1919-20. The expenditure on revenue account amounted to £37,584, as against £23,394, leaving a gross surplus of £2,219 (£6,207). Of this capital charges absorbed £4,832, as compared with £3,861, causing a net deficit of £2,613, comparing unfavourably with a net profit of £2,346 in the preceding year.

Nelson.—**LOAN.**—The Town Council has applied to the Ministry of Transport for sanction to the borrowing of £2,500 for the laying of electricity cables.

Scarborough.—**REDUCED CHARGES.**—The Electric Supply Co. has applied to the Electricity Commissioners for power to amend the charges for electricity for lighting purposes for the quarters ending March 31st and December 31st, up to 15 units, 15s.; and for each unit over 15, 1s. For the quarters ending June 30th and September 30th, up to 10 units, 10s.; and for each additional unit, 1s.

Seaham Harbour.—**ELECTRICITY SUPPLY.**—The consulting engineer to the Seaham Harbour Urban District Council has reported on a proposed scheme for the distribution of electrical energy for public and private consumption.

Skegness.—**RENOVATION OF POWERS.**—The Ministry of Transport has revoked that part of the Skegness Urban District Council Act, 1914, relating to the supply of electricity throughout the area. The order dates from November 26th.

South Africa.—**IOKSTAD (CAPE PROVINCE).** The ratepayers have sanctioned a scheme for electric lighting at an estimated cost of £15,000.

Southampton.—**YEAR'S WORKING.**—The annual report upon the Corporation electricity undertaking (Engineer: Mr. W. G. Turner, A.M.I.E.E.) for the year ended March 31st last, shows a total revenue of £143,216, as compared with £111,932 in 1919-20. Working expenses amounted to £110,654, as against £86,714, leaving a gross profit of £32,562 (£25,278). The net result was a surplus of £10,587 comparing favourably with a net profit of £4,709 in the preceding year. Against this profit, however, capital expenditure out of revenue, amounting to £11,382, was debited, causing an actual deficit of £795. The number of units sold rose from 10,570,248 to 10,916,989.

West Bromwich.—**REDUCED CHARGES.**—The Electricity Committee has recommended that as from December 1st the price of electricity for power purposes be reduced by 12½ per cent., representing the last increase. No recommendation has been made for a reduction in the charges for lighting.

York.—**DEFERRED-PAYMENT WIRING.**—The city electrical engineer recently reported to the Electricity Committee upon the question of free wiring and schemes dealing with wiring on the deferred payment system, and the committee instructed him to prepare an estimate of the cost of wiring certain houses, and to canvass the residents to ascertain if they desired to have a supply of electricity by the fitting up of their houses on the basis of a deferred payment of the cost over a term of three years.—*Yorkshire Herald.*

TRIAL OF APPLIANCES.—To encourage the use of electrical appliances, arrangements have been made for occupiers of houses on the Tang Hall Estate to test the efficiency and convenience of electric irons and heating apparatus. A number of people have been encouraged in this way to purchase appliances.

TRAMWAY AND RAILWAY NOTES.

Australia.—**ADELAIDE.**—**YEAR'S WORKING.**—The accounts of the municipal tramways for the year ended July 31st last show a total revenue of £555,421, an expenditure of £362,823, and a gross profit of £192,597. After the payment of all capital charges a net surplus of £6,723 remained. In the preceding year a surplus profit of £5,948 was realised.

WESTERN AUSTRALIA.—The annual report of the Commissioner of Railways on the Government tramways for the year ended June 30th, 1921, shows a total revenue of £224,892, as compared with £187,961 in the previous year. Working expenses accounted for £204,459, leaving a gross profit of £20,433. After deduction of capital charges there was a net deficit of £9,334. In the previous year there was a net surplus of £10,100.

Birkenhead.—**IMPROVEMENTS DEFERRED.**—The Tramways Committee has rescinded a resolution regarding the proposed expenditure of £99,800 for carrying out work on certain tramway routes to provide work for the unemployed.

Continental.—**ITALY.**—The State railway administration has received permission to electrify the remainder of the Genoa-Breil line, to the extent of some 81 km., of which 20 km. will be in tunnels. The line is one of heavy traffic, amounting last year to about 80,000,000 km.-tons, coal costing about 1½ million lire. With the increase of traffic anticipated to follow electrification, the line is expected to require 7,000,000 kWh. of electricity annually.

Darlington.—**YEAR'S WORKING.**—There was a loss on the corporation tramway system for the year ended £9,100 as compared with £3,741 in the preceding year.

Edinburgh.—**THE HALIFAX SYSTEM.**—The manager of the Corporation tramway system is in communication with Les Tramways Bruxellois, to obtain this company's opinion of the advantages of the use in France of the system was sought for

guidance in the adoption of a system for Princes Street upon the electrification of the city tramways. According to the *Edinburgh Evening News* the Brussels company regards conduit systems unfavourably. The cost of upkeep, as compared with that of trolley lines, is double; there are three or four times as many accidents; and the company would be glad to be able to substitute overhead traction in the place of the conduit system. It is estimated that the conduit lines increase the cost of operation by 1,000,000 francs a year.

Halifax.—**EXTENSIONS AND TRACK RENEWALS.**—The Halifax Tramways and Electricity Committee recommends the Corporation to apply for grants under the unemployment emergency work provisions, to take in hand forthwith the following extensions; the laying of 2,350 yd. of extra-high-pressure mains from Water Lane to Salterhebble, at £3,150; 2,810 yd. from Hangar Hill to Huddersfield Road, at £3,466; 2,280 yd. of tramway feeder from the depot to Salterhebble, £1,601; cable from Wood Street to Chester Road, £1,544; relaying inward tramway track from Springhall Lane to Cow Green, £23,500; double line on the Queensbury route near Cavendish Hotel to avoid risk of cars being overturned by wind, £4,200.

London.—**CHRISTMAS TRAMWAY SERVICES.**—It has been decided to follow the practice of the last two years with regard to the running of the London tramways on Christmas Day. All cars will be returned to their depôts by 4 p.m., and all men who can be spared will be given leave of absence for the day.

Stalybridge.—**CHRISTMAS TRAMWAY SERVICES.**—The Tramways and Electricity Board has issued a notice to its employés intimating that if they refuse to work on Christmas Day they will break their continuity of service, and will forfeit two days' holiday next year.

TELEGRAPH AND TELEPHONE NOTES.

Afghanistan.—**TELEGRAPH SERVICE.**—In recognition of the generous hospitality shown by the Ameer of Afghanistan to the Dobbs Mission, the Government of India has presented the Ameer with sufficient telegraph material to link up the 460 miles separating Kabul from the Indian telegraph extension at Herat via Kandahar, says *The Times*.

Australia.—**LONG-DISTANCE WIRELESS.**—The Radio Communication Co., claiming to be an exclusively British concern, has made an offer to the Commonwealth Government to establish direct wireless communication with the United Kingdom. The offer, which differs in several respects from that put forward recently by the Amalgamated Wireless Co., [as announced in this column recently] is being considered by the Government.—*The Times*.

The Commonwealth Government proposed to bring the present session of the Federal Parliament to an end on December 9th, and hoped before then to deal with wireless schemes.

China.—**WIRELESS INSTALLATIONS.**—The Sub-committee on Drafting of the Washington Conference has adopted the tentative plan presented last week by Mr. Root for dealing with wireless installations in China. Under Mr. Root's plan, which will be reported back to the main Far Eastern Committee at the next meeting, the use of wireless would be restricted to diplomatic and governmental messages. Those installations permitted by Chinese licence would be used only to the extent authorised by the licence, and the Powers would co-operate with the Chinese communication authorities to secure that the wave lengths were not interfered with.—*Reuter's Trade Service* (Washington).

Finland.—**TELEGRAPH SERVICE.**—A mixed Finnish and Russian Commission has reached an agreement with reference to telephone, telegraph, and temporary railway communication. The terms of the agreement, it is expected, will be published shortly.—*Reuter's Trade Service* (Helsingfors).

France.—**TELEGRAPHIC DELAY.**—A breakdown, caused by severe frost, on the French telegraph and telephone systems on November 30th, rendered communication between France and England very uncertain and slow for several days, says the *Daily Telegraph*. No communication at all was possible with Brussels.

Italy.—**WIRELESS TELEPHONY.**—At the Centocelle Aerodrome on December 2nd, in the presence of the Ministers of Marine and Posts and Telegraphs, members of Parliament, and civil and military authorities, a wireless telephone service was inaugurated with Sardinia. In spite of bad atmospheric conditions conversations between Tempio Pausania and Rome were very clearly heard.—*Reuter's Trade Service* (Rome).

Netherlands.—**DIRECT TELEGRAPHIC COMMUNICATION WITH ENGLAND.**—The Director of the Telegraphic Services at Amsterdam announces in the *Board of Trade Journal* that direct telegraphic communication has been established between the Central Telegraph Office in London and Amsterdam. The opportunity of sending telegrams by means of this line is offered on every working day between 12.20 p.m. and 4 p.m., and on Saturday between 10 a.m. and 1 p.m.

Telephone Service.—PUBLIC CALL BOXES.—During the past 12 months there has been a very considerable increase in the use of the Post Office public telephone boxes which are a feature of the Underground railway stations. It is estimated that nearly twice the number of people are now making use of these slot machines. The Underground Co. is co-operating with the Post Office to give facilities by arranging batteries of call boxes with a special attendant in charge. For the average private user, who only requires the telephone occasionally, this convenience is evidently one which is appreciated.

PROPOSED AUTOMATIC EQUIPMENT AT YORK.—Mr. A. Bell, postmaster, has intimated to the Estates Committee of the Corporation that he is making every effort to secure the installation of the automatic telephone system at York. The lease of the present manual exchange in Parliament Street, belonging to the York Corporation, expires on June 1st next, but the Post Office has asked for permission to continue as yearly tenants pending a settlement of negotiations as to the use of the automatic system or otherwise. The Estates Committee has agreed, subject to a revision of rent on the expiry of the present lease.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Australia.—MELBOURNE.—January 25th. Victorian Government Railways. Ten coasting recorders or, alternatively, 10 coasting and service recorders for the trains (cont. 34,766).

February 1st. Four motor-driven grinding machines, with accessories.*

February 15th. Postmaster-General's Department. Telephone apparatus and parts (Schedule 544). (See this issue.)

Blackpool.—December 23rd. Electricity Committee. One 5,000-kW, 3-phase turbo-alternator, surface-condensing plant with auxiliaries; one 2,000-kW, phase and frequency changer, complete with exciter and starting motor. (See this issue.)

Bolton.—For electric lighting at Cable Street Wesleyan Sunday School. Particulars from James Baxter, secretary.

Bradford.—December 24th. Electricity Department. Rotary converting plant (Cont. R.207). (See this issue.)

Dublin.—December 12th. Dublin Union Tramways Co. (1896), Ltd. General stores, including electric supplies, for six months. (November 25th.)

Edinburgh.—Tramways Department. 53 trucks and electrical equipment of cars. Manager, 2, St. James's Square, Edinburgh.

December 19th. Electricity Supply Dept. Insulated cable for five months. (See this issue.)

Egypt.—ALEXANDRIA.—December 21st. Port and Light-house Administration. Stores, including electric lamps, for six months.*

Glasgow.—December 13th. Education Authority. Electric lighting of schools. J. Clark, Director of Education.

Lanark.—District of the Middle Ward. Electrician's, &c., work in connection with the new workshops at Hairmyres Sanatorium and Colony. Mr. P. C. Smith, Housing Department, District Offices, Hamilton.

London.—H.M. Office of Works. December 14th. Electrical and mechanical engineering labour-in-daywork in connection with the maintenance, &c., of installations in the Glasgow and Edinburgh districts during a period of three years from January 1st, 1922. Contracts Branch, H.M. Office of Works, London, S.W.1.

SHOREDITCH.—January 3rd. Electricity Supply Department. One water-tube boiler of 33,000 lb. evaporative capacity. (See this issue.)

Manchester.—December 14th. Supply, &c., of two electrically-driven capstans and three dummy capstans at Bradford Road gasworks. Specification, &c., from Mr. G. W. Kaye, secretary, Gas Department, Town Hall, Manchester.

December 13th. Tramways Committee. Motors and controllers. J. M. McElroy, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

New Zealand.—WELLINGTON.—March 6th. Public Works Tender Board. Waikato power scheme. Two 2,500-kVA alternators, two 3,100-h.p. water turbines, two exciter sets.*

January 17th. Post and Telegraph Department. 25,000 dry cells for telephone work.*

South Africa.—JOHANNESBURG.—January 4th. Municipal Council. Two 2,000-kW converters, with switchgear and spurs.*

Uruguay.—MONTE VIDEO.—December 30th. State Electricity Department. Power station plant: one 4-stroke Diesel engine, coupled to a 200-kW, 3-phase alternator, and one 4-stroke Diesel engine, coupled to a 300-kW, d.c. generator.*

*A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—Nineteen firms last week submitted tenders to the municipal authorities of Ghent for six static transformers for the local electricity supply station. The tenders ranged from 51,160 to 83,035 fr., the lowest being that of the Société Electrique de Nancy. The quotation of the Metropolitan-Vickers Co. was 73,440 fr.

Canada.—According to the *Montreal Star*, the Hydro-Electric Power Commission of Ontario has just concluded a contract with the English Electric Co. of Canada, Ltd., for traction equipment for the new Hydro-Radial cars at Windsor and Guelph. This is the first large order for traction equipment placed by the Commission; it will be manufactured at the St. Catharines plant of the English Electric Co. The equipment ordered is similar to that recently purchased from the English Electric Co. by the Toronto Transportation Commission and now in use on its new cars.

Russia.—The British Mannesmann Tube Co., which recently received an order for 15,000 telephone poles for the Dutch East Indies in face of the keenest German competition, has just obtained a large order for boiler tubes for the All-Russian Co-operative Society. They are to be shipped to Archangel. This order is the first from Russia received locally for many years.—*Financial Times*.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, December 30th. At the Royal United Service Institution, Whitehall. At 7.30 p.m. Presidential address by Mr. C. H. Worthingham.

Friday, December 16th. At the Caxton Hall, S.W. At 7.30 p.m. Extraordinary general meeting. At 8 p.m. Paper on "Notes on Searchlight Construction and Operation," by Mr. A. J. Simpson.

Physical Society of London.—Friday, December 9th. At the Imperial College of Science, S. Kensington. At 5 p.m. Ordinary scientific meeting.

Birmingham & District Electric Club.—Saturday, December 10th. At the Grand Hotel, Colmore Row. At 7 p.m. Annual meeting.

Electrical Power Engineers' Association (Southern Division).—Monday, December 12th. At the Engineers' Club, Coventry Street, W. At 7 p.m. Adjourned discussion on "Notes on Boiler-House Plant."

Illuminating Engineering Society.—Tuesday, December 13th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Discussion on "Progress in Gas Lighting in Relation to Illuminating Engineering," to be opened by Mr. W. J. Sandeman.

Institution of Civil Engineers.—Tuesday, December 13th. At the Institution, Great George Street, S.W. At 6 p.m. Papers on "Deep-water Quays: General Considerations of Design," by Mr. E. Latham, and on the "Stability of Deep-water Quay-walls," by Mr. F. E. Wentworth-Shields.

Association of Mining Electrical Engineers (London Branch).—Tuesday, December 13th. At 40, Kingsway, W.C. At 6 p.m. Discussion on "Types of Cable Covering for Collieries; Bitumen, Paper and Lead and Vulcanised Rubber."

Liverpool Engineering Society.—Wednesday, December 14th. At the Royal Institution, Colquhoun Street. At 8 p.m. Paper on "Mechanical Cargo Handling," by Mr. G. Rae.

Nottingham Society of Engineers.—Wednesday, December 14th. At the Welbeck Hotel. At 8 p.m. Annual dinner.

Association of Engineers-in-Charge.—Wednesday, December 14th. At St. Bride's Institute, Bride Lane, E.C. At 7.30 p.m. Paper on "Combustion of Exhaust Gases from Internal Combustion Engines," by Major W. Gregson.

Institution of Electrical Engineers.—Thursday, December 15th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Induction-type Synchronous Motors," by Mr. L. H. Carr.

(East Midland Sub-Centre).—Tuesday, December 13th. At the Loughborough College at 6.45 p.m. Paper on "Whirling of Shafts." By Prof. C. H. Bulleid.

(Liverpool Sub-Centre).—Monday, December 12th. At the University, Liverpool. At 7 p.m. Paper, "Single- and Three-phase Commutator Motors, with Shunt and Series Characteristics," by Dr. S. P. Smith.

(Liverpool Sub-Centre).—Friday, December 9th. At 7 p.m. At the Ship Restaurant, 45, Charing Cross, S.W. Smoking concert.

(North-Eastern Centre).—Tuesday, December 13th. At the Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Paper on "The Co-Arc Process of Automatic Electric Welding," by Messrs. L. J. St. George and H. Martin.

(North Midland Centre).—Tuesday, December 13th. At the Hotel Metropole, Leeds. Ordinary meeting.

(North-Western Centre).—Tuesday, December 13th. At the Engineers' Club, Manchester. At 7 p.m. Informal meeting. Discussion on "Supply of Power Station Auxiliaries."

(Scottish Centre).—Tuesday, December 13th. At 207, Bath Street, Glasgow. At 7.30 p.m. Paper on "The Co-Arc Process of Automatic Electric Welding," by Mr. L. J. Steele and Mr. H. Martin.

Saturday, December 17th. At the Grosvenor Restaurant, Gordon Street, Glasgow. At 7 p.m. Smoking concert.

Manchester Wireless Society.—Thursday, December 15th. At the Albion Hotel, Piccadilly, Manchester. At 8 p.m. Paper on "Recording of Wireless Telegraphy," by Mr. R. Brooke.

Chemical Society.—Thursday, December 15th. At Burlington House, Piccadilly, W. At 8 p.m. Ordinary meeting.

Chelmsford Engineering Society.—Thursday, December 15th. At the East Anglian Institute of Agriculture. At 7 p.m. General discussion.

Belfast Association of Engineers.—Thursday, December 15th. At the Municipal College of Technology. Paper on "Roll and Roller Bearings," by Mr. A. W. Macaulay.

Institution of Mechanical Engineers.—Friday, December 16th. At the Institution, Storey's Gate, St. James's Park, S.W. At 6 p.m. Papers on "Conveying and Elevating Machinery," by Mr. G. Mitchell, and on "Discharge of Grain Consists in the Port of London by Pneumatic Elevators," by Mr. R. E. Knight.

Electro-Harmonic Society.—Friday, December 16th. At the Great Hall, Cannon Street Hotel. At 8 p.m. Smoking concert.













NOTES.

I.R. Service Department. The only inquiry that we have not been able to solve this week is the following: A correspondent seeks the name and address of the factors of the "Vulcan" series of iron, made in Buffalo, U.S.A.

Educational. On December 2nd the annual prize distribution of the Northampton Polytechnic took place. The Principal, Dr. Walmsley, spoke of the progress which was being made, mentioning that enrolments during the past year numbered over 3,800. Following the presentation of the prizes by Mr. A. Barton Kent, the students and members of the staff gave gymnastic and swimming exhibitions.

ROYAL TECHNICAL COLLEGE, GLASGOW. The recently published report on the 125th session records a further increase in the numbers of students in all classes; the number of enrolments during 1920-21 was 14,093. The accounts show an adverse balance of about £950. Full details of scholastic successes, appointments and resignations are given in the report.

The Influence of Transformer Connections on Third Harmonic Voltages and Currents.—With reference to the article under the above title, which was published in the *Electrician*,

CONSTANT B_{max}						
FLUX		INDUCED VOLTAGE		NO LOAD CURRENT		
WAVE SHAPE	FORM FACTOR COMPARED TO SINE WAVE	IRON LOSS COMPARED TO THAT WITH SINE WAVE	WAVE SHAPE	FORM FACTOR COMPARED TO SINE WAVE	WAVE SHAPE	FORM FACTOR COMPARED TO SINE WAVE
SINE. 	SAME	SAME	SINE. 	SAME	PEAKED THIRD HARMONIC IN OPPOSITION 	>
FLAT THIRD HARMONIC IN PHASE 	<	SAME	PEAKED THIRD HARMONIC IN OPPOSITION 	>	SINE. 	SAME
CONSTANT E_{eff}						
SINE. 	SAME	SAME	SINE. 	SAME	PEAKED THIRD HARMONIC IN OPPOSITION 	>
FLAT THIRD HARMONIC IN PHASE 	<	<	PEAKED THIRD HARMONIC IN OPPOSITION 	>	SINE. 	SAME

WAVE-SHAPE RELATIONSHIP BETWEEN FLUX, INDUCED VOLTAGES AND NO LOAD CURRENT

REVIEW of March 11th, 18th, and 25th, 1921, the author (Mr. S. Austen Stigant) informs us that some errors crept into Table I, p. 302, and that the accompanying table should be substituted for the original version. The chief correction is that with a constant effective voltage and a sine-wave of no-load current, the resultant peaked pressure wave produces a lower iron loss than does a sine-wave of pressure of the same effective value.

Appointments Vacant.—Switchboard attendant, for the Sandy Lane power station of the Coventry Corporation Electricity Department; watchkeeping engineer (59s. 6d.+39s. 1d.) for H.M. Dockyard, Portsmouth. (See our advertisement pages to-day.)

The Electro-Harmonic Society.—The next smoking concert will be held in The Great Hall, Cannon Street Hotel, on Friday, December 16th, 1921, commencing at 8 p.m. Sir James Devonshire, K.B.E., will occupy the chair, and the artists will be:—Miss Winifred Kennard, soprano; Mr. Barrington Hooper, tenor; Mr. Harry Dearth, baritone; Mr. Bernard Turner, humour with saxophone; Mr. W. V. Robinson, Canadian entertainer; Mr. Wilson James and Mr. Harry Dawson, entertainers; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

Disabled Ex-Service Men.—The Ministry of Labour has issued an appeal to employers to enrol on the King's National Roll, in view of the decision that Government contracts should be given only to firms whose names are on that Roll. Invitations to firms already enrolled to renew their undertakings will shortly be issued. Up to the present, the Roll embraces 29,000 names, covering some 365,000 disabled Ex-Service men; 25,000 men are in training under the Ministry's scheme, and there are 25,000 more on the waiting list. During the past 13 weeks "improver" vacancies have been found for 1,929 trained men.

The Cycle and Motor-Cycle Show.—This year the show was held at the Crystal Palace, and was housed in Olympia, it being the seventh of the series of annual exhibitions promoted by the British Cycle & Motor-Cycle Manufacturers' and Traders' Association. So far as electrical matters were concerned, attention was confined to the accessories section, where many makes of lighting and ignition equipments, &c.,

were on view. The stand of Messrs. C. A. Vandervell & Co., Ltd., was of interest to both motor-cyclists and manufacturers alike. The long awaited C.A.V. dynamo lighting set for motor-cycles was shown both on "solo" and "combination" machines.

The dynamo for these installations is only $\frac{3}{4}$ in. in diameter, but it is built on identical lines with the standard C.A.V. car-lighting models. The output is 5 amps. at about 1,000 r.p.m., an ample charging rate to cover all ordinary lighting requirements, which may include a dashlamp, spotlight, &c. The battery, a special "C.A.V.-Willard," has an actual capacity of 3 amps. for 10 hours. This should be registered at an official "C.A.V.-Willard" service station, as it is eligible for exactly the same free service benefits as its larger brothers are for car lighting and starting. Headlamps and special sidelamps were exhibited in various designs and sizes for different type of cycles. The solo motor-cyclist was not neglected and special batteries have been produced for this purpose.

The winner of the highest awards on road and track during 1921, Mr. Victor Horseman, on his Norton machines, invariably used C.A.V. magnetos, a testimony to their merits. The combined lighting and ignition system of the Villiers Engineering Co., Ltd., has been developed from its well-known and highly-efficient h.p. flywheel magneto.

The system is simple, and the magneto has no additional moving parts; the additions comprise a pair of coils and a terminal with suitable connection. The current given off is alternating, and the voltage is constant above 2 miles per hour. There is no risk of burning out the bulbs, provided those used are supplied by the makers.

The pair of lighting coils have no electrical connection with the ignition coil. They are connected in series with each other; the one end of the coil is earthed; the free end of the other is led to the lighting terminal and so to the lamps. An insulated terminal is fixed to the armature plate, and a quickly detachable fastening provided for the cable. A dry battery is used for lighting purposes when the machine is stationary, but immediately the engine is fired the rider has only to switch over on to the magneto to get a brilliant light, consequently the battery is only used occasionally, and will therefore last for a considerable period.

All Villiers motor-cycle engines are being equipped with magnetos suitable to take the lighting coils, and it is a very simple matter at any time to fit the coils, by unscrewing the pole shoes. The lamps are connected in series; the bulb used in the front lamp is of 4-volt, 3-ampere capacity, and the rear bulb 4-volt, 5-ampere capacity.

Every part of the magneto is easily accessible, and inspection of all parts may be made by simply removing the cover.

As its name implies, the magneto is built into and made part of the flywheel, and it is claimed that a quarter of a turn of the flywheel will generate enough current to spark the plug. Also that it is absolutely waterproof, and that with the ordinary type of magneto the angle of advance and retard is limited, and in the retard position the spark is very much weaker than in the advance, whereas in the Villiers magneto the same intensity of spark is obtained in all positions. The amount of space that can be devoted to the armature and winding is greater than in any other magneto, and makes provision for fitting a more efficient coil and contact breaker.

Another flywheel magneto set was exhibited on the stand of the British Thomson-Houston Co., Ltd., and a number of firms showed magnetos, lamps, accumulators, electric horns, &c., suitable for use on motor cycles.

Municipal Tramways Conference.—The Newcastle-on-Tyne Transport and Electricity Committee of the City Corporation has decided to invite the Municipal Tramways Association to hold its annual meeting in the city next September.

A Lecture on Artificial Heating.—NATIONAL ASSOCIATION OF SUPERHEATING ELECTRICIANS.—On Tuesday, December 13th, at St. Bride's Institute, E.C.4, Mr. J. W. Beauchamp, M.I.E.E., will read a paper entitled "Artificial Heating in Relation to Human Needs." Major T. Vincent Smith, M.C., M.I.E.E., President of the Association, will take the chair at 6.45 p.m. The paper will deal with:

1. The influence of temperature upon health and work.
2. The relative values of radiant and convective heat transmission.
3. Quantitative ideas on artificial heat.
4. Waste of heat energy.
5. Electricity as a heating medium and its relation to other means of providing artificial heat.
6. Influence of modern methods of heating upon the design and cost of buildings and their upkeep.
7. Modern forms of electric heating, heat storage, efficiencies and costs.

INSTITUTION NOTES.

Institution of Electrical Engineers.—EXAMINATION RESULTS. —The list of successful candidates who sat for the A.M.I.E.E. examination in October, 1921, shows that eight passed the whole examination and two passed Part II only. In addition, 37 officers of the Royal Engineers passed the whole and 18 Part II only of the examination. The results relating to candidates who sat for the examination abroad are to be published later.

LONDON STUDENTS' SECTION.—On November 11th the opening address of the session was delivered by Sir Philip Dawson, M.P., who took as his subject "The Future of Railway Electrification." He said that one of the main advantages of electric traction over steam traction was the very smooth torque obtained, which resulted in a greater drawbar pull. This was of the order of 25 per cent. of the deadweight, whereas that of steam was only about 16 per cent. Sir Philip outlined the recommendations of the Electrification of Railways Advisory Committee. The sole criterion of the practicability of an electrification scheme was its financial soundness. The speaker gave some figures in comparison of d.c. and a.c. traction. He thought that a.c. struck the "happy medium" in operating costs while having a substantially lower initial cost. Statistics of the working of the electrified portion of the L.B. & S.C. Railway demonstrated the increased traffic capacity brought about by electrification.

EAST MIDLAND SUB-CENTRE.—Mr. C. H. Bulleid will read a paper on "Whirling of Shafts, with special reference to Turbine and Dynamo Shafts," on December 13th at Loughborough. The paper will be illustrated by lantern slides and a demonstration of models will be given.

WESTERN CENTRE.—A meeting of the Centre took place on December 5th at the Merchant Venturers' Technical College, Bristol, when the chairman (Mr. A. C. McWhirter) presided over a large muster of members and visitors. The event of the evening was the paper on the "Cyc-Arc" Process of Automatic Welding, which is abstracted elsewhere in this issue. One of the authors (Mr. Martin) received his technical education at the Merchant Venturers' Technical College, of which he is an associate. The paper was illustrated by interesting lantern slides, and prior to the discussion Mr. Martin carried out practical demonstrations of the process. The discussion will be reported in a later issue.

SOUTH MIDLAND TERRITORIAL CENTRE.—On Friday last the annual dinner of the Centre was held at the Grand Hotel, Birmingham; Mr. R. A. Chattock, chairman of the Centre, presided, and there were present about 170 members and guests, including the Lord Mayor of Birmingham (Ald. D. Davis), Councillor H. K. Beale, chairman of Electric Supply Committee, Dr. G. Kapp, Dr. A. H. Railing, Dr. W. E. Sumpner, Mr. J. S. Highfield (president I.E.E.), Prof. W. Cramp, Ald. W. Walker, Dr. C. C. Garrard, Major A. M. Taylor, Mr. F. Forrest, Mr. E. C. R. Marks, Mr. A. C. Wynne, Mr. T. P. Wilmshurst, Mr. A. W. Willett, and Mr. E. B. A. Ellis.

After the loyal toast, Mr. Chattock proposed "The Institution of Electrical Engineers," drawing attention to the facts that this was the jubilee year of the Institution, and that the Institution had obtained a Royal Charter. Reviewing the history of the Institution, he said he did not see how it was possible for it to have nothing to do with trade; all its efforts were directed to fostering the trade and industry on which this country exists. The Institution did much to develop the brains of the electrical industry, and the Territorial Centres enabled the papers and discussions to be brought before an enormous number of members, whilst the research work promoted by the Institution was of great value to the industry. He looked forward to the time when membership of the Institution would be an indispensable qualification for an engineering post.

The President, Mr. J. S. Highfield, responded, explaining the excellence of the constitution with its world-wide Territorial Centres, and the value of the Royal Charter, which was in effect a mandate from the State to the Institution to carry on its work. He urged that the base of the Institution should be widened by bringing in men such as Lord Southborough, its new honorary member. Care must be taken to ensure that a high standard of qualification for membership was maintained; the examination test alone was too academic, and a certain amount of practical work should be called for. After eulogising the excellent work done by the retiring hon. secretary, Mr. J. D. Morgan, he dealt with the proposal put forward by Sir Henry Strakosch and Sir Peter Rylands, that Germany should erect super-stations and electrify railways in this country, pointing out that the effect of it on the British electrical industry would be disastrous. The Institution was keeping its eyes open to the danger.

Ald. W. Walker proposed "The City of Birmingham and Electricity Supply," commenting on the engineering achievements of the City. He paid a high tribute to the merits of Prof. Cramp, whose removal to Birmingham was a great loss to Manchester, and expressed the confident opinion that trade had taken a turn for the better. The Lord Mayor,

responding to the toast, said that the great abilities of Prof. Cramp were fully appreciated in Birmingham. The City had made great efforts to produce munitions during the war, and was now paying the penalty in the form of more unemployment than other cities experienced. Mr. Chattock in 15 years had transformed the City's electricity supply, and held in the highest esteem by the citizens.

Councillor Beale also responded, referring to the difficulties Birmingham had met with in its endeavours to cope with the demand for electrical energy. He deprecated the outlay of large amounts of capital on new power stations before they knew there was a market for the output.

Prof. W. Cramp, proposing "Kindred Societies and Guests," acknowledged the kind welcome that he had received as a newcomer to the City, and expressed the view that the engineering societies should draw together in one great body of engineers, of which they could all be members. To this end he suggested that the presidents of the institutions should be persuaded to meet and discuss the proposal. If they did not join hands now, in 10 or 20 years they might be in bitter competition.

Mr. E. C. R. Marks responded in a humorous speech, attributing the formation of the Institution of Mechanical Engineers to the rejection by the Institution of Civil Engineers of George Stephenson's application for membership. He was not sure that Dr. Cramp was right in wishing to bring them all together.

A programme of music accompanied the dinner, and afterwards a conversation and concert took place.

SCOTTISH CENTRE.—The Centre has issued to its members a small handbook containing a great amount of information. This embodies the annual report for session 1920-21; a full list of officers and past-chairmen; annual reports of the Dundee Sub-Centre and the Students' Section; programmes for the present session; extracts from the Institution's Articles of Association; and a list of members of the Centre.

On Saturday, December 17th, a smoking concert will be held at the Grosvenor Restaurant, Gordon Street, Glasgow, at 7 p.m. Tickets (2s. each) are obtainable from Mr. W. L. Winning, 166, St. Vincent Street, Mr. Neil McKillop, Corporation Electricity Department, 75, Waterloo Street, or from members of the committee.

Chelmsford Engineering Society.—On November 24th a paper was read before the society on "Gas Producers for Power and Heating Purposes," by Mr. N. E. Rambush, Chief Engineer of the Power-Gas Corporation, Ltd. The President (Mr. G. F. Barrett, O.B.E.), was in the chair, and a hundred members were present. Mr. Rambush first dealt with the various methods of producing gas: (1) Town gas supplies, where only 25 per cent. of the fuel was turned into gas. (2) (a) Complete decomposition of fuel by the air gasification process; and (b) complete decomposition of the fuel by a mixture of air and steam.

A large number of diagrams of various types of generators was shown, and each was fully explained.

The speaker said that the thermal efficiency of various methods of producing gas was roughly as follows: Producer gas from bituminous coal, 72 per cent.; producer gas from anthracite coal, 80 per cent.; town gas using the coke in a producer, 66 per cent.; blue water gas plant, 45 per cent.

Mining Institute of Scotland.—Over 80 members of the Institute recently visited the works of Messrs. Anderson, Boyes & Co., Ltd., Motherwell, and inspected the manufacture of coal-cutting machines and mining switch-gear, in which the firm specialises. The visitors also witnessed experiments relative to the presence of gas in mines and the safety of electrical plant.

Edinburgh Electrical Society.—On November 23rd Mr. A. S. Black delivered a lecture on "The Manufacture of the Modern Electric Lamp." The subject of illumination as it affected filament design was touched on, as also were the new chemical processes connected with gas-filled lamps. The lecturer described the methods of lamp manufacture in use at the Osram works, and illustrated his descriptions by lantern slides and samples.

Bradford Engineering Society.—Before the Bradford Engineering Society, last week, at the Technical College, Mr. A. A. Liardet (Thwaites Bros., Ltd., electrical engineers) lectured on "Radio-Telegraphy." The chair was occupied by Mr. C. E. Allsop, sales manager to the Bradford Corporation Electricity Department, and president of the Association. Mr. Liardet, after dealing with the basic principles of radio-telegraphy, demonstrated both the production of waves by the oscillatory discharge of an induction coil and the later developments in production by rotary high-frequency generators, or by the use of a thermionic valve. During the evening signals were received from large stations in England, France, Germany, Central Europe, Moscow, and from shipping and coast stations. Speech and song were received from Mr. Denison, at Halifax, and heard by the whole audience, and a member of the committee of the Association, as an experiment, sneaked to the meeting from a house in another part of Bradford.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Mr. R. A. CHATTOCK, the City Electrical Engineer of Birmingham, who is now filling the chair of the South Midland Centre of the Institution of Electrical Engineers for the second time, he having been chairman of the section in 1906-7, has served as a member of the Council of the Institution for six years, and has been a vice-president for three years. He occupied the position of President of the Incorporated Municipal Electrical Association at Birmingham in the year 1913-1914. As we stated last week, evidence of his popularity was given at the recent electrical engineers' ball, held in that city.

Mr. Chattock was born in 1865 at Hull, in Warwickshire, and educated at University College School, London, from which he passed in 1881 into the college, where he remained until 1884, going through the full engineering course under Professor Kennedy, and obtaining the senior Gilchrist engineering scholarship. After serving an apprenticeship as a mechanical engineer in the shops of Messrs. John Stewart and Son, in 1889, he took up a position of assistant engineer to the Metropolitan Electric Supply Co. at its several stations



Mr. R. A. CHATTOCK,

Chairman of the South Midland Centre of the Institution of Electrical Engineers, 1906-1907 and 1921-1922.

in Whitbush, Manchester Square, and Sandham Street, London, and in 1892, on erection of the company's new station in Amberley Road, Paddington, he became superintendent engineer at that station. In 1894 Mr. Chattock was appointed chief electrical engineer to the vestry of St. John, Hampstead, London, and in May, 1895, took up the position of superintendent engineer at the Bankside station of the City of London Electric Lighting Co., which position he retained for a period of five years. In March, 1900, he was appointed chief electrical engineer to the Bradford Corporation, and was responsible for large extensions in connection with the electricity department. He resigned this position in 1903 consequent upon his present appointment as City Electrical Engineer at Birmingham. During the time Mr. Chattock has been at Birmingham he has had entire charge of the development of the Corporation electric supply undertaking. This has comprised the design and erection of the large power station in Summer Lane and a number of sub-stations in the outlying districts of the city, which are supplied with three-phase current at a pressure of 5,000 volts, and in which the current is transformed by means of rotary converters into direct current for general distribution. The station has also been designed to give a supply of power to the whole of the tramways in the city. A supply of three-phase current at 5,000 volts pressure to large

power users has also been developed. The large generating station at Summer Lane, Birmingham, for the design of which Mr. Chattock was responsible, was completed in 1914, and is of the total capacity of 35,500 kW. Prior to the war Mr. Chattock was engaged upon the design of a large generating station, the ultimate capacity of which will be 105,000 kW, and a commencement was made on the building work early in 1914. During the war, however, the building of this station was stopped at the request of the Government. Subsequently, when there was a shortage of power in the district for making munitions, arrangements had to be made for rushing up a temporary station, close to the site of the proposed large station, having a capacity of 22,000 kW. This station was running in nine months from the date the building was commenced. In 1918 the Government sanctioned proceeding with the big station at Netchells, and work has been carried on, with the result that the first section is now practically complete, and it is expected to be running in January, 1922. During the 18 years that Mr. Chattock has been connected with the Birmingham Corporation the load has increased from 3,545 kW to 67,100 kW, the revenue has increased from £67,278 to £1,293,521, and the units sold from 3,737,419 to 136,921,417.

Ald. Geo. NEW has been re-elected chairman and Ald. Wm. WALKER vice-chairman of the Sunderland Corporation Tramways Committee.

Mr. H. D. DAVIES, the manager of the Heywood Corporation Electricity and Tramways Department, who was appointed assistant general manager of the Chesterfield Corporation Electricity Tramways and Motor Bus Department, has decided to stay at Heywood, where the authorities have agreed to increase his salary by £50 per annum and also to allow him 5 per cent. commission on the net profits of the Electricity Department.

Mr. LINCOLN CHANDLER has resigned his position as managing director of the Metropolitan Carriage, Wagon and Finance Co., Ltd., and his seat on the directorate.

Mr. G. J. CHURCHWARD, C.B.E., the chief mechanical engineer of the Great Western Railway, will retire at the end of the year. The directors have appointed Mr. C. B. Collett, O.B.E., the deputy chief mechanical engineer, to succeed him.

It is stated that Mr. JAMES MILNE, B.Sc., A.M.I.C.E., has been appointed an assistant to the general manager of the G.W.R. He relinquishes the post of head of the Statistical Department of the Ministry of Transport.

Mr. W. BROWN, A.M.Inst.C.E., A.M.I.E.E., late resident engineer of the North Metropolitan Electric Power Supply Co., at Barnet, has been appointed H.M. Electrical Inspector of Factories, with headquarters in Leeds. Captain R. M. Moberley left St. Albans on November 1st to succeed Mr. Brown as resident engineer.

SIR T. O. and LADY CALLENDER have left West Heath House, Abbey Wood, and their address now is Bidborough Court, Kent, near Tunbridge Wells.

Mr. H. C. SOULE, who for some time past has been manager of the apparatus department of the Westinghouse Electric International Co., with headquarters at East Pittsburgh, sailed from New York, on November 19th, for Buenos Aires, Argentina, where he will take up duties in the office of Mr. L. T. Peck, managing director of the Cia. Westinghouse Electric Internacional, S.A., of Argentina.

Mr. HORACE BOOT, consulting engineer, is standing as an independent Conservative candidate for the forthcoming by-election at South-East Southwark.

Mr. J. LEADBEATER has been appointed electrical engineer and manager of the Hampstead electricity supply undertaking in place of Mr. W. Wyld, who recently resigned. For some time Mr. Leadbeater has occupied the position of chief assistant engineer.

Mr. W. A. TOPPIN, on leaving the Chesterfield Corporation, was presented with a roll-top desk by the employees of the electricity, tramway and bus departments. His new address is Toppin & Knowles, Ltd., electrical engineers, 202, Manningham Lane, Bradford.

Obituary.—Mr. F. HUTH JACKSON.—The death has occurred at the age of 58 years of the Rt. Hon. Frederick Huth Jackson, a director of the Bank of England, a former president of the Institute of Bankers, and president of the National Association of Employers and Employed. He was also a director of the Eastern Telegraph Co., Ltd., and of the British Trade Corporation.

Mr. B. MOUNTAIN.—We regret to announce that Mr. Montague Brown Mountain, M.I.E.E., consulting engineer, of 66, Victoria Street, London, S.W., passed away suddenly last week from pneumonia at his residence, Home Glen, St. Margarets-on-Thames. He was fifty-eight years of age. Mr. Mountain had been for many years connected with electrical and mechanical engineers. He was the son of the late Charles George Mountain, of Messrs. May & Mountain, of Birmingham, and served his apprenticeship with that firm. In about the year 1890 the deceased gentleman opened a Glasgow office for the General Electric Co., Ltd., and later became the Glasgow agent to Messrs. Ernest Scott & Mountain, and joined this firm as works manager at a later date. Mr. Mountain was a brother of Mr. W. C. Mountain, of Newcastle-on-Tyne. He was works manager to Messrs. Crompton and Co., of Chelmsford, for some years, and left that firm to join the British Westinghouse Co. in the building of their

works in Manchester, and afterwards he was engaged with the firm in connection with tramway work. Later on he established the firm of Mountain & Gibson, of Bury, and manufactured a considerable quantity of tramway material. During the war he was engaged upon the manufacture of aeroplane parts, and later joined the Ministry of Munitions. At the termination of the war he joined Messrs. The Roneo, Ltd., and was engaged largely upon the supply of Wilson's roller shutters, and other specialities.

Will.—The late Sir SAMUEL DAVIDSON (Davidson & Co., Belfast), left £185,818.

NEW COMPANIES REGISTERED.

Hitchcock's Magnetic Engine Co., Ltd. (178,055).—Private company. Registered November 26th. Capital, £250 in £1 shares. To acquire interests in certain existing inventions and patent rights relating to magnetic engines. The subscribers (each with one share) are: S. L. Hitchcock, 28, Fox Hill, Upper Norwood, S.E.15, engineer; E. K. Ramsden, Hampden Club, N.W.1, director of a company. The first directors are not named. Registered office: 32, Fenchurch Street, E.C.

Spensers (Scotland), Ltd. (11,952).—Private company. Registered in Edinburgh November 26th. Capital, £9,000 in £1 shares (3,000 10 per cent. preference). To enter into an agreement between A. H. F. Hodgson and the Receiver and Manager of the estate of Spensers, Ltd., and to carry on business as manufacturers of and dealers in electric and gas plant, machinery, motors, apparatus, and appliances of every description. The first directors are: A. H. F. Hodgson, 119, George Street, Edinburgh, lighting engineer; H. Plucknett, 119, George Street, Edinburgh, electrical engineer. Registered office: 119, George Street, Edinburgh.

Electric Line Fittings, Ltd. (178,097).—Private company. Registered November 26th. Capital, £1,000 in £1 shares. To carry on business as indicated by the title and that of manufacturers and producers of and dealers in machinery, plant, articles and appliances, &c. The first directors are: H. W. Burnett, Glenhorne, Doncaster, railway wagon manufacturer; T. Burnett, Windsor Road, Doncaster, railway wagon manufacturer. Qualification: 100 shares. Remuneration as fixed by the company. Secretary: H. W. Burnett. Registered office: Hexthorpe Wagon and Wheel Works, Hexthorpe, near Doncaster.

Premier Accumulator Co. (1921), Ltd. (178,158).—Private company. Registered December 1st. Capital, £40,000 in £1 shares. To carry on the business of accumulator manufacturers as formerly carried on by the Premier Accumulator Co., Ltd., at Northampton. The first directors are: H. Stephens, "Southwood," St. George's Avenue, Northampton; G. A. Schanschief, "North View," Marriott Street, Northampton; F. C. Vine, 45, Dungate, Northampton. Qualification: £100. Remuneration (except managing directors, if any) as fixed by the company. Solicitor: A. E. Phipps, 4, Wood Hill, Northampton.

H. Arrowsmith & Co., Ltd. (178,034).—Private company. Registered November 25th. Capital, £2,000 in £1 shares. To take over the business of manufacturers of electrical goods, switches, adaptors, magnetos and spare parts, and motor car and motor repairs and motor engineers carried on by Henry Arrowsmith and Harry Arrowsmith at Manchester as "H. Arrowsmith & Co." The permanent directors are: Henry Arrowsmith, 4, Romney Street, Moston, Manchester (chairman); Harry Arrowsmith, 28, Leighton Street, Moston, Manchester. Qualification: £100. Remuneration as fixed by the company. Secretary: Henry Arrowsmith. Registered office: 260a, Deansgate, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

North Wales Power & Traction Co., Ltd.—Particulars of £1,000,000 (including £250,000 already registered) authorised September 26th, 1921, and covered by trust deed dated July 29th, 1919, and November 2nd, 1921; present issue of £300,000 in addition to £200,000 outstanding, charged on benefit of prior deed of July, 1919, lands, hereditaments, and premises, referred to therein and benefit of agreement with the Aluminium Corporation, Ltd., for the supply of energy. Trustees: Unity Investment Trust, Ltd., and Lord Morris.

Fluxio Welding Co., Ltd.—Debenture dated November 8th, 1921, to secure £1,000. Charged on company's undertaking and property, present and future. Holder: J. Cheetham, "Newbold," Newton Drive, Blackpool.

Conner Magneto and Ignition, Ltd.—Debenture dated November 14th, 1921, to secure £160,000, charged on company's undertaking and property, present and future. Holders: General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.

Armature Repairing and Supply Co., Ltd.—Issue on November 1st of £2,000 and on November 21st, 1921, of £200 debentures, parts of a series already registered.

A.G.E. Electric Motors, Ltd.—Particulars of £18,000 debentures authorised November 14th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Electric Motors (South Wales), Ltd.—Satisfaction in full on October 6th, 1921, of mortgage or charge dated October 26th, 1920, securing £5,000.

Wilson Hartnell & Co., Ltd.—Satisfaction to the extent of £1,000 on November 9th, 1920, of debentures dated December 22nd, 1902, securing £2,500.

East Anglian Electricity, Ltd.—Satisfaction in full on November 10th, 1921, of debentures dated July 26th, 1916, securing £1,000.

Laminated Gears, Ltd.—Issue on November 22nd, 1921, of 2,000 debentures, part of a series already registered.

Bourne End and District Electricity Corporation, Ltd.—Issue on November 23rd, 1921, of £200 debentures, part of a series already registered.

CITY NOTES.

The India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.

At the annual meeting held at the Company's offices, 100, Cannon Street, E.C., on November 30th, Major LANCELOT DARWIN, who presided, said that as regarded trade generally the year had been a disastrous one, a disaster which, if repeated, would not only bring that firm to ruin, but would half ruin the whole country. The causes were, no doubt, well known to them all, but might be stated as follows, in the excellent words spoken by the Chairman of Lloyd's Bank to his shareholders in February last, for since that date there had been only a partial recovery. He said:—

"Rarely, if ever, has such a dramatic change occurred in so short a time as took place in trading conditions in this country in 1920. At the beginning of the year practically every trade was enjoying extremely active and prosperous conditions, manufacturers being unable to cope with the insistent demand for goods. Apparently price was no object provided goods could be obtained. This led to an orgy of speculation, when prices were forced up to an alarming figure. It soon became evident to all cautious observers that the position was becoming one of some danger. At the same time consumers, both at home and abroad, became unwilling, and in most cases, unable to pay the inflated prices demanded. The check thus given to inflation gradually became more pronounced, and in the autumn stocks began to be unloaded at greatly reduced figures. Then occurred the coal strike, which inflicted a heavy blow on the declining trade, and by the end of the year industry as a whole was suffering from extreme depression, with very great unemployment as a natural concomitant. It should be emphasised, however, that the root of the trouble is not over-production, but under-consumption. The necessary corollary is that production must be further expanded, thereby enabling prices to be further reduced, and so stimulating consumption."

The accounts presented were for 11 months' trading to August 31st, 1921, instead of the usual period of one year ending on September 30th. This was to enable them more easily to meet the requirements of the Finance Act, 1921, which provided for the termination of Excess Profits Duty and for certain assessments, adjustments, and repayments necessary for that purpose. The total difference in the valuation of the commencing stock at prices ruling at September 30th, 1920, and at those ruling on August 31st, 1921, was £407,149, on which figure their rebate was calculated, and from that fact it would be seen that the loss on the 11 months' trading was due, very largely, to the diminished value of the commencing stocks. Over the period of seven years ended September 30th, 1920, during which Excess Profits Duty was enforced, they were assessed in a total sum of £435,603, of which only £32,567 now remained unpaid. As against this, and arising out of the re-valuation of their various stock, they were in a position to reclaim duty in a sum approximating to £224,000 gross, or to £156,752 after allowing for income tax thereon, a figure which had been taken to the credit at the profit and loss.

The turnover at Silvertown for the 11 months from October 1st, 1920, to August 31st, 1921, was only 50 per cent. of that of the preceding year, this reduction being due to the general slackness of trade, which reduced both the quantity of deliveries and the prices obtainable. The only shop showing an increased turnover was the golf ball shop, where the turnover for the 11 months was 45 per cent. greater than for the 12 preceding months. The rubber department shops, the telegraph shops, the instrument shops, and the battery department, had turnovers which were more than half as much as in the preceding year, whilst in all other manufacturing shops the turnover was less than half. The shop which most reflected the results of the year was the tire department, where the turnover was rather less than 25 per cent. of that of the preceding year. This great decrease in the sale of tires was very largely traceable to conditions common to all British tire manufacturers. Work generally was seriously interfered with by strikes which occurred in other trades. The difficulties of obtaining fuel necessitated the entire closing of the factory for 3½ weeks, the working of half-time practically throughout the whole period of the coal strike, and short time working even after the end of the strike. Moreover, they were only able to keep the factory running under these conditions by going to the expense of fitting up half their boilers to burn oil fuel.

The market value of their raw and partly-manufactured material, which was in stock at the end of September, 1920, fell rapidly during the following five months to about two-thirds of its September value, with the result that sales of finished goods could only be effected by writing down very materially the cost of the bought-in materials. They had been free from any disputes with their own workpeople, and had been able to arrange for reduction in the bonuses given during the war period. The French trade prospects had been improving steadily, and they had already had to increase their output at Persan. To sum up the cause of their losses, they were ultimately traceable to unsettled markets, foreign dumping, reduction of working hours, high rate of pay, low standards of work, increased overhead charges, external strikes, and heavy taxation, with a consequent decrease in

production. On one supposition, and one supposition only, he emphatically repeated his impression at the previous meeting of the most complete confidence in the ultimate future of the company. This supposition was that the whole of their team would not be "stuck hard," but would pull well together. The team included in any way concerned with the company, office staff, draughtsmen, mechanics, fittermen, stait, directors, and also the shareholders. Before the country could regain a healthy economic position the whole country must face in that spirit the hard times through which we were going to pass.

Sir C. H. GRAY seconded the motion, which was carried unanimously.

The Eastern Extension, Australia & China Telegraph Co., Ltd.

Sir John Demson-Pender, G.B.E., (Chairman), presided at the annual general meeting, held in London on November 30th. He said that the enforced postponement of the meeting had not prevented the distribution of the final dividend of 10 per cent., free of tax, as the directors considered it justifiable from the estimates placed before them. The revenue, compared with 1913, had risen by over 300 per cent., and, in view of the prevailing commercial depression, the financial result was not unsatisfactory. It had not been found necessary to provide any further sum for depreciation of reserve fund investments, owing to previous provision, which covered this depreciation. The principal items of increased expenditure were due to revised staff salaries and special allowances, and the heavy cost of cable maintenance. Referring to the balance sheet, the Chairman said that the new capital, which was practically all taken up by shareholders, had been added to the Capital Account, and the account had been debited with £559,824 as part payment for the new Madras-Singapore cable, and for the acquisition of land and staff buildings at many of the company's stations. At the last meeting reference had been made to delays in transmitting the Far Eastern and other traffic, and the hope was expressed that cable repairs and renewals would in a short time bring the system up to the pre-war efficiency in working. Owing to numerous adverse circumstances this had proved difficult of accomplishment, but progress was being made, and it was hoped that shortly the public would have a faster service, even in times of serious interruptions, in the main line sections. The motion for the adoption of the report and accounts was seconded by Sir A. J. Leppoc Cappel, K.C.I.E., and carried.

Col. BURR asked whether recent developments in wireless telegraphy, such as the construction of a station for direct communication between this country and Australia, and the development of thermionic valves for telephony, would adversely affect cable companies. In reply the Chairman said that, although he would make no prophecy regarding wireless communication, he would point out that Germany, who was supposed to be "well up" in wireless, contemplated entering into an agreement with the big Atlantic companies for direct communication with the United States. Italy also was making endeavours to arrange direct cable communication with South America, and he thought that this pointed to the fact that the days of cables were not yet over. If wireless communication was more efficient it would cut them out, but there remained a lot of work to be done first.

Telephone Manufacturing Co. (1920), Ltd.

At the annual meeting, held on November 29th, the managing director said that the company was now a complete organisation, owning 13 subsidiary installation companies in this country, and controlling three abroad. The business of each installation company was to secure orders to install and maintain private installations in its allotted area. The system had become so popular that there were nearly 7,000 subscribers, paying at the present time an annual rental of £95,335, and their contracts provided for a total rental of no less than £948,868. Trade depression could have no effect upon the stability of those 7,000 agreements. All were binding, and could not be cancelled.

The installations themselves remained the property of the installation company, so that, in addition to the rental, they had the value of the installations themselves. A firm or company did not, as a rule, become a subscriber until it had enough orders or large enough works to justify an interconnection telephone system, so that the £948,868 becoming due to them was many thousands of substantial houses as good security as it was possible to imagine. It had always been the practice to depreciate the value of all installations at the rate of 10 per cent. of the original cost per annum, and they had many installations still bearing revenue which stood at nothing. But as the installation companies did not sell the installations, the depreciation was locked up. For that reason they proposed immediately to issue loan capital against those secured rentals. An issue was being made on their behalf of £1,000,000, which would enable a 5 per cent. cumulative income to be paid for the next 14 years.

The profit and loss account for the period of 19 months, showed a net profit, including the proceeds from installation companies, of £1,000,000. Of this £1,000,000 was earned prior to the date of incorporation of the company, and being capitalised, and formed a very useful asset in addition to the reserves of the company. They proposed to appropriate £124,151 to carrying down the balance to the next year, £25,436 remaining available, to pay a dividend of 2 per cent. share less tax, leaving £24,796 to

be carried forward, subject to taxation. These results were only from eight installation companies, as five established recently had not completed their first financial year.

German Companies.

The accounts of the *Elektrowerke A.G.*, of Berlin, have been issued for the year ended March 31st, 1921. The company owns lignite mines and power stations in the Bitterfeld district for meeting the requirements chiefly of nitrogen works, and the whole of its share capital of 250,000,000 marks is held by the Commonwealth (Reich). The gross profits amount to 6,090,000 marks, of which 2,770,000 marks has been applied to depreciation and 1,350,000 marks placed to the renewal fund. The net profits are 850,000 marks.

The *Berlin Elektrizitäts Werke, A.G.*, now practically an investment company, reports net profits of 13,809,000 marks for 1920-21, as contrasted with 5,781,000 marks in the previous year, and the dividend rises from 10 per cent. in 1919-20 to 18 per cent. last year. In conjunction with the A.E.G., the directors state that the company has acquired most of the shares in the *Mix & Genest Telephone Co.*, whose business would complement that of the A.E.G. It is now proposed to increase the share capital by 39,400,000 marks to 118,500,000 marks, and to alter the name of the company to that of a bank for electrical services.

The report of *Max Schorch & Co. Electrotechnical Works*, of Rheidt, states that the orders received in 1920-21 did not suffice for the full utilisation of the works, and a strike of nearly three months exercised an unfavourable influence on the results. Including the balance forward, the net profits amount to 1,596,000 marks, comparing with 1,577,000 marks in 1919-20. It is proposed to pay a dividend at the rate of 10 per cent., as in the preceding year, and to increase the share capital by 4,500,000 to 19,000,000 marks. The directors state that an improvement in business has taken place recently.

The *Telephonfabrik A.G.*, late *J. Berliner*, of Hanover, reports gross profits of 4,431,000 marks for 1920-21, as compared with 1,497,000 marks in the previous year. After setting aside 275,000 marks for depreciation, as against 139,000 marks, the net profits and balance forward are returned at 4,331,000 marks, as contrasted with 1,535,000 marks in 1919-20. The rate of dividend has been increased from 15 per cent. to 20 per cent., and it has been decided to raise the share capital from 20,000,000 to 40,000,000 marks. It is stated that all departments are well stocked with orders.

Allgemeine Elektrizitäts Gesellschaft.

The report of the directors of the *Allgemeine Elektrizitäts Gesellschaft* for the year 1920-21, states that the situation of trade became less favourable in the final quarter. Since then, however, the demand had again revived, more so than in other countries, as the industries, which were very actively occupied, were extending and complementing their power installations, the electrification of agriculture was progressing, and work was proceeding for the extension and amalgamation of the largest electricity works. The community of interests with the *Felten & Guillaume Co.* had stood the test, and the manufacturing agreement with the *Osram Co.* had also hitherto corresponded to expectations. As to the new relations established during the year, the report mentions those entered into with the *Linke-Hofmann Locomotive Works*, the *Rhenish Metalware and Machinery Works*, and the porcelain works of *Ph. Rosenthal & Co.*, of Selb. The share capital of the A.E.G. was increased by 300,000,000 to 850,000,000 marks, of which 350,000,000 represents ordinary shares, and the premium of 94,100,000 marks realised on the capital issue in May increased the reserve fund to 168.67 millions of marks.

The report proceeds to state that most of the workshops were well occupied during the year. Generators for an output of up to 20,000 kW were constructed for various hydro-electric works. The removal of the transformer factory to the large shops at *Oberschonweide* was completed so that the company was now able to cope with the large demand; and transformers of up to 80,000 kW had been delivered in large numbers. The degree of activity at the *Oberspre* cable works was smaller than usual in the spring; the department for light and power cables had been well occupied and the telephone cable branch had been abundantly supplied with orders. It had been possible for the locomotive works materially to increase its turnover, and adequate orders were still on hand for home and foreign account. A further satisfactory development had taken place at the electric steel works and rolling mills at *Henningsdorf*, and in order to place the works on a wider basis it had been transferred to a separate company, with the co-operation of the *Linke-Hofmann Co.*, and the *Lauchhammer Iron & Steel Co.*

The technical departments for the execution of individual installations were abundantly occupied for the heavy iron and steel industry; and foreign iron and steel producers placed orders for complete electrical installations for iron and steel works. A not inconsiderable number of orders was received for large generators for hydro-electric works. The company possessed valuable patents for earth connection coils, according to Prof. Petersen, which had already come into extensive use; and the Plankuch cable protection system was enjoying increased popularity, so that the favourable experience with both systems had resulted in large repeat orders. The textile industry was pro-

ceeding to take advantage of the electric drive. Concerning the electricity supply industry, the report states that the orders received for large sets plainly showed the revival in the supply business. In the establishment of power stations the promoters availed themselves of the experience of the A.E.G., so that there was a growing desire to have the entire installations carried out by the company. As an instance, mention is made of the Provinciale Zeeuwseche Electriciteits Maatschappij, of Middelburg, Holland. A large number of orders for generators for hydroelectric works were booked, a further demand was experienced for rectifier installations, while many orders for transformers of large output were also received. The business in electric tramway plant had been very quiet, large orders having almost exclusively emanated from other countries. A benzol motor lorry was brought out in conjunction with the National Automobile Co. The electrification of ordinary railways was making but slow progress. A summary of the financial results for the past two years, and for 1916-17, is given below:—

	1916-17	1919-20	1920-21
	Marks.	Marks.	Marks.
Share capital	184,000,000	310,000,000	850,000,000
Gross profits	46,733,000	80,285,000	247,913,000
Depreciation	1,100,000	3,418,000	2,023,000
Net profits and balance forward	30,370,000	45,707,000	82,388,000
Dividend	23,000,000	28,000,000	50,000,000
“ per cent.	12½	14	16
Carried forward	1,180,000	807,000	1,505,000

The accounts further show that a total of 5,500,000 marks was allotted to the payment of bonuses, pension fund, and war benevolent fund in 1916-17, 16,000,000 marks in 1919-20, and 17,000,000 marks in 1920-21. The balance sheet records open reserves amounting to 288.67 millions of marks, the current accounts' account appears under the assets at 1,010,000,000 marks as compared with 438,010,000 marks in 1919-20, and of the former the company's own bank credit is given at 657,940,000 marks, as against 26,400,000 marks a year ago, the bank credit exceeding all the company's floating liabilities.

The Western Telegraph Co., Ltd.

The annual general meeting was held in London on November 30th. Sir John Denison-Pender, G.B.E., who presided, referred to the death of Lord Balfour of Bureleigh, who had been a director for 16 years. Turning to the accounts, he said that, although the balance of profit was not so large as in the previous year, it was satisfactory, having regard to adverse exchange conditions and slackness of trade. These last two circumstances were responsible for a decrease in revenue, partly offset by increases in other items, of £610,000. There was a reduction of £381,000 in the item of taxes and the E.P.D. having terminated so far as the company was concerned in July last, would not appear in the next accounts. The cable laid, in conjunction with the Western Union Cable Co., from Brazil to Barbadoes, was still lying idle in consequence of the refusal of the United States' Government to permit the landing of the cable in Florida. The company hoped that a decision would be arrived at shortly, as, in the meantime a valuable direct communication between South America and the United States was being held up, while the traffic was mainly passing over the lines of the company's competitors. The renewal of the older section between Lisbon and Madeira had been completed, and arrangements were in progress to carry out a similar renewal of the original Madeira-St. Vincent cable early next year. Upon the completion of this the cable steamer would commence laying a new cable between Pernambuco and Maranhão, other cables connecting Pernambuco with Macao, Victoria, and Rio de Janeiro, and a third cable between Rio de Janeiro and Santos, thus materially strengthening the coast connections. This work would entail an expenditure of £700,000, bringing the total cost of renewals and fresh lines since 1918 to £3,000,000. The fund for covering depreciations in the Reserve Fund Securities required no further assistance during the year, and the value of the securities could still be taken as £2,500,000. They could not hope for improvement in message revenue until the exchanges became settled, bringing a revival of international commerce and trade. The Earl of Middleton, K.P., seconded the motion for the adoption of the report and accounts, which was carried. The retiring directors were re-elected.

When the company met in October it Aluminium Cor. had not been possible to prepare the accounts and the meeting was adjourned until such time as they should be ready.

Mr. K. M. Clark, however, addressed the meeting, and said that they had succeeded in obtaining sufficient orders to keep the rolling mill working full time. The work upon the Cowlyd Dam had been continued, and they were now engaged in the removal of the plant and the completion of the pitching. They still required to construct the Leet connecting the Cowlyd Lake with the Llugwy Lake, and once this was done they would have a greatly improved water supply. Their relations with the North Wales Power and Traction Co. had been intensified during the past year, and they had assisted that company in its arrangements for the building of a considerable portion of its transmission system, for when this was brought into operation a large portion of

this company's energy would be sold to the North Wales Power & Traction Co. They believed they had made an arrangement with that company that would, to a considerable extent, place this corporation in a position of independence as regards the aluminium market, and ensure a more profitable use of the energy. The Electricity Commissioners held a very lengthy public inquiry at Llandudno in February, and issued a judgment announcing their intention to create the North Wales Power & Traction Co., the authorised distributors for electric energy in the North Wales and Chester electricity district. The application by the North Wales Power Co. was made in conjunction with this company, and the conjoint working of the two companies would have very satisfactory results.

Prospectus.—The Telephone Manufacturing Co. (1920), Ltd.—This company, whose business is referred to in the report elsewhere of the meeting held last week, has been inviting applications (until December 31st) for an issue of £300,000 guaranteed 8 per cent. cum. income bonds at 96 per cent. The issue is for the purpose of repaying advances from the bank and for the future development of the business.

The prospectus states that: "Amongst the many valuable patents and rights owned by the company may be mentioned . . . the Telephonone . . . an entirely new device for the automatic recording and giving of telephone messages." If this is really "an entirely new device" the choice of name is unfortunate, for the reason that Mr. Valdemar Poulsen, the well-known Danish engineer, exhibited at Paris in 1900 an appliance, for exactly the same purposes, which he called the "Telephonone." We described this apparatus fully in our issues of April 27th (p. 637) and October 12th (p. 573) of the year mentioned. It was stated in the latter reference: "The Telephonone is already in practical operation in several telephone stations in Denmark." This was over twenty years ago.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Stock Exchange Committee under Rule 148a:—

Midland Counties Electric Supply Co., £400,000 7½ per cent. mortgage debenture stock, issued at 96 per cent., partly and fully paid, after issue of allotment letters.

Anglo-Portuguese Telephone Co.—250,000 shares of £1 each, fully paid (Nos. 150,001 to 400,000).

Johnson & Phillips.—£350,000 8 per cent. first mortgage debenture stock.

Metropolitan District & London Electric Railways.—£142,400 Joint Power House 4 per cent. rent charge stock.

Newcastle-upon-Tyne Electric Supply Co.—The Financial Press states that a meeting of holders of second mortgage debenture stock is to be held on December 9th, to consider resolutions increasing the rate of interest from 5 to 6 per cent., and authorising an additional £1,500,000 of stock, making the total authorised amount £2,000,000. The directors propose to issue to the public shortly £750,000 additional stock in order to meet the requirements incurred in connection with extensions of the stations and the development of the business generally.

Claud Hamilton, Ltd.—According to the *Financial Times* the accounts show, after writing off depreciation, paying preference dividend, and transferring £6,210 to general reserve, a balance of £17,245 to be carried forward, subject to E.P.D. and Corporation tax. No dividend is recommended on the ordinary shares, but it is proposed to capitalise £3,000 of general reserve fund and distribute this amount among the ordinary shareholders as fully-paid bonus shares in proportion of one for every ten shares held.

New York Edison Co.—It is stated that the issue of \$30,000,000 New York Edison Co. first Lien and Refunding Mortgage 20-year 6½ per cent. bonds, offered to the public in New York at 104½, and interest, was immediately oversubscribed.

Chilian Electrical Fusion.—The *Financial Times* reports that the Chilian Electric Tramway Co. and the National Electric Power Co. have concluded negotiations for amalgamation. The capital of the new company will be £12,000,000, of which the major portion will be found in London.

Marconi International Marine Communication Co., Ltd.—Interim dividend of 5 per cent., less income tax.

Western Telegraph Co., Ltd.—First quarterly dividend 5s. per share free of tax, being at the rate of 10 per cent. per annum.

New Issues.—According to the Financial Press an issue will be made by the Llanelli and District Electric Lighting and Traction Co. of £125,000 7½ per cent. debenture stock at 94½, and one by the Reading Electric Supply Co., of £100,000 in 7½ per cent. debentures at 95.

Power Gas Corporation, Ltd.—After putting £4,000 to reserve, a dividend of 6 per cent. per annum less tax, is to be paid, carrying forward £11,594.

Brazilian Traction, Light & Power Co.—A quarterly dividend of 1½ per cent. on the cumulative preference shares is announced.

Pinchin Johnson & Co., Ltd.—Interim dividend of 5 per cent., less tax.

Manx Electric Railway Co.—Net receipts £18,982, plus £1,200 brought forward. The preference dividend is to be paid in respect of the year ended September, 1916, and £916 is to be carried forward.

United Wire Works, Ltd.—Dividend of 5 per cent. on the ordinary shares, £1,500 to general reserve, £1,281 carried forward.

Coventry Chain Co., Ltd.—A final dividend of 7 per cent., less tax, making 10 per cent. for the year on the ordinary shares, is announced.

Waygood Otis Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum on the ordinary shares.

STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE markets are certainly moving towards brighter conditions. There is more business doing than of late, and the approach of the Christmas holidays fails to exercise any check upon the activities of the bargain-hunter and of people who want to take advantage of the low levels of prices existing in most industrial companies' shares, for instance, where the prospect of the undertakings are reasonably well-assured for the future. Report after report shows losses as compared with a year ago. On every fall in shares, however, it is noticeable that buyers come forward to pick up anything that is going cheaply. The contention is that the current year for industrial concerns is likely to prove the worst, so far as the writing-down process is concerned, and the gradual improvements in various trade directions are held as evidence that the bottom of the slump has been reached, and that industry is now set towards a more cheerful prospect. The settlement arrived at in the early hours of Tuesday morning, between the Government and Sinn Fein, has relieved the Stock Exchange from the incubus which has pressed upon the markets for months. Removal of this blanket of fear made its effect felt immediately. Prices responded in all directions. Buying orders came in from quarters which hitherto had been retaining money on deposit at the banks, apprehensive of a fresh outbreak of civil strife in Ireland. A note of hesitation was heard as to Ulster's possible part in the proceedings, and the best prices were hardly maintained.

Electrical stocks and shares hardened with others, but, as a good many of the principal issues have been rising during the past two or three weeks, the effect in the markets with which we deal was less noticeable than in some other parts of the Stock Exchange. The cable group, indeed, is dullish, owing to the diminished profits shown by the Eastern group and referred to in last week's number of the ELECTRICAL REVIEW. Eastern ordinary is easier at 16½, while the share members of the group remain heavy at 16½. Anglo-American Telegraph deferred, however, has risen to 17½. Marconi enjoyed a sharp recovery, the price of the parent shares rising 3/16 to 11 1/16. The advance came on the top of the interim distribution of 5 per cent. on Marconi Marines which caused the price of the latter to jump sharply to 21s. 6d. Radio Corporation shares are being tipped as a speculative look-up to those who have money to spare for such a purpose. The ordinary are 10s. 3d. and the preference 9s. 9d. Extremely vague rumours are in the air with reference to certain developments said to be afoot between some of the Marconi companies. These have assisted the better tone; otherwise they are too vague to deserve even a passing reference.

Home electricity issues are holding their ground. Westminster at 3½ are ½ better. City of London preference strengthened to 15s. The feature, however, is the strength of the new County of London debenture stock. The price has risen to ¼ premium. Ample though the security is, the price, which is equivalent to 103½ for the fully-paid stock, looks too high as against the quotations of some of the other stocks of its kind. The British Thomson-Houston 7 per cent. debenture stock, offered at 92, started off at ¼ discount when the market began, but the price has since hardened to ¼ premium. The Midland Electric 7½ per cent. debenture stock, issued the other day at 96, is now negotiable, the price being ¼ to 1 premium.

Home Railway stocks have had one of their spasmodic spurts, gains of several points being registered by most of the leading issues of the term companies. The Undergrounds keep pace in the movement. Metropolitan have risen 1½ to 25½. Districts are 2 higher at 16. The Underground stocks and shares are still somewhat dull, the £10 shares giving way to 3½, but the 5s. shares, which rallied a couple of points to 67½. Mexican 1st and 2nd mortgage bonds have risen to 61½ and the 3rd mortgage to 13, showing improvements of 4 and 3 points respectively. The outlook in Mexico is regarded as clearer, and the search for such bonds as are likely to show substantial gains in capital value when a final agreement is reached between Mexico and the United States. Some like the Mexican Tramways 5 per cent. bonds, in which a further rise of 2 points has occurred this week, while the more gambling element leans to the company's 6 per

cent. bonds standing at 27½, with seven years of unpaid coupons, which will require to be dealt with in course of time. The firsts are, of course, receiving part of their interest arrears, and seem to offer a reasonable chance to the speculative investor, the others falling at present, at any rate, somewhat into the category of simple speculation.

Up to Tuesday evening the allotments of the £300,000 Telephone Manufacturing 8 per cent. cumulative income bonds offered at 96 had not been received, so far as we are aware. The Llanelli and District Electric Lighting & Traction Co. is about to issue £125,000 7½ per cent. debenture stock at 94, and the Reading Electric Supply Co. is asking 95 for £100,000 in 7½ per cent. debentures. If the financial atmosphere is cleared by a real settlement of the Irish problem, it is bound to be the case that a good many new issues will be made, possibly before the New Year, because investment stocks have already gone up on the strength of the hope that, with Irish peace, money from the distressful isle will come to this country to swell the funds already available for investment.

Amongst manufacturing shares, Cromptons at 13s. 9d. are 9d. lower. English Electrics at 10s. have regained their loss of last week, but the preference at 12s. 6d. are 1/16 down. Henley's gave way to 29s. 3d., and Metropolitan-Vickers preference to 1½. There is not much doing in this department.

Babcock & Wilcox at 2 5/16 are a little lower, as compared with last week. Vickers remain weak, and the iron and steel market, although affected by the firmness which characterised most of the markets to-day (Tuesday), has not yet recovered from the heaviness that the Washington disarmament proposals brought about. Rubber, the produce, has been up to within ¼d. of 1s. per lb., but fell back again to 11¼d., and share prices have been moving in correspondence. The Castner-Kellner Co. has a dividend of 13 per cent. for the year, as against 22 per cent. a year ago.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend.		Price Dec. 8, 1921.	Rise or fall.	Yield p.c.
	1919.	1920.			
Brompton Ordinary	12	12	6½	—	29 18 0
Charing Cross Ordinary ..	7	8	4½	—	8 17 10
do. do. do. 4½ Pref. ..	4½	4½	2½	—	7 4 4
Chelsea	4	6	3½	—	9 4 8
City of London	13	14	26 9/16	—	10 9 6
do. do. 6 per cent. Pref. ..	6	6	18½	+6d.	6 19 4
County of London	8	8	8½	—	9 1 6
do. do. 5 per cent. Pref. ..	6	6	7½	—	7 10 0
Kensington Ordinary	7	9	4½	—	9 4 8
London Electric	23	23	1	—	10 0 0
do. do. 6 per cent. Pref. ..	6	6	3	—	7 10 0
Metropolitan	6	7	8½	—	9 6 8
do. do. 4½ per cent. Pref. ..	4½	4½	21½	—	7 13 2
St. James's and Pall Mall ..	15	12	12	—	8 17 10
South London	6	7	2½	—	10 13 9
South Metropolitan Pref. ..	7	7	16½	—	8 12 4
Westminster Ordinary	10	10	6½	—	8 10 2

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	6	6	82½	—	7 5 7
do. Def.	14	14	17½	+½	8 9 0
Chile Telephone	6	6	6	—	6 17 3
Cuba Sub. Ord.	7	7	7	—	10 0 0
Eastern Extension	10	10	16½	—	8 2 2
Eastern Tel. Ord.	10	10	16½	—	6 8 1
Globe Tel. and T. Ord. ..	10	10	16½	—	8 2 2
do. do. Pref.	6	6	6	—	6 9 9
Great Northern Tel.	22	24	25	—	9 13 0
Indo-European	10	10	30	—	8 6 8
Marconi	15	15	15	+½	8 10 8
Oriental Telephone Ord. ..	12	12	2	—	8 0 0
United R. Plate Tel.	8	8	6½	—	7 0 8
West India and Panama ..	Nil	Nil	5½	—	Nil
Western Telegraph	10	10	16½	—	8 2 2

HOME RAILS.

Central London Ord. Assented ..	4	4	49½	—	8 1 8
Metropolitan	12	12	25½	+1½	5 17 8
do. District	Nil	Nil	18	+2	Nil
Underground Electric Ordinary ..	Nil	Nil	18	—	Nil
do. do. "A"	Nil	Nil	5½	—	Nil
do. do. Income	4	2	67½	+2	4 9 0

FOREIGN TRAMS, &c.

Anglo-Arg. Trams, First Pref. ..	54	12½	28	—	10 9 6
do. do. 2nd Pref.	Nil	54	2½	—	10 4 8
do. do. 5 per cent. Deb. ..	5	5	68½	—	7 18 8
Brazil Traction	Nil	Nil	30	+1	Nil
British Columbia Elec. Ry. Pfee. ..	5	5	68	—	8 12 4
do. do. Preferred	5	93½	61	—	49 5 0
do. do. Deferred	8	124½	60½	—	10 1 6
do. do. Deb.	40	40	4	—	7 1 8
Mexico Trams. 5 per cent. Bonds ..	Nil	Nil	55½	+2	Nil
do. do. 6 per cent. Bonds ..	Nil	Nil	17½	—	Nil
Mexican Light Common	Nil	Nil	15	+3	Nil
do. do. Pref.	Nil	Nil	26	+1	Nil
do. 1st Bonds	Nil	5	61½	+4	8 9 8

MANUFACTURING COMPANIES.

Babcock & Wilcox	16	16	2½	—	6 18 9
British Aluminium Ord. ..	10	10	14½	—	10 0 0
British Insulated Ord. ..	15	15	18	—	10 18 0
Callenders	15	15	18½	—	6 18 8
do. 6½ Pref.	6½	6½	18½	—	14 11 0
Crompton Ord.	10	10	1½	—	9d.
Edison-Swan	10	—	5½	—	7 16 8
do. do. 5 per cent. Deb. ..	5	5	6	—	11 8 6
Electric Construction	10	10	17½	—	16 0 0
English Electric	8	8	10½	+1½	18 0 0
do. do. Pref.	8	8	12½	—	7 13 0
Gen. Elec. Pref.	6½	6½	17½	—	11 16 8
do. Ord.	10	10	17½	—	10 5 7
Henley	15	15	29½	—	6 8 8
do. 4½ Pref.	4½	4½	34	—	9 2 10
India Rubber	8	8	13	—	9 8 2
Met.-Vickers Pref.	8	8	13	—	511 9
Siemens Ord.	10	10	1½	—	—
Telegraph Con.	30	20	2½	—	—

* Dividends paid free of Income Tax.

LEAVES FROM AN INSPECTOR'S NOTE BOOK.

By "ANODE."

TRAVELLING round from works to works, as an inspector does, he becomes acquainted with all sorts and conditions of engineers, and the best criterion of the worth of the engineer is, naturally, the condition in which he keeps his plant.

In cases where the electrical equipment consists of a few motors they are generally cared for by either the mechanical engineer or a handy man, and I have found in these cases that the mechanical man has a profound suspicion of any device with an "electric wire" attached to it; in the event of any untoward incident occurring in connection with the electrical gear he promptly shuts it down, and obtains the advice or aid of someone qualified to give it.

The handy man, as a rule, keeps his machines clean, that is, if he can get at them without having to climb ladders and turn himself into a contortionist, and I had a few words to say on this point a few weeks ago, when speaking about the fixing of motors in inaccessible positions.

Then, in other cases, you have somebody who is great on taking everything adrift in order to see how it works. This is all right until one day he rewires up and gets a wrong connection on his starter, and the motor starts off on a weak field and races "some."

When you are called in he explains the whole affair to you with great wealth of detail, and enters into a learned discussion as to how the motor makers are weighed in the balance and found wanting, and how their only hope of salvation lies in engaging him as their chief designer and technical adviser.

In cases like this I listen with great reverence and attention to the words of the oracle, and then send him away for something, and while he is gone I change over the leads. On his return I ask him to start up the motor in exactly the same way as when the fault was noticed by him.

To his great astonishment the motor functions properly, and he is left stranded, and I am then in a position to admonish him as to the evil of making rash statements, and calling upon me and disturbing the even tenor of my way.

In one case I was very nearly let down, and this through my own carelessness. I had arranged to spend the week-end with some friends, and late on the Friday afternoon I was making my final inspection at a pork butcher's, where everything was generally O.K. On this occasion it was not so, and on testing through the whole machine and starter I got a very low reading, something like 10,000 ohms, whereas the usual reading was in the neighbourhood of 15 megohms.

This was distinctly annoying, inasmuch as it meant a possibility of losing my train, and in order to save time, I disconnected the leads from the starter to locate the fault.

The fault lay on a terminal insulator, and was easily rectified, and as soon as this was done I reconnected the leads to the starter and made tracks for the station. On the Monday I had a wire from Head Office asking me to proceed immediately to the pork butcher's, as his machine had broken down. This was not pleasant, as my report had gone in to Head Office saying that the motor was in good condition generally, and no defects were noted.

Arriving at the scene of the disaster I saw what I had done, viz., connected the starter up wrongly, and before the butcher arrived I changed over the leads.

When he appeared he raved at me and my company for a good long period, and I could not get a word in. At last I asked him to show me what was the matter, which he promptly proceeded to do, but the motor started up perfectly, and he was completely bowled out.

This little incident taught me a lesson, and I never

made an inspection afterwards without running the machine.

Coming back to the topic I started on, in the case of works with a large number of machines there is generally an electrical engineer, whose duties are naturally confined to electrical matters.

In these cases you nearly always find the equipment in a high state of perfection, and defects are rectified directly they are noticed. In one works with over 300 motors in continual use, it was a very unusual occurrence to find any defects, but the electrical engineer was an exceedingly capable man, with a first-class staff of fitters under him.

On one occasion a field coil burnt out in one of the turbo-generator sets, and it was impossible to replace it till the week-end. He kept the set running on about half-load, and at mid-day on the Saturday he closed it down. By 4 p.m. the same day he had the top half of the generator lifted, the armature out, and the burnt-out coil removed. Those of my readers who are acquainted with d.c. turbo sets will appreciate what this means, especially when the voltage was 220 and the commutator was of the radial type.

This is easily the smartest piece of work I have witnessed, and I say without fear of contradiction that the maker's staff in their own works could not have beaten it.

This shows the value of experience, and it is to be regretted that these positions are not more often filled by practical men.

In the case of another works the engineer was a man of a totally different stamp, and his machines were in poor condition—not that he was in any way inferior to the gentleman just mentioned, as a matter of fact he could have beaten him hands down on theory, but he had not the knack of controlling his staff, with the result that he muddled along; as long as things went on comfortably he did not worry, and when the inevitable breakdown occurred, instead of having one fault to rectify, it generally meant that he had to move the machine for a complete overhaul, and more often than not he was at his wits' end to find a spare.

Had he gone about his work systematically he would have considerably lessened his responsibility and kept his plant in a state of greater efficiency. On one occasion he had a breakdown in an old bipolar generator with a smooth-core armature. This machine was really due for the scrap heap, but owing to his lack of foresight he could not dispense with it, as at that time he could not get anything like a reasonable delivery of a modern direct-coupled set.

The armature was therefore sent away for re-winding, and it being found that the commutator was worn down to safe limits, it was necessary for a new one to be made. When the armature was delivered to him it was immediately put to work, and not even the elementary precaution of adjusting the brushes to the new commutator was taken, the result being that the surface of the commutator was damaged, the copper dust from it lodging at the back of the risers, and after 12 hours the set gave out through earths and shorts at the back of the commutator due to the dust. The result was that the armature had to be returned to the repairer and the commutator taken off and the faults cleared. While this was being done, the other set broke down, and the works were completely stopped for four days.

Had this engineer thought the matter over beforehand this would never have happened, and his firm would have been saved a very considerable amount; it would also have obviated a long and acrimonious dispute between his firm and the repairers, whom he had the gross impertinence to blame for the trouble.

A funny incident occurred once. I had to make a

first inspection of a small 3-phase, squirrel-cage induction motor, and as it was not installed I had no opportunity of seeing it running. I took all necessary dimensions, put the megger on it, found all in order, and passed it for insurance. The next day I had a visit from the alleged electrician, who said that he had ordered the machine for clockwise rotation, whereas it would only run anti-clockwise. On getting particulars of this distressing state of affairs, I found that he did not know that changing over any two of the stator leads would reverse the direction of rotation. Hence the pyramids.

AN ELECTRICAL REVIEW OF E.-H.-P. TRANSMISSION.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E.E.,
M.I.E.E., F.R.A.E.S.

Just over ten years ago, the writer summarised his experience, jointly with Mr. C. T. Wilkinson, of the above-mentioned subject, in a paper read before the Institution of Electrical Engineers (*Proc.*, I.E.E., Vol. 46, Part 207, 1911). At that time, the amount of h.p. transmission work in Europe was comparatively trifling. Since then, however, enormous strides have been made, and literally to-day the Continent is becoming covered with a close network of overhead sub-distribution lines, supplied by e.h.p. transmission systems. The writer has come across a considerable number of these latter systems in the course of systematic tours that he has been making lately to investigate the Continental development of the applications of electricity to agriculture—the economical exploitation of which is so intimately tied up with the provision of cheap and effective methods of transmitting electricity.

An excellent opportunity was afforded recently for obtaining a summary of the world's experience, up-to-date, in e.h.p. transmission practice, at the Paris International Conference concerning "Grands Réseaux de Transport d'Énergie Électrique à Très Haute Tension." This formidable and unwieldy title was officially, though quaintly, translated into English as "Large Transmission Systems of Electric Power at very High Tension." The author, as mentioned last week,* now submits some notes gleaned from the papers read at the conference (some 56 in number), the formal discussions, and also from these informal discussions, which are so often of such great value, that take place unofficially between the official meetings set forth on the programme.

In pre-war days, European practice was largely based upon the designs and apparatus of German engineers—which, in turn, were developed from American schemes. With the advent of the war, most of this class of work stopped for a time. For one thing, plant ordered from German engineering firms could not be delivered; for another, the financial position was upset, and the nations at war had obviously something else to think about. However, in the second stage of the war, the neutral nations became very wealthy, while the warring nations needed more and more power for the production of munitions of war. Power has for some time been exported to the U.S.A. from the second highest British waterfall—Niagara, Canada. The North-East of Denmark is supplied with power from Sweden by a 3-mile long, 25,000-volt, electric cable under the sea. A special war work export transmission line is that between Goesgen, in Switzerland, and Pouxeux, in France—112 miles (180 km.) in length, and designed for eventual operation at 110,000 volts, though now worked at 77,000 volts. The construction of this line was started in July, 1918, and it was completed in October, 1919; the load is 9,000 kW. This line is described in a paper read at the conference by M. Renault.

As main divisions for the discussions, the programme was apportioned out as follows: (I) The generation and transformation of energy; (II) the construction of the transmission lines; (III) the operation and protection of the lines; and (IV) legislation affecting these works. In these notes, it is proposed to deal with the discussions in the same order.

(I) The generation and transformation of electricity, was chiefly dealt with by a discussion on: (a) alternator design; (b) transformer design; (c) controlling apparatus, e.g., relays, switches, &c.; (d) open-air sub-stations; and (e) the difficulties associated with the parallel operation of stations.

As regards (a), chief attention was given to turbo-generators, in which connection Mr. F. D. Newbury (Pittsburg, U.S.A.) presented a most interesting paper. There is apparently not much difference nowadays, between European and American practice. European engineers have the advantage, however, in that they can obtain large steel forgings of better and more uniform quality, which permits of operation at higher stresses. Mica insulation is becoming the universal standard. European engineers are favoured in their

designs in that 50 cycles is the normal standard, as compared with the American practice of 60 cycles. It was pointed out that building costs favoured a small number of larger sets. As regards the present ideas concerning the maximum possible ratings in two-four- and six-pole designs, to-day's limits of manufacture seem to be:—

2-pole	3,600 r.p.m.	10,000 kVA.
4 pole	1,800 r.p.m.	40,000 kVA.
6-pole	1,200 r.p.m.	80,000 kVA.

But difficulties of transport are a considerable factor, even within these limits.

As regards voltage, M. Hansson (Paris) stated that 6,000 volts was a suitable limit, though European practice employs pressures up to 12,300 volts.

The modern alternator of large size is frequently subjected to severe short-circuit tests and, in order to secure good regulation with variable load, it has been customary to specify a low voltage drop and, consequently, a low value of reactance. However, good protection is now considered to be of more importance, so an increase of magnetic leakage is provided for in modern alternators. In spite of a high voltage drop, the employment of high-speed voltage regulators has permitted the maintenance of quite good regulation on the supply system. The present tendency is to permit the use of alternators with a voltage increase between normal running and no-load conditions of 12 per cent. General practice is tending to the direct connection of alternators to step-up transformers, instead of to bus-bars. They thus form separate groups of which the total impedance must be taken into account in the case of a short circuit.

As regards (b), little experience has as yet been gained in Europe with apparatus for a pressure of over 110,000 volts; as, though lines have been constructed for operation at a pressure of up to 150,000 volts, conditions have not yet called for the maximum. For large capacities, three single-phase transformers are advocated in place of three-phase transformers of equivalent rating. This method facilitates handling of material and, further, a single-phase transformer is all that need be kept in reserve as a spare. The opinion of various operators of transformers is not uniform so far as the advantages for or against earthing the neutral of high-voltage systems are concerned. It is certain, however, that the earthing of the neutral considerably reduces the cost of the transformers. Insulation is, together with the temperature and ability to withstand short-circuits, one of the main factors which determine the life of a transformer. The insulation has to be considered separately between: (a) windings; (b) windings and earth; (c) coils; (d) adjacent turns. It is considered that the test voltages prescribed by the French Electro-technical Committee provide an ample factor of safety (e.g., for transformers without an earthed neutral; the insulation test voltage against earth is twice the service voltage, plus 1,000 volts, applied during a period of one minute.)

For transformers of over 50,000 volts and up to 70,000 volts, porcelain insulators filled with resin and oil are preferred on the Continent to plain porcelain. For voltages above 70,000 volts, special bushings either of the condenser or oil-filled type are employed. Oil cooling is exclusively utilised.

The transformer cases are provided with breathers containing air-drying chemicals, such as calcium chloride, to prevent the ingress of moisture.

Reference has been made above as to the difference of opinion that exists as regards earthing the neutral, and it may be remarked that direct earthing (i.e., without a resistance) is now the accepted American practice. The Swiss and Germans prefer to earth the neutral by means of reactances having an inductance value which corresponds to the capacity of the system. Many other prominent European engineers are coming round to American practice in this direction, as regards e.h.p. lines, so the majority vote seems to be in favour of earthing.

Large transformers of very high secondary voltages are generally constructed with the low-voltage winding delta connected, and the high-voltage winding star connected.

With such a big field to cover, but little time could be spared for the discussion of switch and relay design. Further, these details do not seem to attract the interest that is roused over the main problems of design. Oil-break switch-gear seems to be the greater favourite, though the condenser type has many adherents. The Merz-Price system of protection is very favourably spoken of by Continental engineers.

Open-air sub-stations are arousing considerable interest at the present time. They first appeared in the United States about 1912, and in Europe in 1917. The factor that seems to decide whether this system should be adopted or not, is really one of capacity and pressure. Large capacity and e.h.p. stations would seem to be preferable if constructed on the open-air system, especially where land is comparatively cheap. The cost of the apparatus is increased by about 5 per cent., owing to the extra requirements to ensure waterproofness; on the other hand, the overall cost of the installation may be as much as 15 per cent. less than if an orthodox building were constructed. In snowy situations trouble is sometimes occasioned by snow, and in cold situations, special transformer oil has to be employed with a freezing point of -25 deg. C.

Not much time was given to considerations concerning the

difficulties associated with the parallel operation of stations. There was, however, a strong plea for co-operation between the owners of the stations for their mutual benefit and assistance. This argument seems to have taken effect, and it is now quite a usual thing for Continental municipalities to put aside their special jealousies and fall in line with what is, after all, but reasonable procedure, which tends to a reduction of capital and to greater surety in service. In connection with this subject, a very masterly paper was read by Mr. Bakker (The Hague) summarising the investigations of Dutch engineers on the subject. The general argument was developed mathematically in a very interesting manner.

(To be concluded.)

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Western Centre.

Mr. A. C. McWHIRTER, chairman of the Centre, delivered his inaugural address at Cardiff on November 7th, in the course of which he says: During its, as yet, short existence, the Western Centre has made good progress; commencing in 1912 with a membership of 213, we have now reached the very satisfactory total of 421. Nevertheless, there are many electrical engineers in this district not yet members, who are eligible for admission into one or other of the various grades. Our Centre is increasing its activities each year, and I would suggest dividing the Centre into two, with the Bristol Channel and the River Severn as the dividing line. This would allow a greater number of meetings to be held in the West of England and Wales, and would certainly stimulate local interest in the Institution meetings.

With regard to labour problems Mr. McWhirter says: Surely it is not beyond the wit of man to devise a scheme of arbitration which will avoid trade upheavals? Wages, in many industries, are regulated by the Board of Trade returns. It is a hard economic fact, however, that the cost of living will not fall until wages are decreased. The alternative to decreased wages is increased production, and if we are to maintain our position as an export nation we must increase our daily hours of work. We shall be forced back to our pre-war hours of labour, and I am sure that with very little extra effort the total production can be doubled. We must not wholly blame the workers for their "ca' canny" policy, for it is an acknowledged fact that the majority of the more intelligent and highly skilled craftsmen take little or no interest in the affairs of their unions, with the result that these organisations are not conducted in a manner beneficial to the industry generally and the workers in particular. A much broader outlook is required in trade union matters, and it is the duty of employers and all others in authority over labour to encourage their good workers to interest themselves in the affairs of their union much more than they have in the past. From my own experience of district and national councils for the electrical contracting trade, the feeling of confidence is growing stronger at each meeting, and a very marked difference can be observed in the attitude even of the extremists. The Whitley scheme is good, but it does not go far enough, for we have had instances of the finding of one district council entirely upsetting those of another council in the same district.

The Electrical Contractors' Association is hopeful that in the near future contractors will be required to be registered, and I believe that our Institution would welcome and support such a reform. The Institution would possibly be the body authorised to issue, by examination, the necessary licence. In reviewing the position of the contractors, it is necessary to consider the question of supply authorities which possess trading powers. While it is often the case that such a department can undertake the work for a low price, it must not be assumed that this is a proof of efficiency; more often it is merely a matter of accounting. I am absolutely opposed to municipal trading.

Commercial development is a matter which is exercising the minds of many of us just now. Success can only be achieved by adjusting and co-ordinating all the forces in the electrical industry with a view to fashioning an efficient business-getting machine. The present lack of system, under which few manufacturers consider any interests other than their own, is largely responsible for the discontent which is manifest in every direction. The manufacturers should meet and discuss with the wholesalers, retailers, and large users, suggestions which would assist in producing efficient apparatus at a price which would tempt the user to purchase. The supply authorities should devote attention to reducing the cost of power to a point which will make it a necessity to very one on their minds. They should evolve a scheme, either alone or in conjunction with manufacturers and contractors, to hire out the more expensive apparatus. The wholesaler should carry sufficient stock for all the usual requirements and keep in touch with the newest and best appliances. These he can introduce to the retailer and contractor, who in turn should assist by interesting the user. Many contractors do

not realise how much they can do towards the development, not only of their own businesses but of the whole electrical trade. Few consumers make the maximum use of their power and lighting installations simply because they do not realise the possibilities of electricity. By pointing out new uses, the contractor will help the consumer in the efficient running of his business; at the same time he will be promoting the sale of additional appliances with consequent benefit to the manufacturer, the wholesaler, and himself.

The technical training of apprentices is an urgent problem. Restricting the period of instruction to the evening hours is quite unsuitable for the average boy; apprentices should receive a part time training during the day of not less than one whole afternoon a week, devoted entirely to technical instruction. With the assistance of our Technical College, part time training was started in Cardiff last session, and the results have been highly satisfactory. It is the duty of every employer to see that the electrical profession will be composed of well trained craftsmen who will do us credit—we must not forget that these boys will some day form part of their trade union and possibly become leaders. Many firms—particularly those engaged in repetition work—flood their factories with apprentices and employ proportionately few journeymen, to keep down production costs. It is, however, impossible for these firms to absorb all the lads when they have completed their apprenticeships. They are thus thrown on the world with a very inferior training, for it is well known that factory trained apprentices do not receive an all-round experience.

The time has now come to standardise certain dimensions of electric motors and generators—particularly the small and medium sizes. The multiplicity of types in carbon brushes and brush-holders is another continual source of annoyance and expense. Standardisation could be successfully carried much further than is at present attempted.

We, in common with other industries, are undoubtedly passing through the most critical period in our experience. Many well informed critics are of opinion that the present depression in the trade of this country will continue and possibly increase during the next three or four years. I do not believe anything of the kind is inevitable in our business provided we can institute a new and better spirit in our work, and I am optimistic enough to hope that before my term of office has expired, we shall have passed the bottom of the curve of trade depression.

DISCUSSION.

Mr. W. A. CHAMEN considered that standardisation must be adopted by all manufacturers if real economic progress was to be made. New housing schemes were adopting electricity for domestic purposes, and wall plugs, switches, &c., should be standardised in order to effect interchangeability. He agreed with Mr. McWhirter's views on labour. A way must be found of pulling together; only by so doing could things be put right.

Prof. KNOX was keenly interested in the remarks appertaining to the training of apprentices, and the scheme introduced at Cardiff. Considerable opposition had been offered to similar schemes in Lancashire, not only by the employers, but also by local education authorities and the workers. The trade unions had no interest in their members being trained technically. The employers could not see the sense of it. In Germany in 1913 there were 188,000 in the higher technical classes taking full time day courses exclusive of those at the universities and university colleges; in this country the number of students attending technical institutions and University colleges was 2,784.

Mr. R. H. ALGER considered that power companies and municipal authorities had to look for their loss largely in the homes of the country, and it was up to the contractor to make widely known the apparatus that could be used in the home. Contractors had not received in the past the support they should have from the supply authority side. He agreed with the remarks regarding municipal wiring; it did not pay.

Mr. PLEVIN agreed that the return of good trade conditions could only be obtained by the co-operation of both sides. He was told that the wages of the labourer was 35s. per week at the present time. He refused to believe that that was adequate remuneration for any man.

Mr. ROGERS said that the proper training of apprentices appealed to him, as it always seemed to him that the electrical fitter never had a proper mechanical training. Regarding the splitting of the Centre, he was sorry the suggestion had been made. It was possible that South Wales would benefit, but the West of England would suffer.

Prof. BACON said the division of the Centre was a matter on which finality ought to be reached. Facilities should be afforded the Plymouth members for attending meetings, and alternative meetings could be held at Bristol and Exeter.

Mr. BURR agreed with the sentiments of Prof. Bacon regarding the division of the Centre. As regarded municipal trading he was at variance with Mr. McWhirter. Municipalities should have showrooms. In Swansea they had an understanding with the contractors which worked quite satisfactorily, inasmuch as it saved the contractors the trouble of equipping showrooms.

Mr. HUGHES said standardisation was of supreme importance in connection with an electrically-operated colliery.

Mr. NEW reminded Mr. McWhirter that, generally, muni-

cial trading accounts were carried out by another department. Co-operation from the Contractors' Association was necessary if the charges were to be reduced.

Mr. STRETTON considered it would be to the advantage of all concerned if two distinct Centres were created. More co-operation between the various sections of the industry was needed.

Mr. TEASDEL alluded to municipal wiring, saying that the financial view taken by Mr. McWhirter was impossible. He admitted that contractors could do the work cheaper, nevertheless people came to municipal authorities feeling more secure of getting a sounder job; for this privilege they were willing to pay an extra pound or two.

Major DAVID considered the standardisation of motors was of the utmost importance.

Mr. S. T. ALLEN said the suggestion of splitting the district came as a great disappointment to him.

Mr. EVANS said he confirmed what Mr. Teasdel had said regarding municipal wiring. If Mr. McWhirter's suggested registration of contractors came about, it would matter little whether the work was done by the contractor or the authority.

Mr. McWHIRTER in reply said, regarding the splitting of the Centre, that they had to consider Swansea. The meetings already held there were most encouraging and their enthusiasm was great. Finances would not permit of Swansea being a sub-centre. He agreed with the remarks of Prof. Knox. Municipal showrooms could be worked satisfactorily both to the authority and the contractor, provided the authority did not pinch all the trade. The whole point in dispute was what was a fair profit to the authority and the contractor, when a customer was introduced by the latter?

OIL ENGINES AND ELECTRICITY SUPPLY.

By G. PORTER, A.M.Inst.C.E.

(Abstract of paper read before the DIESEL ENGINE USERS' ASSOCIATION.)

THE discussion that was promoted by Mr. Geoffrey Porter's paper on the function of the heavy oil engine in connection with the general supply of electricity, at the October meeting of the Diesel Engine Users' Association that was held at the Institution of Electrical Engineers, was opportune in view of the consideration that is being given by the Electricity Commissioners to various schemes for extending and improving the general supply of electricity throughout the country. The author submitted interesting figures of tabulated working costs, including capital charges, of undertakings using steam plant, or heavy oil engines, or a combination of both, and in each case he showed the permissible purchase price payable for a bulk supply from an outside source. Curves showing total transmission losses of various mean loads and power factors, permissible purchase prices, costs per kWh of alternative methods of operating, &c., accompanied the paper. There were also appendices giving particulars of Diesel engine performances at actual undertakings, heavy fuel oil engine consumptions, examples of terms offered to local supply authorities for bulk supply, and the estimated costs of a power station employing heavy oil engines. Although there was naturally considerable difference of opinion with regard to the merits or demerits of various systems of providing for a supply of electricity in an area under varying conditions, it was generally admitted that there could be no case for *complete bulk supply*—that is, for a system of supplying in bulk throughout the country, which would entirely eliminate local generating stations of comparatively small power, and that there was a very strong case for the installation of heavy oil engine plant so long as a good supply of suitable liquid fuel could be ensured. One speaker, who had had experience in connection with about forty electricity supply undertakings equipped with Diesel engines, gas engines, steam engines, and steam turbines, some of which were taking bulk supplies, referred to the very large number of cases in which no bulk supply could compete with the local generating station. He felt, as others did also at the meeting, that bulk supply should be made use of wherever possible, and even perhaps in certain cases in which at the moment it might not be the most economical way to meet the immediate needs of an undertaking, but that every case must be considered on its own merits. He added that he had no doubt that the Electricity Commissioners would be approachable and willing to hear all sides of any question of this sort, and he felt certain that, after the experience which the Commissioners had obtained during the past year, they would now understand the many difficulties and limitations of bulk supply, and that anyone with a good case for local extensions of generating plant would get a fair hearing.

Mr. Porter's statements concerning the great development of the oil supply industry and the ample proportions of the oil reserves in the world were emphasised by several speakers. Reference was made also to the possibility of oil being distilled from coal on a larger scale in the future, and to the

successful operation of Diesel engines during the war period on tar oil. The consideration of the use of heavy oil engines to an increasing extent in the future was closely bound up with the development of larger units in which so much progress had been made for marine work during the last few years.

In the course of his paper Mr. Porter says, *inter alia*:—The dimensions of the problem of the future production of electricity have been brought within their practical limitations, and it appears probable that the improvement of electrical distribution will be sought along the lines of development of the best existing resources. Further capital expenditure on a large scale must be most carefully applied if the means adopted are not to defeat the desired end.

It is not suggested that the heavy oil engine is the best form of prime mover to employ in any and every situation. For the present he confines its adoption to undertakings of moderate size where the industrial demand is not large, and where units not greater than 1,000 kW can be confidently adopted. The conservation of fuel must be the guiding principle, and the use of coal for purposes other than steam raising is fire-shadowed. The power production of the future appears to lie between fuel oil and coal gas, and the superior portability of oil will be a strong factor when the desirable features of either are equated. The production of mineral oil is increasing very rapidly. Its transport from overseas becomes a simpler problem month by month, and there is every indication that the supply will keep pace with demand. The Diesel engine is in active and successful commercial application in capacities up to 6,000 b.h.p., and ratings of 1,000 b.h.p. per cylinder. The manufacturers of these large capacity engines are prepared to build an 8-cylinder engine up to 10,000 b.h.p., and have actually constructed a satisfactory experimental engine of 2,000 b.h.p. in one cylinder. One of the most promising directions in which progress is moving is the opposed piston construction. Much larger capacities per "line" are available with this type than are usual in the ordinary design of Diesel engine. Even more promising is the heavy oil engine of the regenerative type invented by Mr. W. J. Still, in which the highest known thermal efficiencies are achieved. The flow of heat is so admirably controlled that there seems no reason why very large powers should not be obtainable. The conditions are such that cylinders may be rated much more highly than is at present possible in engines of the ordinary Diesel type. A 6,000-b.h.p. cylinder is said to be a practicable possibility. This engine has also been designed as an opposed piston engine with good results. Briefly, the heavy oil engine is obtainable commercially in capacities up to 6,000 b.h.p. without undue multiplicity of cylinders. Such a capacity will be sufficient to drive an electrical generator of from 3,500 to 4,000 kW.

From the point of view of the power station engineer the paramount advantage of the steam turbine is its capacity to concentrate great powers in comparatively small bulk and weight. The influence of this property upon capital cost has been, until recent years, great enough to outweigh the comparatively low thermal efficiency of the steam cycle, from coal handling plant to generator coupling. The internal combustion engine must show thermal efficiencies so good that high capital cost is no disadvantage. In general this condition is satisfied.

The capital costs of the steam and heavy oil engine power station are at present roughly in the ratio of 5 to 7. This proportion stands for the 4-stroke cycle Diesel engine and the steam turbine with boilers and auxiliaries. For Diesel engines of the 2-stroke cycle the ratio is about 5 to 6. And for the smaller capacities dealt with by the semi-Diesel and other oil engines the proportion is about 2 to 1.

On the operating side the position is wholly in favour of the heavy oil engine. An average thermal efficiency of a steam turbine power station of 15,000 kW operating at a 20 per cent. load factor is from 7 to 8 per cent., and the heat expenditure per kWh lies between 40,000 and 50,000 B.th.u. The highest contemplated overall thermal efficiency under ordinary operating conditions and at load factors exceeding 50 per cent. is not above 20 per cent., and the more usual efficiency of from 7 to 8 per cent. corresponds to an energy production of from 500 to 600 electrical units per ton of coal burnt.

Thanks to the economy of the heat cycle adopted, the heavy oil engine provides infinitely better results for a tithe of the trouble. In quite small power stations there is no difficulty whatever in obtaining overall thermal efficiencies of from 25 to 29 per cent. under ordinary operating conditions. The heavy oil engine is not so sensitive to load factor as the steam turbine or engine. In engines operating at 65 per cent. plant load factor one ton of residual petroleum fuel oil will produce 3,300 kWh for a heat expenditure of 12,500 B.th.u. per electrical unit.

In many instances it must be more advantageous for the local electricity supply authority to generate locally, using heavy oil engines, with the benefit of their high efficiency reflected in the operating costs, than to purchase in bulk from an external authority producing energy by less efficient means and transmitting for local distribution from a distance. The indifferent efficiency of production is aggravated by the inevitable loss in the transmission system, a loss that must be

considered in fixing the purchase price, and will fall upon the local distributing authority.

The reply to this criticism is always in terms of load factor. In some miraculous way the bulk supplier's best possible efficiency of about 20 per cent., reduced to a mean of about 12 per cent. at the purchaser's switchboard, according to distance, will enable him to compete with the 27 per cent. (a low figure) efficiency the prospective purchaser can obtain by continuing to generate locally with the heavy oil engine.

Will the 50 and 60 per cent. load factors so frequently mentioned as the bulk suppliers' perquisite be realised, except in a strictly industrial district?—and even here the tendency towards shorter factory hours may have a detrimental effect. In a neighbourhood where the industrial demands are small the bulk supply authority will probably develop a peak load corresponding to the sum of the peak loads of the individual local distributing bodies. The price of a bulk supply under such conditions might readily be prohibitive.

An equally important consideration with regard to bulk supply is capital cost. A wholesale scrapping of sound, even if inefficient, plant would involve a great waste of existing assets. Whatever may be the inducement to purchase in bulk, the abandoned assets and their annual burden on the funds of the local undertaking cannot be got rid of. The crux of the matter is not so much what price the bulk supply authority will charge for energy, but how much the local distributor can afford to pay without prejudicing the interests of his consumers.

The purchase of the whole or part of the requirements of a local supply authority is not justifiable on economic grounds. It is less expensive for the local body to generate locally, and by doing so with the use of the heavy oil engine as the prime mover the interest of the consumer is safeguarded.

There are fashions in engineering matters just as in other worldly things, and fashions are very difficult things to withstand. At present we have the fashion of the "big set" swollen to such proportions that its habitat is too small for its activities. Many small and medium undertakings will further their interests much better by adopting a fashion more suited to their conditions, in the form of the heavy oil engine.

TELEPHONE LINE WORK IN THE UNITED STATES.

DISCUSSION AT NEWCASTLE-ON-TYNE.

At a meeting of members of the North-Eastern Centre of the INSTITUTION OF ELECTRICAL ENGINEERS, at Newcastle-on-Tyne, on November 14th, Mr. E. S. BYNG read his paper on the above-named subject (see ELEC. REV., November 25th).

Mr. J. R. M. ELLIOTT, in opening the discussion, said the author's information was possibly that for which many of them had been waiting for some time. The climatic conditions existing in this country were so different from those in America that it had generally been regarded as necessary to have a higher standard of constructional development for English plant, and what had been shown on the screen seemed to bear that out. Before the war the record of the U.S.A. with regard to the use of mechanical appliances was very good, especially in connection with the construction of line work and cable laying. The use of those appliances had been developed, but he had hardly been prepared to hear the records that the lecturer had submitted. One factor that must have contributed largely to the development of those mechanical appliances was the low cost of petrol, but that was no reason why they should not try the experiment of making use of some of them and ascertain the relative costs compared with America, but it must not be forgotten that the cost of production was a vital factor. In America the cost of petrol and machinery was low, and charges for wages and salaries were high; generally, the reverse was the case in this country, so that one could not jump to a conclusion as to the effects of such a change of methods. Regarding the use of American technical terms and words, he thought the author would have done well had he appended a glossary of them and their English equivalents. Passing on to details, regarding the possibility of manufacturing and using a No. 27 B and S gauge cable ($3\frac{1}{2}$ lb.), he did not think there would be any difficulty in drawing it, but in other operations there might be a tendency to break, and there might be a difficulty in jointing. He would not care to have h.p. lines mounted on poles bearing telephone wires. In this country motor-cycles, with adapted side-cars, were found most useful. There had been in contemplation the construction of a 3-ton lorry, fitted for constructional purposes, but the difficulty had been to carry ladders suitable for their requirements.

Mr. G. W. WILLIS thought American engineers showed great foresight in making provision for development. The American nation had shown great perspicacity in its use of the telephone, and if the telephones in this country were supported by the public as was the case in the States, then

they could make a much better show. They seemed to have a lot to learn from the Americans, but, at the same time, much of their work appeared to be very rough and ready. Were there no mischievous boys in America?—because the plant was so close to the ground that it would not last a week in England. He imagined that the reason that there were not frequent break-downs of line was that the span of the lines was so short.

Mr. VERNIER had no idea that cables of the size mentioned had been erected as aerials. The problem with which he had to deal was different from that of the post office, to which reference had been made; it was to carry telephone cables on overhead transmission lines, and they devised a system of hangers of leather with a clip which had proved quite satisfactory.

Mr. F. G. C. BALDWIN said that while it must be admitted that the telephone had been developed in America by a high standard of technical skill and commercial enterprise, it should not be forgotten that a good deal of pioneer work was done here. He had been under the impression that the use of antimony as an alloy with lead for cable sheaths was experimented with some years ago, and that in view of the tendency to brittleness which the use of antimony engendered the matter had been dropped. That difficulty had apparently been got over. The advantages of aerial cable that Mr. Byng mentioned were much more applicable to American conditions than to British ones. During the period from 1900 to 1911 a large amount of dry-core lead-covered cable was erected in this country. A good deal of it had been recovered, and examination revealed the fact that even the comparatively soft pig-skin slings had caused serious indentations in the lead; and incidentally that crystallisation of the lead sheath appeared to be fairly general. He was particularly interested in the method described for leading-in cables at exchanges; it was certainly flexible. So far as he knew the leading-in arrangements adopted at the Victoria Exchange in London were superior to any that had hitherto been employed in this country. Instead of carrying the cables along the walls of the chamber they were carried along an iron racking running from end to end of the cable chamber beneath the main frame, and provision was made on the rack for any necessary crossing of cables. Referring to the boiling-out process in conjunction with woven-cotton sleeves, he was not satisfied personally that the process was all that was claimed for it. His experience had not been that superior insulation could be absolutely relied upon by the adoption of that process in preference to any other. The reason was not apparent, but was probably due, either to a lack of appreciation of the requisite temperature, or to want of experience on the part of the joiner in applying the wax.

Capt. GASCOIGNE, referring to the statement that 1,500 pairs of wires were included in one cable, suggested that that number was, possibly, too great because of the serious trouble in case of breakdown.

Brief remarks were also made by Messrs. SIMPSON and GILPIN.

The Cost of Wiring Installations.—In the course of inquiries made by Mr. Scott Moncrieff in connection with the work of the Electrical Development Association on unemployment in the electrical industry, he ascertained that there was a strong feeling amongst wiring contractors that a reduction in the cost of wiring would result in a material stimulation of business with a corresponding reduction of unemployment. Opinions differed as to the reduction necessary, but it appeared to be generally agreed that from 20 to 35 per cent. would go a long way towards inducing potential customers to have their premises wired. Many of the latter were anxious to obtain a supply of electricity, but were definitely holding back on account of the high prices current. A few contractors held that a reduction of 50 per cent. would be necessary to bring about the desired result. Where the cost of wiring was round about 35s. a point, business was dull, but where the price was 25s. to 30s. a point the contractors were fully occupied, and all new premises were being connected to the mains, whilst some were being changed over from gas lighting. It was pointed out that the cost of labour was the chief obstacle, and that a fair proportion of the desired reduction should come from that quarter. "Small men," who did their own wiring, could quote lower prices than the larger contractors, and were getting work to do, whilst contractors were reducing their staffs. The high cost of motors was also deterring would-be power consumers from adopting electricity. Another adverse factor was the cost of laying distributing mains. The reduction that had already taken place in the cost of wiring had materially improved the demand for connections.

Photographing London by Night.—Messrs. Pathé Frères, the well-known cinematograph firm, have taken the first of a series of night photographs of London buildings and monuments. The apparatus was mounted on four lorries. Two of these bore generating sets, and two carried three 1,000,000 c.p. "Sunlight" arcs each. Among other edifices photographed was the tower carrying "Big Ben."

"CYC-ARC" AUTOMATIC ELECTRIC WELDING.

By L. J. STEELE, M.I.E.E., and H. MARTIN, A.M.I.E.E.

(Abstract of paper read at the INSTITUTION OF ELECTRICAL ENGINEERS.)

THE process of welding electrically by direct means two pieces of metal of widely different sections has hitherto remained unsolved, and the welding of dissimilar metals of widely different melting points, such as brass and steel, has been considered impossible. The "Cyc-arc" process of automatic electric welding has, however, solved these problems, and it is believed that the system (which has already been illustrated and described in this journal*) is unique on account of the fact that metals, differing both in size and quality, can be automatically welded together as the result of a single operation of an ordinary bell push, by the consequent heating of only the metal parts to be welded, without using an electrode or any flux.

The process was developed to save labour when attaching small screws or studs to ships' plates to carry the supporting clips of electric cables and fittings, and the advantages of doing so without perforating the bulkheads or decks is obvious; it is the only known successful method of doing so. In 1918 a light magnetic stud holder was constructed to retain the stud accurately in position upon the iron or steel plate while it was being welded thereon, thus eliminating one operator. Instructions were then received at Portsmouth Dockyard from the Admiralty that apparatus should be made in accordance with proposals submitted (by members of the dockyard staff) of what was named a "semi-automatic device for stud welding." This apparatus, which was intended primarily for the welding of iron or steel studs or screws to iron or steel plating, consisted of a pair of pot magnets supporting, but insulated from, a stud holder attached to a plunger, the latter being movable against the pressure of a spring, and fitted at one end with an insulated striking knob. The apparatus was to be fixed in position for the stud to be welded by simply energising the magnets. Then, with the spring holding the stud out of contact with the plate, it was intended that the knob at the end of the plunger should be struck to overcome the action of the spring, momentarily bringing the stud in contact with the plate, and also closing the welding circuit. The stud, after momentarily touching the plate, would be released and at once forced out of contact by the action of the spring, thereby drawing an arc. After an interval of time the molten stud was to be forced against the adjacent molten plate by again pressing the knob of the plunger, thereby welding the stud to the plate, the current in the main circuit through the stud, weld, and plate, being finally switched off. The three variables which had to be correctly adjusted in order to obtain even apparently satisfactory welds were: the amount of current through the arc, the length of the arc upon striking, and the length of time it had to be maintained before making the weld. Obviously, one or more of these factors must vary for every different size, shape, and material of stud and, in view of the extremely short time during which it was necessary to maintain the arc, it was found that considerable accuracy in all the above three factors was necessary to secure even moderately good results, and an automatic timing and control system yielded important improvements in uniformity in the resulting welds.

The necessity of centralising the arc as much as possible throughout the entire period of operation, and also the desirability of forming an enlarged crater of molten metal in the plate into which the stud end is to be inserted have been met by the use of a ball-ended stud. The length of arc that is just sufficient to enable the arc to be uniformly and reliably struck and maintained is 1/16 in. The means of effecting the desired adjustment at the welding tool is shown in fig. 1. The method is simply to screw down the adjusting head (35) until the plunger (36) just comes into contact with the solenoid core (31). As the plunger (36) projects beyond the adjusting head (35) by exactly 1/16 in. this will determine the exact length of arc which is struck when the solenoid is energised. A limiting device (29) indicates when it is necessary for the position of the solenoid and accessories to be adjusted relative to the plate by means of the adjusting screws and nuts (1) and (6).

In consequence of improvements, completely successful results, both in operation and in welding, were achieved, and welds thus obtained exceeded our best anticipation, both in quality and in uniformity. It was in fact found, as the result of careful tests, that the strength of the weld actually exceeded that of the metal itself.

Although for a long time after success was obtained we believed this welding process to be entirely new, we have since found that this fundamental method was discovered and presumably used in about 1890, but with hand instead of automatic operation and control of the time-period of the arc. It is evident, therefore, that the application of automatic timing by means of electrical control is the principal feature of our invention, the lack of which feature prevented this

effective welding process from being developed and utilised at least 20 years ago.

Additions to and modifications of, the apparatus, were next made by means of which the timing apparatus was started and stopped, and the whole sequence of operations required to make a weld effected by simply pressing an ordinary bell-push attached to the welding tool. This important improvement, though really of quite a simple nature, is best understood by reference to fig. 2.

The difficulties in welding steel and iron studs, as compared with those made of naval brass, at this stage of development necessitated further experiments with a view to finding some method or apparatus which would satisfactorily weld such studs. However, satisfactory welds of the type in question can only be secured by returning the stud to the plate under powerful and sustained pressure, and we therefore designed a tool which returned the stud to the plate under the action of compressed air admitted into a cylinder, the piston of which was attached to the stud-holder of the welding tool.

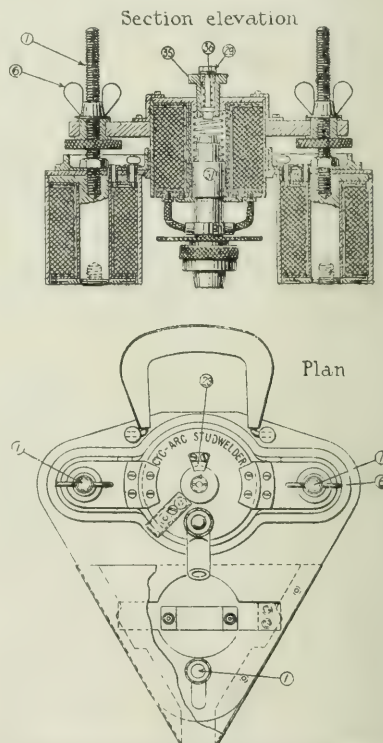


FIG. 1. SECTIONAL ELEVATION AND PLAN OF "CYC-ARC" WELDING TOOL.

which showed that our theories were correct, and that satisfactory welds of steel or iron to other metals could be obtained with it.

We have since classified the two kinds of welding apparatus as Type A and Type B, the former being essentially a portable type, having a welding tool provided with hold-on magnets and spring replacement of the stud-holder plunger, and the latter being a fixed or shop-tool type, the welding tool being attached to a slidable spindle, such as that of an ordinary post drill, and being connected to a compressed-air supply through an electrically-operated valve, in order to replace the stud against the plate under air pressure.

Our latest form of timing and control apparatus, common to both the above-mentioned types of apparatus, is driven by means of a very powerful, double-spring motor, has a gravity-loaded vertical plunger contact for its main involute cam, and is provided with a uniformly divided and clearly marked timing dial and accessories, which can be simply and instantaneously adjusted to ensure that the apparatus will accu-

* ELEC. REV., September 30th, 1921; p. 432.

ately maintain the arc for any period of time between 0.1 and 3.0 seconds, variations of 0.01 second being readily obtainable. The simple and accurate time adjustment is secured because the rotation of the marked dial causes the rotation of a spindle, to one end of which is attached a cam, which regulates and limits the lowest position of the main plunger contact of the apparatus relative to the main involute cam. The cam in question being of similar shape to the main involute cam, if the main plunger contact is normally allowed to drop to a low position, it will make contact with its own involute cam proportionately earlier than if retained normally in a higher position, thereby increasing the arcing period. In its upper or zero position, although, as the result of the operation of the tuning apparatus, the main contactor closes momentarily, the arc-striking solenoid is not energised, for the simple reason that the stud-holder solenoid is short-circuited at the moment the contactor control-coil circuit is closed.

This improved timing and control apparatus has so far quite justified itself. The period of each complete rotation of the cam spindle of this improved apparatus is 7 seconds. In cases, however, of the use of the "Cyc-Arc" apparatus continuously and rapidly on one particular class of job which requires a practically uniform time period, a much cheaper and simpler timing and control apparatus can be provided, so designed that, instead of each operation of the timing apparatus occupying a 7-second period, the arc strikes practically instantaneously when the push-button is pressed, the total time period of this form of direct-acting timing device being practically the same as that of the arc.

About 400 welds can be made with the timing device without re-winding it.

The Type A portable apparatus, as now constructed commercially, consists of two main parts, viz., the controller and the welding tool. The former comprises:—

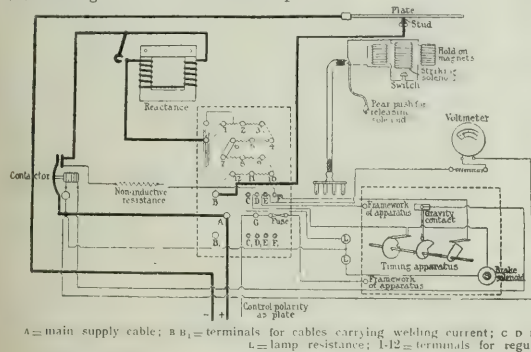


FIG. 2.—CONNECTIONS OF PORTABLE WELDER.

(1) Automatic timing and control apparatus. (2) Marble connecting and regulating panel. (3) Adjustable reactance. (4) Noninductive resistance. (5) Carbon-filament lamp resistance. (6) Resistance coils for current regulation, with supports and insulators. (7) Automatically-operated electric contactor. The nichrome resistance coils may be arranged either in series or in parallel, or practically in any combination thereof, so that large variations, both in the current-carrying capacity and in the ohmic resistance of the coils, can be obtained, thus permitting of a wide range of adjustment for welding purposes. To supply a controller for much larger work the only modifications necessary in the standard controller are the substitution of a contactor of greater capacity and an increase in the size of the main connecting leads. Provision is made for the connection of two welding tools if it is desired to double the output of a single-controller set, which two tools are operated on our dual-control system. Fig. 2 shows the connections of the commercial Type A apparatus, which is designed for operation from ordinary direct-current welding supply mains, and only very slight modifications are necessary to make it suitable for any voltage between 60 and 100. The normal current-range is from 200 to 500 amperes, according to the size of the stud or other fitting to be welded. The actual energy consumed per weld, however, is extremely small, the usual duration of the welding current being about 1 second.

The apparatus will satisfactorily weld naval brass or manganese-bronze studs of good quality up to $\frac{1}{2}$ in. diameter on to brass, manganese-bronze, iron, or steel of practically any thickness, and also on to galvanised iron or steel. Once the apparatus has been set up for a particular size of stud or fitting its operation is practically automatic, and it can be worked by semi-skilled labour.

The operations necessary for making a weld (after the controller and the surface on which the weld is being made have been connected to the supply mains) are as follows: the stud or other fitting to be welded is first placed in the holder of the welding tool, and the latter is secured in the desired position by means of the hold-on magnets. The arc-limiting

device is then *set*, after which a single action of the bell-push starts the timing and control apparatus, thereby making the welds. The cams of the timing and control apparatus stop automatically in exactly the same position relative to the contact fingers as that from which they started. The weld having been made the tool is removed from the surface (to which it is attached by the magnets) by opening the tumbler switch and withdrawing the tool from the stud, which remains welded in position.

The welding tool can be taken to any position where the work has to be performed. The entire equipment can be transported by two men, the welding tool itself being readily and conveniently handled by a single operator, its weight being under 20 lb.

The value of the current required with a given time-setting depends to a certain extent upon the time during which the arc current is maintained, and *vice versa*, but there is a substantial range for adjustment, throughout which range no seriously deleterious effects on the welds need be anticipated. The approximate range of arc-current adjustment is between 200 and 500 amperes, with a 100-volt supply. Currents of air (such as those in draughty passages) may cause the welding arc to be blown to one side, if not actually extinguished. The hold-on magnets of the welding tool are provided with an adjustment to allow of the tool being readily adapted and fixed to uneven or curved surfaces.

A fixed type of welding tool has recently been constructed for use with the type A apparatus to fit any kind of light post-drilling machine. This adaptation already promises to have a wide field of application in engineering shops for light work.

The Type B electro-pneumatic set also comprises the controller and welding tool with arrangements for the supply of compressed air. The welding tool, fig. 4, consists of a combined solenoid and air cylinder that is intended to be attached to, though insulated from, the spindle of a drilling or other

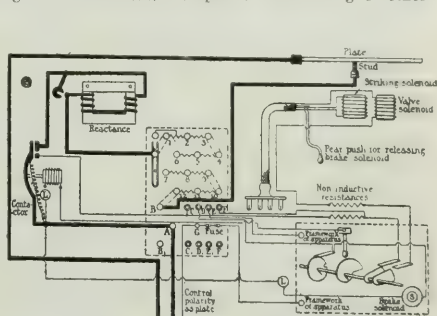


FIG. 3.—CONNECTIONS OF ELECTRO-PNEUMATIC WELDER.

suitable machine, which has to be sufficiently rigid to withstand the powerful thrust exerted by the piston of the welding tool when subjected to the maximum air pressure which can be supplied. The size of welding tool shown will deal with work requiring currents up to 1,500 amperes, and for electricity supply purposes a motor-generator such as that described later will be used.

The air-supply required careful consideration, because the quantity needed is so small; the maximum amount of compressed air required per minute will be less than 0.05 cu. ft. The compressor is of the motor-driven tire-inflator type, which keeps fully charged an air receiver interposed between it and the welding tool, the maximum pressure being 150 lb. per sq. in.

Fig. 3 shows the connections of the Type B apparatus. The use of the apparatus, modified to operate on the dual-control system, enables its output of work to be doubled, with only about a 25 per cent. increase in the cost of apparatus and without any appreciable increase in the size or cost of the welding supply plant. The single controller is fitted with a pair of solenoid-operated discriminating switches, as well as with an additional contactor, non-inductive resistance and accessories, as compared with a controller for a single-operator set. The discriminating switches, which are operated by the ordinary action of the push-button control on the welding tool, permit of a welding operation being effected by only one welding tool at a time, during which operation the other tool is completely and automatically isolated, and thus put out of action. The hold-on magnets of the welding tools are, however, quite unaffected by this arrangement. Owing to the extremely short overall time required to make each weld, viz. 7 seconds, compared with the time taken to remove the welding tool after the completion of the weld, and to replace it in another position with a fresh stud in the holder ready for welding, two operators can use two welding tools alternately on the dual-control system, without delaying or interfering with one another in any way, and thus make double the number of welds possible with a single-operator equipment; this enables two operators to work at the rate of from 80 to

500 welds per hour with the portable apparatus, and at a rate of over 200 welds per hour with the fixed machine adaptation of the welding apparatus.

The successful results obtained are due mainly to the method of automatic control and accurate timing of the cycle of operations, and it has been possible to draw up a table of the adjustments of current and timing necessary for the welding of different sections to varying thicknesses of plates, and also with relation to the welding of different metals. Perfect results are obtained between naval brass or manganese-bronze studs, and steel, iron, or brass plates. Equally satisfactory welds are obtained if the iron or steel is galvanised, provided that the zinc deposit is not unduly thick. Surprisingly good and strong welds can also be made with brass tubes on to steel plates, and the latter may be less than 30 mils in thickness. Excellent welds can also be made on to spring steel. When welding brass tubes 3/16 in. in diameter on to steel plates about 0.03 in. thick, the time during which the arc is maintained is only 0.1 second. An action which contributes materially towards the strength of the weld takes place when welding such tubes. The molten brass rises into the interior of the tube at its base and forms a solid section for an appreciable height.

Another valuable application of the process is for the tipping of machine tools. Welds obtained are extremely reliable and satisfactory. It is necessary, however, to anneal the tool as soon as possible after tipping before attempting to grind or work on it in any way.

The great strength of the welds obtained by this process of welding led to the conclusion that this might reasonably be attributed to three causes: (1) Absence of oxides in the weld. (2) Extremely local heating in the region of the weld. (3) Penetration (in each direction) of the metals to be welded. Since then, by the aid of micro-sections at a magnification of 50 diameters, the above conclusions have been definitely confirmed.

It would appear that the effect of heating does not extend for more than 0.5 in. from the weld. There are also indications of a fused mixture on each side of the weld to a depth

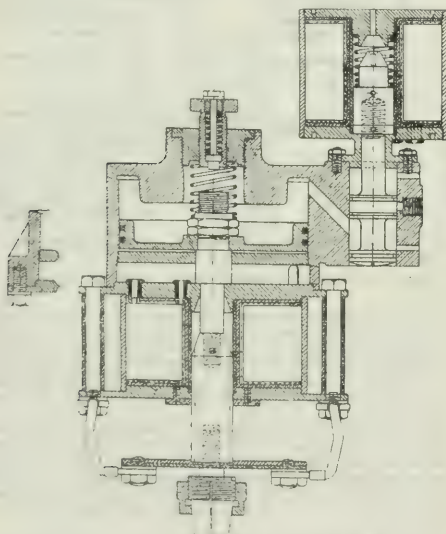


FIG. 4. "Cyc-Arc" ELECTRO-PNEUMATIC STUD WELDER.

of about 0.01 in., but not much penetration beyond this. Mechanical tests have shown that plates to which studs have been welded by the "Cyc-Arc" system have actually been reinforced by such welds. Lloyd's Register of Shipping has fully approved of the process for use in ship construction.

Apart from the advantages just mentioned, there is also great economy in time and labour. At least 10 studs can be welded in position in the time occupied in fitting one bolt or screw by the ordinary methods of drilling and tapping, and, with an average run of work, large studs can be welded at the rate of at least 40 per hour. The cost of fixing studs by this method is less than one-quarter that of screwing them by the ordinary method. The fact of the surfaces being wet is not disadvantageous to this process of electric welding; in fact, perfect welding can be made under water.

Particular attention is called to the quality of the welds between iron, steel, brass, or bronze, not only as regards mechanical strength, but also electrical conductivity, which indicates a means of making electrical connections of a quality hitherto unobtainable, in a perfectly simple and rapid manner. A striking illustration is all kinds of electrical bonding. It is obvious that, apart from ship construction,

electric bonding, &c., this system of welding is capable of application in many industries.

The "Cyc-Arc" process differs from the majority of other welding processes in the fact that each weld takes a relatively heavy rush of current for an exceedingly short time. As, in addition, the supply pressure need not exceed 60 volts, an extremely small quantity of energy is required per weld, e.g., a 3/8-in. diameter stud takes 12.5 watt-hours, or 1/80 kWh, while a 1/2-in. stud weld takes only 2 watt-hours, or 1/500 kWh.

Although the Type A welding apparatus is being operated satisfactorily direct from the ordinary 60 or 100-volt direct-current welding supply mains on fairly large installations where the supply mains and plant are of considerable capacity, it has, on the other hand, been found necessary to design special supply plant for use in conjunction with the "Cyc-Arc" apparatus.

Where the existing welding supply plant is of small capacity a special "kinetic generator" can be supplied at a relatively low cost. In the intervening periods between welds the machine merely motors "light," but the moment a weld takes place it automatically becomes a generator, supplying practically the whole of the welding load, owing to the combined effect of its flywheel and the special design and arrangement of its field windings. The current taken from the welding supply mains when supplying the Type A welding apparatus through this special kinetic generator need not exceed 50 amperes, while its motoring current when running light is only from 12 to 20 amperes.

The consequent advantages in minimising peak loads on the welding supply plant, and in reducing the size of the supply mains necessary for "Cyc-Arc" welding are obvious.

To meet cases where no suitable welding supply is available motor-generators can be supplied at a cost not greatly in excess of the price of the kinetic generators, because the driving motors are only of approximately 3-kW capacity. These motor-generator sets, when running light from the supply mains, take about 1 1/2 kWh per hour, this amount being increased to less than 2 1/2 kWh per hour when welding the largest size of stud at the maximum possible rate with the Type A apparatus. In addition, the maximum load on the supply mains need not exceed 5 kW, i.e., 23 amperes at 220 volts d.c., 11.5 amperes at 440 volts d.c., or 6 amperes at 440 volts a.c., three-phase.

Where no electricity supply is available, the kinetic generator has been adapted for use with small petrol, paraffin or steam engines, and can be also supplied in portable form. The size of engine required for the Type A apparatus is only from 5 to 6 h.p., the average load when welding at a maximum rate being about 2 1/2 h.p., and the petrol consumption being less than 1 gallon per day of 8 hours, during which at least 400 welds should easily be made.

Direct current is supplied to the "Cyc-Arc" welder under conditions the characteristics of which are unusual, that is to say, in such a manner that the circuit should be substantially devoid of the effect of the inductance of series coils at the moment of striking the arc, while the advantage of cumulative compounding for maintaining the voltage during welding operations is considerable. These objects are achieved by employing a machine comprising a field system, and an armature with two windings and two commutators, each winding being connected to a separate commutator. The brushes of one commutator are coupled in parallel with the brushes of the other commutator to the leads supplying the welder, series excitation being provided by a winding in the circuit of one only of the armature windings, and the shunt winding being conveniently, though not necessarily, excited from the same side of the system. The generator has a double winding, and the common field is so arranged that one winding strikes the arc while the other gives the cumulative compounding for maintaining the voltage during the weld. The arrangement also facilitates self-excitation and maintains a steady supply of current to the solenoids, as well as affording a means of compensation for any drop in speed to enable the flywheel energy to be utilised. The generators are suitable for driving by induction motors having a synchronous speed of 1,500 r.p.m. A cast-steel flywheel is mounted between the motor and the generator, and the drop in speed during a full 2-second weld taking 500 amperes at 60 volts is about 15 per cent. The regulation is based on the assumption that there is a definite period between each weld in which to restore the energy of the flywheel. Any undue increase in the motor load owing to the drop in speed of the machine is prevented by the compound winding of the d.c. motor, or by the use of a slip resistance in the case of an induction-motor drive. The current peak is less than one-seventh of that required by a set not provided with a flywheel.

The Brush Electrical Engineering Co. constructed the first kinetic motor-generator of the above described type. Alternating current will ultimately be used, more particularly in welding considerably larger work than it has hitherto been possible for us to undertake. There are, however, difficulties to be overcome in order to obtain satisfactory "Cyc-Arc" welds by means of an a.c. supply owing to the uncertainty of striking an alternating-current arc. Satisfactory means have, however, been evolved for overcoming these difficulties, which it is not proposed to discuss at the present time. However, we consider that it will be generally advan-

teague to use d.c. for small work, and that it will probably be worth while constructing the modified apparatus necessary for use with a.c. only when using currents of well over 1,000 amperes.

It will probably be a matter of some surprise that reference has been made so fully to the welding of widely dissimilar metals, and that so little has been said with regard to welding iron and steel. Welding these metals offered exceptional difficulties, but investigations in this connection are, however, almost completed, and we hope to publish the resulting information in the near future. This difficult problem has now been solved, and ferrous metals of widely different section and composition can be directly welded with exceptionally good results.

DISCUSSION.

The authors illustrated their paper with a number of lantern slides and also exhibited a large number of welded articles and component parts of the welding apparatus. A complete set of portable apparatus was on view and its operation was demonstrated, the welds made in horizontal, vertical, and overhead positions being very successfully carried out; a good weld was also made under water for the first time in public.

In the course of the brief discussion that followed the reading of the paper, the co-patentees of the "Cyc-arc" system were congratulated upon having overcome the many difficulties which they had encountered in the course of their work. It was pointed out that metals of different classes could also be welded together electrically by the Thompson method, and the importance of obtaining the correct shape of the surfaces to be welded was mentioned. One speaker mentioned a demonstration of the "Cyc-arc" process he had witnessed some time ago, and testified to the strength of the welds that were made therewith. Another had hopes that a machine would be produced before long that would give even better results so far as efficiency and cost were concerned, and in reply Mr. L. J. STEELE explained that they had tried to weld aluminium by their new process with moderate success; the chief fault was the lack of mechanical strength. They did not claim to be the first to weld different classes of metals, but what they did do was to weld together metals of widely different size and melting points. The "Cyc-arc" system had, of course, its limitations like any other method, and he preferred not to give definite cost figures at the moment, but hoped to do so later. With regard to the polarity, they preferred to make the stud to be welded positive, as a better weld resulted, but they could weld with either polarity, and that was one of the reasons why they anticipated that the use of a.c. would be attended with equally gratifying results as d.c.

LEGAL.

TRYAD CO., LTD., v. FRANCO ELECTRICAL CO., LTD.

By this action, concluded by Mr. Justice Coleridge in the King's Bench Division on December 1st, the plaintiffs claimed damages against the defendant company for failure to deliver a certain model which plaintiffs had ordered in July, 1920.

Mr. BARRINGTON WARD, K.C., appearing for the plaintiffs, said that the chief question to be tried would be as to what damage the plaintiff company had sustained by reason of the defendants' failure. The matter started in the early part of 1920. The plaintiffs, who were advertising agents, were the inventors of an ingenious device, electrically operated, which showed the name of the person they wished to advertise. They had a model made with which they were not quite satisfied, and a friend introduced them to a director of the defendant company named Brackensley. They took with them the model and told Mr. Brackensley that they were not satisfied with it, and told him what they wanted. They said they wanted a model properly made, the details of which they gave, and Mr. Brackensley was asked whether his company could undertake the work. Mr. Brackensley assured them that there would be no difficulty in doing it. The question then was as to the time in which the model could be made. The plaintiffs pointed out that dispatch was vital to them, and they were assured that there would be no difficulty about that. Mr. Brackensley said that they would require the model in six weeks, and it was agreed that it should be made within that time, but it was not delivered in time.

The defence was that no time at all was mentioned, and it was left to the defendants to do their best and produce the model as soon as they possibly could.

His LORDSHIP, after hearing evidence on both sides, in the course of his judgment, said he was satisfied that time was mentioned, but he doubted very much whether anything more was done than to mention six weeks in a letter. In that letter plaintiff said "we understand that the model should be ready within six weeks from this date (July 15th), but plaintiffs' original story was that it was to be within six weeks from July 8th. That showed plaintiffs' views were capable of alteration. His LORDSHIP did not think there was a binding contract to deliver within six weeks, and the question remained as to delivery within reasonable time. From the evidence it appeared that a period of from eight to nine weeks would seem to be a reasonable time. The plaintiffs were

going to exhibit the model at an exhibition to be held at the White City, and the defendants promised that it should be ready in time to do that. The plaintiffs then issued circulars and engaged a stall at the exhibition at the White City, which lasted from November 29th until December 3rd. They hoped for good financial results as the result of the exhibition of their model at the White City. It was a device for lighting shop windows. It was portable, small, adjustable, and not inflammable, and would work in such a way as would attract the attention of the public to such windows. Defendants, it seemed, put out the making of the model to sub-contractors. When the exhibition came along the model was delivered. There was only an alternating current at the White City, and when the model came to be placed in position it was found that the alternating current was useless for the working of the model. Defendants then suggested that a motor engine should be used somewhere where the public would not see it, saying it would give the public the impression that the model was being operated by electricity. Plaintiffs, however, and quite rightly too, said his Lordship, would not agree to that. The consequence was that the exhibition went by without the plaintiffs getting the buyers they anticipated. His Lordship said he was of opinion that defendants did not supply within a reasonable time. As to damages, that was a more perplexing part of the story, but on the whole he had come to the conclusion that plaintiffs might have sold 50 at a profit of £5 each. He therefore gave judgment for the plaintiffs for £250, with costs.

FATHER AND SON IN BUSINESS.

In the Mayor's and City of London Court, last week, before His Honour Judge Atherley-Jones, K.C., Mr. Charles Brannan, receiver of D. Rose (Machine Supplies) Co., Ltd., 9 & 10, Cheapside, claimed £14 0s. 6d. against Mr. Lewis, 247, Mile End Road, for electrical fittings supplied. Mr. Harry Strouts appeared for the plaintiff, and said that the plaintiff company carried on business for the sale of sewing machines and electrical goods. Two or three years ago they sold a sewing machine to the defendant, for which he paid. He was then carrying on business at Church Lane, Whitechapel. The man now appearing as the defendant was the father of the man who was really sued, and who was an electrical engineer. Lewis, junior, ordered the electrical goods now sued for, and took them away and used them in his business. He had promised payment. Now the father came to the Court, but he was not the defendant. The son had been supplied with previous lots of electrical engineering goods, and the father must have known the summons was for the son. Lewis (Senior) said that the case was a very peculiar one. The summons was thrown into his shop, and before he could explain that he was not his son the man ran out of the shop. He protested about being summoned. His name was Harry Lewis and his son's was Aaron. Two of his sons were in the electric lighting business. His son Aaron was not quite 21 years of age. He was not financing his son. The case was adjourned for a month for the son to be added as a co-defendant, and the costs were reserved.

ARC WELDING ELECTRODES.

In the matter of letters patent No. 142,934, granted to E. H. Jones and Alloy Welding Processes, Ltd., a motion was heard in the Chancery Division on November 29th by Mr. Justice Sargant by which a rectification of the specification by amendments relating to certain wiring, &c., was sought.

The Hon. R. STAFFORD CRIPPS, appearing in support of the motion, said that the rectification proposed simply related to the striking out of certain paragraphs, and the other side (for whom Mr. F. Hunter Gray appeared) thought it a proper amendment to be made. The patent was for improvements relating to the manufacture of electrodes for depositing metals by the electric arc which are composed of metal wire or rod covered with a slag-forming material. None of the amendments, if allowed, would make the invention substantially different, as they were by way of explanation only.

HIS LORDSHIP: You can take your order with leave to apply.

WORKMEN'S COMPENSATION CASE.

At West Hartlepool County Court on the 2nd inst., the Judge agreed to an award of £100 by consent in connection with the application of Augustus E. DeQuincy, of South Road, for compensation from the Mayor and Corporation of West Hartlepool. It was stated that applicant was employed at the electricity works in Burn Road last January, when he received injuries in consequence of an electric shock. He was given light work about March, and received full wages.

POSTMASTER-GENERAL v. MAYOR AND CORPORATION OF LIVERPOOL.

In the Divisional Court of the King's Bench judgment was given in favour of the Postmaster-General. Leave to appeal was granted to the respondents in view of the public importance of the case.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

(compiled expressly for this journal, by MESSRS. SEFTON-JONES, O'DELL and STREPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

- 30,654. "Device for grinding commutators." W. K. Cooper. November 17th.
- 30,670. "Electric heating apparatus." R. Bergeon. November 17th. (France, November 25th, 1920.)
- 30,698. "Rechargeable motive power for generating electricity." J. T. Newman. November 17th.
- 30,692. "Four-way foot-control switch for electric motors for dentistry, &c." W. H. H. November 17th.
- 30,702. "Electric gaslighters." J. R. Quinn. November 17th.
- 30,704. "Electric gaslighters and gas sockets." H. Weld-Blundell. November 17th.
- 30,725. "Electric ceiling roses." A. B. Goldsmith. November 17th.
- 30,730. "Means for causing electricity to be supplied to instruments or circuits." A. R. Angus. November 17th.
- 30,740. "Electric heaters." A. H. Darker & J. Stone & Co., Ltd. November 17th.
- 30,751. "Electric heating apparatus of the thermo-siphon type." E. Albano and C. De Mattei. November 17th. (Italy, May 10th.)
- 30,752. "High-voltage slot-windings of electrical machines, and process for manufacture thereof." Akt.-Ges. Brown, Boveri & Cie. November 17th. (Switzerland, December 16th, 1920.)
- 30,757. "Telephone systems." Siemens & Halske Akt.-Ges. November 17th. (Germany, November 23rd, 1920.)
- 30,759. "Telephone systems." Relay Automatic Telephone Co., Ltd. Compagnie Generale de Telegraphie et de Telephonie sans Fil. November 17th.
- 30,783. "Electric connectors." J. H. Brown & E. Scott. November 18th.
- 30,801. "Supporting-means for electric sound-producing horns." Clear-Hooters, Ltd. November 18th.
- 30,843. "Transformer for wireless telegraphy." U. Beaton. November 18th.
- 30,850. "Printing telegraphy." Western Electric Co., Ltd. (Western Electric Co., Inc.) November 18th.
- 30,852. "Electro-metallurgy or electro-deposition of metals." A. Waldberg. November 18th.
- 30,860. "Self-supporting electric coils." W. W. Burnham. November 18th.
- 30,861. "Induction coils." W. W. Burnham. November 18th.
- 30,877. "Telephones." Siemens & Halske Akt.-Ges. November 18th. (Germany, December 29th, 1920.)
- 30,879. "Apparatus for transforming alternating into direct current and vice-versa." A. C. Norman. November 18th.
- 30,885. "Electric instruments." British Thomson-Houston Co., Ltd. (General Electric Co.) November 18th.
- 30,907. "Duplex, &c., telegraphic systems." H. W. Sullivan. November 18th.
- 30,930. "Electrically-heated smoothing-irons, kettles, &c." C. A. Schierwater. November 19th.
- 30,935. "Electric incandescent lamp holders." R. L. Aspden. November 19th.
- 30,965. "Utilisation of X-rays." H. J. Monson. November 19th.
- 30,968. "Electric heaters." British Thomson-Houston Co., Ltd. (General Electric Co.) November 19th.
- 30,972. "Ignition and lighting set for motor vehicles." H. G. C. Fairweather (Soc. G. Doue, O. Durand & Cie.) November 19th.
- 30,973. "Protecting device for electric installations." E. C. R. Marks. (S. A. E. Soc. Anon.) November 19th.
- 30,983. "Electric bells, gongs, &c." C. G. Lawson. November 19th.
- 30,984. "Electrically-operated horns." M. F. L. A. Aymard. November 19th.
- 30,993. "Electrical recording and reproduction of sound." S. G. Brown. November 19th.
- 30,994. "Method of multiplication of phases of an alternating current network." E. C. R. Marks (S.A.E. Soc. Anon.) November 19th.
- 31,006. "Portable electric lamps." C. Hyland. November 21st.
- 31,014. "Electric transmitters." B. A. Pilkington. November 21st.
- 31,021. "Insulated connector for electric conductors." H. V. Owen, F. G. Ounce, and M. J. Railing. November 21st.
- 31,027. "Electromagnetic apparatus for recording sound." A. F. Sykes. November 21st.
- 31,033. "Electric storage battery containers." G. Fuller and Fuller's United Electric Works, Ltd. November 21st.
- 31,043. "Electric ignition timers or distributors for internal-combustion engines." V. Shearer. November 21st.
- 31,057. "Electrodes or anodes for prevention of corrosion, &c., in steam boilers, condensers, &c." V. H. Cruickshank. November 21st.
- 31,060. "Electric excess-voltage cut-outs." F. Muller. November 21st.
- 31,060. "Instrument for measuring or indicating wattless component of alternating currents." Chamberlain & Hookham, Ltd., and S. James. November 21st.
- 31,063. "Electric heat radiators." A. J. Ellis and J. C. Vines. November 21st.
- 31,095. "Telephone instruments." Automatic Telephone Manufacturing Co., Ltd. November 21st. (United States, December 7th, 1920.)
- 31,096. "Apparatus for overcoming effects produced upon telegraph, &c., lines by vicinity of single phase currents." F. Carles. November 21st. (France, March 4th.)
- 31,121. "Mounting armatures of electrical machines." Forges et Ateliers de Constructions Electriques de Jeumont. November 22nd. (France, November 23rd, 1920.)
- 31,122. "Commutation of direct-current machines." Forges et Ateliers de Constructions Electriques de Jeumont. November 22nd. (France, November 23rd, 1920.)
- 31,147. "Terminal ends for electric wires and cables." L. F. Summers. November 22nd.
- 31,169. "Electric cookers and radiators." I. S. Dalgleish and E. Schattner. November 22nd.
- 31,225. "Electric instruments." British Thomson-Houston Co., Ltd. (General Electric Co.) November 22nd.
- 31,229. "Automatic electric switches." R. P. Myers. November 22nd.
- 31,249. "Electric switches." Western Electric Co., Ltd. November 22nd. (United States, November 26th, 1920.)
- 31,250. "Electric starters for internal-combustion engines." R. Haddon (F. Neumeier Akt. Ges.) November 22nd.
- 31,270. "Apparatus for electrical etching." Week's Photo Engraving Co., Inc. November 22nd. (United States, April 2nd.)
- 31,271. "Liquid cooled electric machines." M. Seidner. November 22nd. (Germany, December 28th, 1917.)
- 31,274. "Electrical switching devices for sound-warning signals." J. F. Monnot. November 22nd.
- 31,275. "Electrical etching." Week's Photo Engraving Co., Inc. November 22nd. (United States, April 25th.)
- 31,312. "Electric horns of motor vehicles." W. Turton. November 23rd.
- 31,325. "Electric fuses or cut-outs." J. Schull. November 23rd.
- 31,332. "Electric fuses." E. G. Gairard and A. H. Railing. November 23rd.
- 31,353. "Production of unidirectional electric currents from alternating currents." N. Lea and Radio Communication Co., Ltd. November 23rd.
- 31,354. "Generating and detecting sound waves in water." W. F. Rawlinson. November 23rd.
- 31,355. "Generating and detecting sound waves in water." W. F. Rawlinson. November 23rd.
- 31,366. "Electrically-operated cranes, hoists, and the like." W. H. Scott and J. Bentley. July 12th, 1920. (Addition to 164,784.) (171,123.)
- 31,371. "Telephonic call systems." R. C. M. Hastings. June 10th, 1920. (171,129.)
- 31,375. "Electric conduit boxes." M. J. Railing and T. Taylor. July 2nd, 1920. (171,133.)
- 31,387. "Wireless signalling apparatus." Radio Corporation of America. April 24th, 1915. (146,333.)
- 31,390. "Method of and apparatus for receiving radio-signals." J. L. Hogan, jun. November 27th, 1916. (146,997.)
- 31,398. "Electric systems for the transmission of power, and multi-speed induction motors suitable for use therein." British Thomson-Houston Co., Ltd. May 31st, 1917. (147,029.)
- 31,383. "Sparking plugs." H. R. Bellings. July 7th, 1920. (171,137.)
- 31,362. "Telephone and the like systems." M. Latour. June 25th, 1915. (147,750.)
- 31,321. "Electric current controlling devices." V. G. Apple. January 17th, 1919. (147,733.)
- 31,905. "Cascade high-frequency amplifiers." Ges. fur Drahtlose Telegraphie. July 22nd, 1918. (147,853.)
- 30,228. "Manufacture and operation of vacuum tubes." Dr. E. F. Huth Ges. March 20th, 1918. (148,000.)
- 30,232. "Reels and the like for winding and unwinding aerial conductors." Dr. E. F. Huth Ges. January 16th, 1918. (148,318.)
- 30,401. "Generation of high-frequency currents." Ges. fur Drahtlose Telegraphie. January 19th, 1915. (148,446.)
- 30,444. "Electric systems and the like." Majestic Electric Development Co. December 26th, 1917. (148,481.)
- 30,506. "Slip pieces for bow collectors for electric vehicles." H. Silbermann. September 1st, 1915. (148,629.)
- 30,838. "Spark plugs for subaqueous sound signals." Signal Ges. February 6th, 1915. (148,972.)
- 30,846. "Signal transmitting devices." Signal Ges. September 25th, 1917. (148,974.)
- 30,837. "Electromagnetic sound producers and receivers." Signal Ges. August 14th, 1918. (148,976.)
- 30,837. "Device for adjusting the degree of coupling in sound receiving apparatus." Signal Ges. August 16th, 1918. (148,977.)
- 30,846. "Signal transmitting devices." Signal Ges. September 25th, 1917. (Addition to 148,974.) (148,986.)
- 32,484. "Automatic electrical chain welding machine." Firm of "Union." September 2nd, 1919. (150,390.)
- 32,892. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. August 3rd, 1920. (171,145.)
- 32,115. "Manufacture of electric rotating machines." T. Tanaka. July 11th, 1919. (152,004.)
- 32,301. "Process of and apparatus for electrically-treating foods and like products." F. S. Smith. August 6th, 1920. (171,157.)
- 32,359. "Submarine and other electrical cables." H. W. Sullivan. August 7th, 1920. Cognate application 14,079 21. (171,161.)
- 32,367. "Electrical connecting and supporting devices." Electric Outlet Co., Inc. January 10th, 1920. (157,068.)
- 32,540. "Systems of electric ship propulsion." British Thomson-Houston Co., Ltd., and J. Martin. August 11th, 1920. (171,180.)
- 32,565. "Transmitting and receiving circuits for wireless telegraphy." A. K. Macrorie and H. Morris Airey. August 11th, 1920. (171,183.)
- 32,708. "Dynamo electric machines." Soc. Anon. Four l'Exploitation des Procédés M. Leblanc-Vickers, September 18th, 1920. (151,256.)
- 32,938. "Electric motors." Hoover Suction Sweeper Co., Ltd. (H. E. Hoover). August 17th, 1920. (171,194.)
- 32,454. "Repeaters for multiplex signalling systems." Western Electric Co., Ltd. October 31st, 1919. (153,583.)
- 32,497. "Link connecting piece, especially for electrolytes." H. Hubener. February 11th, 1920. (158,859.)
- 34,331. "Electric furnaces for obtaining high temperatures." Automatic Telephone Manufacturing Co., Ltd., and F. N. Roseby. August 21st, 1920. (171,207.)
- 34,506. "Fault indicator for use in connection with electric ignition systems." F. A. A. Ellmore. August 24th, 1920. (171,214.)
- 34,632. "Electric arcs." W. H. Sturge. August 25th, 1920. (171,216.)
- 34,774. "Means for regulating alternating-current circuits." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). August 26th, 1920. (171,218.)
- 34,780. "Electric arc lamps." H. H. Thompson. March 26th, 1918. (150,354.)
- 35,626. "Magneto electric ignition apparatus." R. Bosch Akt. Ges. August 30th, 1919. (151,003.)
- 35,241. "Current regulators for incandescent lamps and other translating devices." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). September 1st, 1920. (171,231.)
- 35,907. "Permutation locking device for controlling switches or lock bolts." A. Houston and H. P. Stephenson. September 8th, 1920. (171,235.)
- 36,096. "Junction boxes for electric cables as used chiefly in collieries." Greengate & Irwell Rubber Co., Ltd., and R. Povey. September 15th, 1920. (171,250.)
- 36,447. "Electric transformers and like apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). September 15th, 1920. (171,251.)
- 36,729. "Apparatus for the automatic regulation of the ignition in internal-combustion engines." Schneider et Cie. July 10th, 1920. (166,504.)
- 37,112. "Systems of electrical distribution." British Thomson-Houston Co., Ltd. (General Electric Co.). September 26th, 1920. (171,265.)
- 38,249. "Sparking plugs." F. W. Schroeder. October 5th, 1920. (171,279.)
- 38,432. "Means for receiving wireless signals." Ges. fur Drahtlose Telegraphie. October 8th, 1919. (152,003.)
- 38,662. "Furnaces." F. Fuller, R. A. Bedford, and C. Roberts. October 8th, 1920. (Addition to 141,403.) (171,284.)
- 38,731. "Magnetic pocket lamp." A. A. Lion. October 11th, 1920. (171,285.)
- 38,952. "Process for fastening the electrodes in vacuum tubes, more especially in Röntgen tubes." Elektrische Glühlampenfabrik. "Watt" Akt. Ges. October 18th, 1919. (152,617.)
- 39,291. "Transmission of high-frequency oscillations over high-power conductors for telegraphy and telephony." Ges. fur Drahtlose Telegraphie. December 1st, 1919. (154,884.)
- 30,148. "Luminous electric discharge tubes for the production of illuminated signs and the like." M. Schmirer. October 26th, 1919. (153,004.)
- 34,744. "Sparking plugs." H. Burton. December 2nd, 1920. (171,313.)
- 34,835. "Terminals for high-tension electric cable." A. J. H. Elverson. December 10th, 1920. (171,317.)

1921.

939. "Electric gas lamps with glow discharge." J. Goosman. January 8th, 1920. (157,000.)
- 4,720. "Industrial process and of apparatus for the internal electro-plating of insulators." Soc. Materiale Elettro Traazione. February 12th, 1920. (158,809.)
- 13,952. "Wave and current motors." E. Bouchaud Praceq. March 26th, 1920. (164,803.)
- 15,062. "Electro-magnetic wave signalling systems." M. Latour. December 8th, 1915. (Addition to 147,462. Divided application on 147,462.) (164,809.)
- 17,430. "Motor vacuum pumps for high vacuum." Akt. Ges. Brown, Boveri & Cie. July 17th, 1920. (Addition to 165,400.) (166,521.)

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GERMAN AMBITIONS.

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In offering the strongest possible opposition to the specious proposal that Germany should be allowed to carry out large super-power station equipment and railway electrification work in the British Isles, we believe we have spoken as the Voice of the Industry. Among those who have the real interests of British electrical industry at heart, the proposition has no friends. The eminent English industrialist who adopted the idea which seems so clearly to have originated in Germany and to have been designed to serve German ends, admitted that he was not an electrical engineer, that it was a *dangerous* suggestion to make, and that electrical interests would have something to say against it. It must seem to some almost ludicrous to imagine that such a proposition could be thought of seriously for a moment by anybody who wished to safeguard the interests of the industry for the future. Be that as it may, the menace has reared its head, and though it may disappear because it is seen to be opposed to the interests of the industrial life of the nation, the incident, if we dare use so small a word with regard to it, must not be lost upon us. We must as an industry present a solid and unbreakable front to any such attack if it be renewed in some other form.

We sympathise with the view of those who advocate the abandoning of the war spirit now that we are at Peace, but we know only too well with whom we are asked to be friends, and with whom we are advised to resume, and substantially to extend, our pre-war relations. Unfortunately, our late enemies are indisposed, or unable, shall we say, remembering the peculiar psychology of the race, to lay aside their ambitions to gain economic and industrial supremacy by means of organisation, "a strong sense of duty," moral power, moral will, and all that sort of stuff, and we can imagine the self-congratulatory spirit with which the great industrial and financial magnates of Germany regard the agreement to be entered into with France under which they shall pay hundreds of millions of pounds of the reparation *debt* in the form of rehabilitation and equipment work in the devastated areas of France. Vast areas which were ruthlessly raked with a veritable devil's rake are to be rehabilitated by the destroyer in such a way as to provide prosperity for German trusts, shareholders, and hundreds of thousands of workpeople. We recognise as readily as anybody that France is not so industrially strong as she might have been, and it may be to her advantage to be assisted back to life again even by her aforesaid destructive foe. But, after all, the other Allies have a say with regard to such a matter, and it does seem sickening to contemplate a recovery of Germany's credit by allowing her to gain material advantage and prestige out of the repair of her misdeeds, and to enlarge and strengthen her industrial organisation by the work that she would be permitted to do.

But the matter does not end there. Assume that Germany is unable to secure the realisation of her super-power station ideas here: that is but part of her plan defeated. She looks to secure large business in France under the Loucheur-Rathenau agreement, but even that does not by any means satisfy her desires, and by moral power, will power, or whatsoever other influence we please to call it, she plans to secure the lion's share in the reconstruction of Russia. Now this is a prize worthy of a contest. There are other great manufacturing and concession-working nations besides Germany, and they will do well

to watch their interests, or Germany may realise her dreams of economic conquest and world industrialisation far more quickly than they may think possible. Germany, with her industrial magnates acting as her plenipotentiaries, will do well to recognise that Britain and America have vast manufacturing productive and constructive capacities. Press dispatches from France suggest that Herr Stinnes, in his plans for Russian reconstruction, has, in conjunction with Herr Rathenau, advanced, as the basis of negotiations recently begun in London, the idea that "Great Britain, the United States, and France" will form "with Germany a consortium for the economic reconstruction of Russia." We Allies are to find the money, transport, and raw materials for Germany, in order to ensure Germany a monopoly of the manufacture and supply to Russia of finished articles. Metallurgical industries are to be prohibited in Russia in order to safeguard this German monopoly! Russia's future as an industrial nation is to be sacrificed to the ambitions of Germany. Yet her requirements in such directions are bound to be vast beyond all possible present-day conceptions as years pass by.

The profits from the German undertakings in Russia are to be shared between the Powers forming the consortium in such a way as to ensure the payment of war reparations. Think of it all! Germany is to be loaned the money to develop her industries, and to prevent the development of those of other countries, in order that she may be able to pay the price of her misdeeds! Of course, there would be a moratorium in order that the plan could be put into execution "as a trial." And if it failed—what then? The Paris report that tells us all these interesting Stinnes-Rathenau things, winds up by pointing out that this is a German scheme—a remark that fairly takes our breath away. Who would have thought it? Then further and finally, "similar schemes have already been mooted by friends of Dr. Rathenau, notably by Herr Deutsch, a director of the Allgemeine Elektrizitäts Gesellschaft." Again, who would have thought that? Well, we frankly confess that we should, and that is really why we are referring to the subject here and now. Unless the whole British electrical industry is thoroughly wide-awake and energetic and possessed of a spirit of large enterprise, German interests may gain their ends in France and Russia too. It is not enough to hope for their electrical defeat in our own islands. The reconstruction of Russia, when it really begins, will be largely electrical, and there ought to be men in British electrical life ready to play their part and grasp the opportunities.

So serious and so widespread was the effect of the Great War upon the markets of the world that scarcely a country could be named with which British trade did not experience

either a severe reverse or an almost complete stoppage. Many of the best of Britain's former customers were gradually transformed into creditor nations, whilst with some other countries interchange dwindled practically to vanishing point. Yet throughout that period of measureless difficulty, to the trader, business with one market fluctuated but little with regard to values; in fact, the British Empire as a whole not only maintained its position in the market in question, but even increased its share from 53 to 57 per cent. That market was India. Some very striking figures may be quoted here: In 1913, the United Kingdom shipped to India over £70,000,000 worth of goods of home produce, of which no less than £67,000,000, i.e., 96 per cent., represented manufactured articles. In the year 1917 the figures were £60,000,000 and £57,000,000 respectively; in 1919, £70,860,000 and £67,100,000. In 1913, 16 per cent.,

and in 1917, 13 per cent. of the exported manufactures of the United Kingdom were shipped to India.

Somewhat later figures have been published by the Government of India, according to which, in the twelve months ended in March, 1920, the value of India's imports of merchandise (exclusive of Government stores) from the United Kingdom amounted to £105,000,000. Truly, therefore, India would appear to be a promising market. For the foregoing reasons, exceptional interest attaches to the review by Mr. T. M. Ainscough (H.M. Senior Trade Commissioner at Calcutta) of the conditions and prospects of British Trade in India, which is summarised on another page. Having regard to the possibility of a protectionist policy being generally adopted in India, Mr. Ainscough's remarks on the advisability of opening branch factories may be studied with some advantage, even by those manufacturers whose plans have hitherto been frustrated.

The Imatra Falls and Russia.

It must be at least ten years since a great scheme was brought forward for the utilisation of the Imatra falls of the Vuoksen in connection with the proposed electrical transmission of power to Petrograd, and, among others, Belgian concerns were interested in the project. The control over the falls, however, now lies in the hands of the Finnish Government, which contemplates proceeding with the work of installation at some future date for the supply of light and power in Finland, including the working of the State railways. In this connection attention may be drawn to the fact that Swedish hydro-electric experts recently paid a visit to Finland for the purpose of inspecting the site of the projected hydro-electric works, the party including Mr. Ekwall, engineer and principal of the Hydro-Electric Administration in Sweden. Mr. Ekwall, in the course of an interview with a Stockholm newspaper, is reported to have stated that before the war the question of the use of the power of the Imatra was ripe, and a big scheme with this object in view was prepared by the Hydraulic Construction Bureau at Stockholm under the guidance of Prof. Richerts. Since then the Finns have worked out an alternative project, and Mr. Ekwall has been given the honorary commission to solve the problem. This concerns the utilisation of the enormous water powers of the Vuoksen, which, after the regulation of the Saimen, are expected to yield from 600,000 to 700,000 h.p., whereas the Swedish works at Trollhattan at present only furnish 100,000 h.p. Concerning the question as to the present attitude of Finland towards the transmission of power to Petrograd, which was chiefly the basis of the original scheme, Mr. Ekwall does not feel disposed to express any opinion as the matter is of a delicate nature, and is also partly of a political character. The present scheme aims at the utilisation of 150,000 h.p. in the first place, which would be consumed in Finland, although it is considered that it would be more economical to install plant for 300,000 h.p. at the beginning.

It has transpired from other sources that opinions are divided in Finland as to the participation of Russia in the matter of the utilisation of the Imatra falls. In some quarters this idea is entirely rejected, while in other circles it is pointed out that Finnish-Russian co-operation would be of advantage to Finland and would strengthen her position. It is considered to be quite certain that the Russian capital as well as the whole of the North-Western district is dependent to a high degree upon the power of the Vuoksen, and it is said that the Russian industries which have been developed in this district on the basis of cheap supplies of English coal are in great need of electric power, whilst no large sources of power other than those in Finland are available. It is, therefore, deemed to be only natural that the colossal sources of power of the Vuoksen are attractive also to the Russians.

THE MIDLAND ELECTRIC MANUFACTURING CO.'S WORKS.

The difference between "natural history" and "natural philosophy," Lord Kelvin used to say, is *measurement*. Until precise methods of measurement are devised and applied, an art remains an "art" and not a science. Scientific methods are essentially methods involving measurement. But measurement alone is not sufficient to constitute a science; the data obtained by measurement must be correctly interpreted. Thus it is necessary (1) to devise methods of measurement, and (2) to ascertain the meaning of the measurement, in order to place a subject on a scientific footing.

Doubtless every art is capable of being subjected to measurement, but many still remain in the stage of guess-work. This is largely true of the management



FIG. 1.—SALES CORRESPONDENCE OFFICE.

of manufacturing industries. Successful management necessitates the production and sale of goods at a lower inclusive cost than the price obtained for them. The latter is a known figure; the former is the resultant of very many factors—raw material, labour, works and establishment charges, and selling expenses. Unless all these factors are ascertained by measurement, the managers must necessarily arrive at their values by processes of estimating, not to say guess-work; and if the values are consequently known only approximately, accurate deductions from such data are quite impossible. But if each item that goes to make up the cost of the finished product can be definitely measured, the situation is completely changed; scientific method can be substituted for approximation and "rule of thumb," and correct inferences can be drawn from the ascertained data. If, moreover, the measurement is continuous, so that fresh data are available every month, week, or even day, a continuous watch can be maintained over the manufacturing processes, and the effect of every change in method of manufacture, every hitch in the routine, every variation in the quality of workmanship or material, can be identified and duly appraised.

This seems a high ideal at which to aim; but one should always have an ideal and strive to approach it. Granted that in many industries the conditions do not permit of the close detailed costing that is necessary for this purpose, the fact remains that other industries allow of it, particularly those in which large numbers of articles of a few standard types are manufactured on repetition lines. Our purpose in this article is to give a brief description of a factory in which the principles to which we have referred are carried out to the fullest possible extent with the most beneficial results. The factory is that of the Midland Electric Manufacturing Co., Ltd., of Birmingham, which we recently were privileged to visit; this company manufactures ironclad switchgear for pressures up to 500 volts and for currents from 10 to 200 amperes, and confines its

operations strictly to a limited variety of standard groups—some 16 or 17 in number.

The business was founded in 1908, and in the early days it largely consisted in the manufacture of switchboards and distribution boards, in which a notable feature was the well-known "Kantark" fuse. The outbreak of war, however, led to concentration on ironclad switchgear, for which there was an immense demand, and in 1916 the premises were considerably extended; at the same time the manufacturing methods were radically changed, and the managing director, Mr. W. L. Barber, decided to adopt a comprehensive system of records and accurate costing—in a word, to apply scientific method to every branch of the business. An immense amount of time and labour was devoted to the organisation of the system, which was gradually developed and brought to completion in 1919.

Before dealing with this aspect of the business we shall give some particulars of the works, to which the accompanying illustrations relate. The company has secured the ownership of the whole of the block of which the works form a part between Barford Street and Rea Street, and plans have been prepared for successive extensions in accordance with perfectly definite aims, the buildings being laid out and positions allotted to the gangways and even the individual machines. But after a certain amount of progress had been made, bringing the area occupied up to 24,000 sq. ft. in 1920, the Rent Restriction Act came into force, and, by prohibiting the removal of the dwelling-houses which stood on the site, brought the extensions temporarily to a standstill. As it happened, the urgency of the need for extensions was relieved by the sudden collapse of trade towards the end of last year, and the existing accommodation suffices for the immediate needs of the business at present. The works are laid out on modern lines, a single storey with saw-tooth roofs, and the freehold site which the company has acquired for their development has a total area of 70,000 sq. ft. It is intended eventually to utilise the whole of this area.

The stores are situated in Rea Street, where all raw material is weighed and examined on delivery. The



FIG. 2.—TOOL ROOM.

principle adopted by the company is to purchase all components which can be made to better advantage in other works; such are iron and brass castings, screws, porcelains, and hot-pressed metal parts. Much use is made of extruded brass strip in special profiles to suit the requirements of the work, and brass castings are being replaced by this material and hot stampings.

As many of the cast switchboxes are of large size, and are delivered in large quantities, roomy iron bins and racks are provided for their storage. "Components" form the basis of the whole manufacture, and as over

3,000 different components are required for the company's standard products, a correspondingly ample provision of wooden shelving, &c., has been made. Components and finished products are handled in trucks on skids, moved about on trolleys, which can be brought under them and raised to lift the skids clear of the floor. The whole of the components are housed in the above-mentioned store.

Between the Rea Street stores and the dispatch department on Barford Street are the various workshops where the individual components are manufactured and the finished products are assembled.

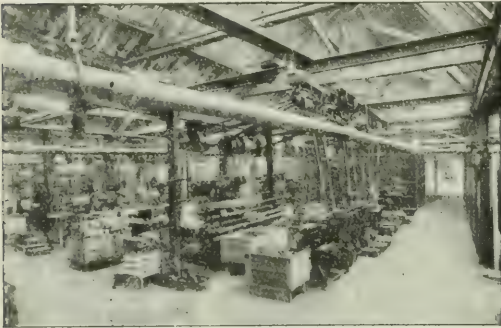


FIG. 3.—VIEW IN MACHINE SHOP.

Throughout the works (which are driven by electric power derived from the Corporation mains) the utmost use is made of templets and jigs, some of which are very elaborate, and a large tool shop is provided for their preparation and storage. Much use is made of special-purpose machines and labour-saving devices; for example, where brass parts are attached to porcelains, the screws are inserted and driven home in some cases by self-feeding machines, and in others by automatic hand screw-drivers. Enamelled parts are sprayed or dipped, and stacked on trucks, which are



FIG. 4.—M.E.M. GLASGOW IRONCLAD DOUBLE-POLE SWITCH

wheeled bodily into the gas-heated ovens. Many of the lighter parts are formed to shape by stamping and pressing, and numerous machines are provided for this purpose; capstan lathes, &c., are also freely used.

The works are heated with a system of hot-water piping, and are well lighted and ventilated.

Special consideration is given to the physical comfort of the workpeople and to their various methods of recreation in their leisure time; the arrangements for the latter are entrusted to the hands of committees, on which the supervisory staff is represented to provide a

link with the management. Tea is provided daily for the whole of the employés at a nominal price, and facilities for warming and cooking food are placed at their disposal. Lectures, concerts, &c., are periodically arranged, and are well attended. So successful have been the endeavours of the management to develop and maintain harmonious relations with the employés, that "labour troubles" are practically unknown in these works.

The accompanying illustrations show some of the most typical products of the company. Throughout the range of its manufactures the Admiralty practice

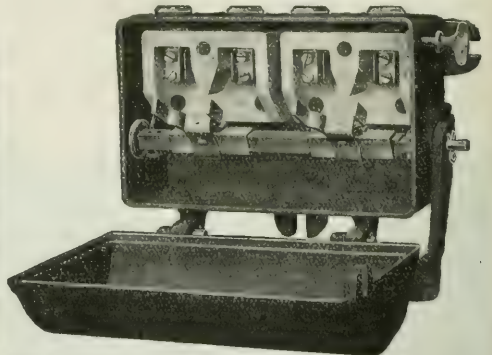


FIG. 5.—PARAGON IRONCLAD DOUBLE-POLE SWITCH OF LIGHTER TYPE FOR FACTORY USE.

is followed of insulating with mica and porcelain, the switch parts being mounted on steel rods or bars with mica insulation; special attention is given to ease of assembling and facility of access, the requirements of the installer being kept in view. The fuseboard shown in fig. 6 can be easily disassembled in 10 seconds. In that shown in fig. 7, each of the fuse banks can be pulled forward and turned over for wiring, or entirely removed, after withdrawing two screws. With each fuseboard a record of the correct fuse-wires is enclosed. Simplicity of construction is a marked feature of the designs; for example, a small cut-out box consists of two castings, which are self-

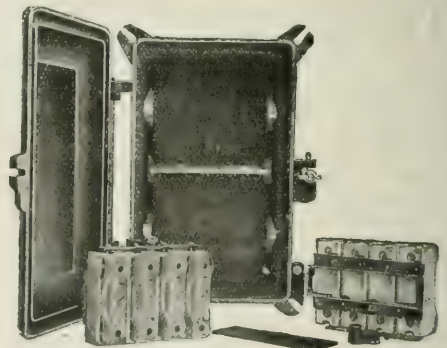


FIG. 6.—M.E.M. IRONCLAD DOUBLE-POLE FUSEBOARD, 30-AMPERE WAYS, DISASSEMBLED.

locking and self-locking, so that no machining is required, and when it has been enamelled it is complete.

New designs are considered by a committee of heads of departments, and are thoroughly tried out before manufacture is resolved upon. In the drawing-office highly systematic methods are adopted; every component is drawn on a separate sheet of standard size, the tracing of which is filed conveniently for reference, blue prints being used in the shops. When a design has been adopted, the mechanism is mechanically tested exhaustively, a switch, for instance, being closed and

opened as many as 500,000 times. The method of production of each part is then settled, time studies being carried out and a standard working time arrived at, to which are added allowances for incidental operations and for rest, and these times, when once determined, are never changed unless the method of production or the design is changed. A premium bonus system is in force, under which the workman is credited with half the time saved on the standard time allowance; this system has proved very satisfactory to both parties.

In addition to the committee on design, there are periodical meetings of the heads of the staff to discuss matters which arise, and sub-committees to which specific questions are referred for investigation, a procedure which has proved most helpful.

Turning now to the system of records adopted in the works, we must say at once that a complete account of it would occupy far more space than we could devote to the subject; we have never met with an equally elaborated system in practical operation, or indeed anything approaching it, and in order to acquire an intimate knowledge of its working many days would have to be spent in studying the details of the system. We shall therefore confine our attention to an outline of the scheme: The criticism that it is unduly elaborate is met by the reply that it has efficiently fulfilled its purpose, and has materially reduced the cost of production. Within the last two years so marked an improvement has taken place that

The ideal aimed at in conducting the business is that all goods shall be delivered at once from stock, and this is so far achieved that 75 per cent. of orders are filled in this way. Hence it is necessary to maintain a stock of each item, which is never allowed to fall below a certain minimum before a fresh batch is put in hand. This involves the issue of a "sanction" for a quantity which, in the case of the smaller devices, comprises many thousands of complete switches or fuses. The requisite supplies of raw material, castings, screws, &c., are ordered to comply with the sanction—raw materials are never ordered for stock, but only for a definite "sanction"—and work is commenced on the components, which pass into store as they are completed. The term "components" is not restricted to individual parts; porcelains fitted with fuse-clips, for example, whilst built up of components, themselves become components for the assembly shops. No work order is released until all the necessary material is ready in stock, and in this respect, as in many others, the material planning office, which is regarded as the "brains of the works," plays an important part. The purchasing department sends a copy of each order to the stores receiving office, where the incoming materials are checked; corresponding vouchers are forwarded respectively to the records office, and to the material planning office, where a card index of details for each of the 16 sanctions now in progress is kept, and where the staff is able to trace the exact location of all materials and components and the progress made with each works order. The completion of every batch of products is reported to the material planning office, which releases them for sale by order to the dispatch department or passes them into stock as the case may be.

When a works order is released for fulfilment, the whole of the components required by each workman are conveyed to him, with the appropriate "tally," and he wastes no time in journeys about the works. Several inspectors are constantly on duty to ensure that avoidable delays shall not occur.

All tools are controlled by a system of card indexes, which shows not only the purpose of a tool, but also its condition, and its position at any time; the preliminary study carried out by the production engineer not only determines the time to be allotted to each operation, but also specifies the tools, jigs, &c., that will be required by the operator. All workmen's time is booked up to specific jobs, and idle time is all checked; the amount of time saved, and the corresponding bonus earned (almost invariably the work is done in less than standard time) are entered on cards, which also provide for the allocation of the "burden"—standing charges which in the aggregate vary little with the output of the works, but which vary considerably in respect of each job, in accordance with the time spent on it, and with the number of items over which they have to be distributed.

It is here that the system reaches its highest development; unless the expense burden can be accurately allocated, the true cost of the products cannot be correctly ascertained. But in these works the subject has been closely studied, and the data used are constantly being revised and checked in the light of actual results; every line of work is accurately costed to a minute fraction of a penny, so that the management is constantly kept informed as to the actual position, the progress made in reducing costs from week to week, and the opportunities that remain open for improvement. The reduction in labour of 40 per cent., already mentioned, due to the operation of the system, in itself would justify its introduction.

Seeing that the annual expense burden which is to be distributed over the whole of a year's output cannot be accurately known in advance, it is necessary to base it upon previous results, and to make such allowance as experience and judgment show to be necessary. If the output is increasing, naturally the burden per item diminishes, and *vice versa*. This is the most difficult

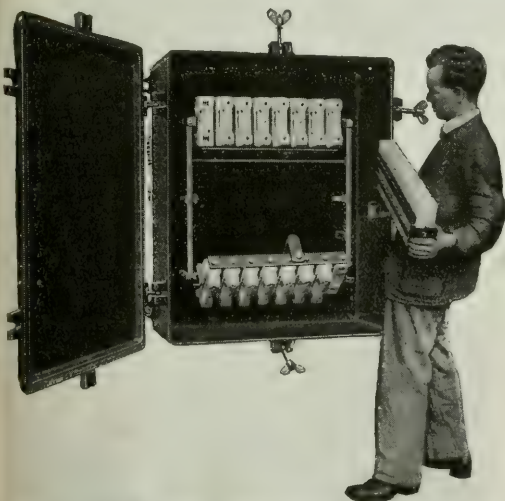


Fig 7.—M.E.M. Ironclad Triple-Pole Fuseboard with 100-ampere ways, showing one of the fuse banks pulled out on the telescopic carrier and swung over for access and wiring. The simplicity of entire removal of the fuse banks is also shown.

six men can now produce the same output as previously required ten men, and the costing system is of such a nature that the products are effectively controlled as regards both price value and quality. Every batch of articles which passes through the works is carefully costed, and any variation of costs is at once brought to light and investigated by the Costs Committee. Such variations may be due to a variety of causes—the stoppage of a machine, the absence of a foreman, material of lower quality, &c.—and in every case the cause is sought and traced home to its origin.

In carrying out the system, the accountant's office, the works manager's office, and the material planning office are mainly concerned. The last two are situated in the works, and, in addition, each foreman has an office fitted with racks for cards and provided with a telephone.

part of the system to operate, but in these works the methods devised for dealing with it have been very highly elaborated, to such an extent, in fact, that the cost accounts are balanced from week to week, and any discrepancy is at once brought to light. Thus the management knows at any time not only whether the business is being carried on at a profit, but also the rate of profit which is being earned. In many businesses it is impossible to gauge with certainty the results of the year's trading until the year is complete and the accounts have been made up—a vastly inferior position to be in. That a large costing and accounting staff, and an elaborate system of card indexing and card recording, are necessary goes without saying; but the company is satisfied that the system is not merely well worth the trouble and expense involved—it is indispensable to the obtaining of the maximum production at the minimum cost.

Similar orderly methods are pursued in the external relations of the company; every order is dealt with in such a manner that the date promised for delivery is kept in view, the actual progress made in filling it is constantly known, and at every stage any inquiry that the customer makes can be at once replied to. Machines are freely used for computation, and every process is more or less self-checking. Prices are catalogued in £ and decimals of a £ for foreign purchasers, to facilitate quick conversion into local currency in accordance with the exchange rate of the day.

The latest development in a technical sense is the production of a new range of switches, together with many improvements on the existing patterns of fuse and distribution boards. All switches are put through a flash test at 2,000 volts. Special care is taken to ensure that the finished products reach the customer in good order; small articles are packed separately in cardboard cartons labelled with the capacity and voltage of the contents, whilst larger ones are wrapped in brown paper and labelled. The output of finished products is two to three tons daily, but owing to the precision and order with which the work is carried on, there is no sign of hurry or confusion in any part of the works. It should be observed that although the organisation is so highly developed, the system in no way restricts the introduction of new designs or the improvement of old ones; the advantages of standardisation in expediting output are secured without the sterilisation of inventive ingenuity. A tour of the works, and an inspection of their organisation, is an experience of great interest, and leaves the impression that scientific management is not here a mere fetish, but an ideal at which the company continually aims; nothing, indeed, struck us more than the keen interest displayed by the leading members of the staff in the working of the system, and the pardonable pride with which they demonstrated its efficiency. But anyone who obtains permission to study the details of the system may be warned that it cannot be done in a day.

THE SCAR HOUSE HYDRO-ELECTRIC SCHEME.

BRADFORD WATERWORKS 300-KVA INSTALLATION.

THE Bradford Waterworks Committee possesses storage reservoirs for water supply in the Valley of the Nidd, and recently it has been found necessary to construct a further reservoir at Scar House, near the head waters and just below the existing Angram Dam, in order to provide additional storage capacity.

The construction of the new reservoir involves the building of a very large and important masonry dam, which will be known as the "Scar House Dam," and in order to provide the necessary energy to operate the cranes, blondins, crushing plant, and various machinery involved in this construction, Mr. Lewis Mitchell, M.Inst.C.E., F.G.S., waterworks engineer to the Bradford Corporation, with characteristic foresight, conceived the idea of utilising the water flowing from the Angram Dam Reservoir to operate a hydro-electric plant for this purpose. The water from Angram flows into the River Nidd, and about two miles down stream from the Angram Dam it is conveyed from that stream into the Rainstang Tunnel, through which the water passes to the Bradford service reservoirs.

Messrs. Vickers, Ltd., secured the contract for carrying out this work in November, 1920, and the inauguration of the plant took place on December 7th.

The two Francis turbines installed were made by Messrs. Vickers, Ltd., at Barrow-in-Furness, to the designs of their associated firm, Messrs. Ateliers des Charnilles S. A., Geneva (late Piccard Pictet), and each is designed to operate under a net head of 168 ft., giving an output of 295 b.h.p. and a discharge of 19.5 cu. ft. per sec. at a speed of 1,000 r.p.m., but owing to the position of the turbines in the water level in the Angram Reservoir, the turbines are also capable of working under a head of 207 ft., giving the same output but a correspondingly reduced discharge, or under a head of 148 ft. with correspondingly reduced output.

The guaranteed efficiency under a net head of 168 ft. was as follows, allowing a tolerance of plus or minus 2 per cent.: At full load (295 b.h.p.), 79 per cent.; at $\frac{2}{3}$ load, 80 per cent.; at $\frac{1}{3}$ load, 79 per cent.; at $\frac{1}{4}$ load, 76 per cent.; but when tested recently the efficiency of the turbine at full load worked out at 86.5 per cent.

The turbines are governed by two oil-pressure

governors (Piccard Pictet patents), which work each in conjunction with a relief valve; that is to say, each turbine has its own governor and its own relief valve owing to the considerable length of the pipe-line used. The result of this is that, if the load is suddenly thrown off, the relief valve opens very quickly, beginning to open before the governor commences to close the turbine gates, after which the relief valve closes very slowly, taking between 80 and 100 seconds to do so after opening in from 2 to 3 seconds, thus ensuring that the over-



FIG. 1. EXTERIOR OF GENERATING STATION.

pressure in the pipe-line will not exceed about 14 per cent. of the final static head.

The general arrangement of the generating sets is well shown by figs. 2 and 5.

In the power house each of the water turbines drives by means of a semi-elastic coupling, an open type three-phase generator with an over-hung exciter; each machine is capable of giving a continuous output of 250 kVA at 0.8 power factor, 2,400 volts, 50 cycles, 1,000

r.p.m., and each generating set has been tested at an over-speed of 80 per cent. The excitation voltage is 110, and the efficiency at full load and 0.8 power factor of each generator is 93 per cent. A flywheel is provided for each generating set in order to prevent the use of the more expensive electrical machines which would be necessary if the whole of the flywheel effect required were embodied in the rotating members of the alternators.

The energy is conveyed to the switchboard by single-core, rubber-insulated, 3,300-volt Association

meet the requirements of the Bradford Corporation Waterworks engineers on the site, the lighting is to be done at 110 volts direct current, and the sub-station comprises the following equipment:—

The h.p. line is brought in to a cubicle which controls a 20-kVA transformer that feeds a 20-kW motor generator, which can either charge the battery or supply energy for lighting direct. As a stand-by and for use when the water turbine is not running for any reason, a belt-driven 20-kW generating set is provided with a 35-h.p. Vickers-Petter's semi-Diesel engine fitted with an electric starter and compressed air apparatus, to run on crude oil; this generating set is also capable of either charging the battery or supplying the lighting circuits direct.

As an annexe to this sub-station there is a battery room containing 60 Chloride accumulator cells in glass boxes, which, when fully charged, will give a discharge of 979 ampere-hours in ten hours to a final pressure of 1.83 volts per cell, 816 ampere-hours in five hours to a final pressure of 1.78 volts per cell, or 701 ampere-hours in three hours to a final pressure of 1.75 volts per cell. The ampere-hour efficiency of the battery is 90 per cent. at all rates, while the watt-hour efficiency is 75 per cent. at the ten-hour rate.

Portions of the pipe line between the power house and the Angram Dam are shown in figs. 3 and 4.

There are two connections to the Angram Reservoir, and an air valve is provided to free any air which may collect in the pipe, and to allow the escape of air when the pipe is being filled; this valve also prevents the formation of a vacuum in the pipe-line if the latter is emptied too quickly. The 30-inch diameter pipe is approximately 312 ft. long; following this, there is a section approximately 1,484 ft. long of 35-in. bore pipe 3/16-in. thick; this, again, is followed by a section approximately 1,488 ft. long of 33-in. bore pipe, while the

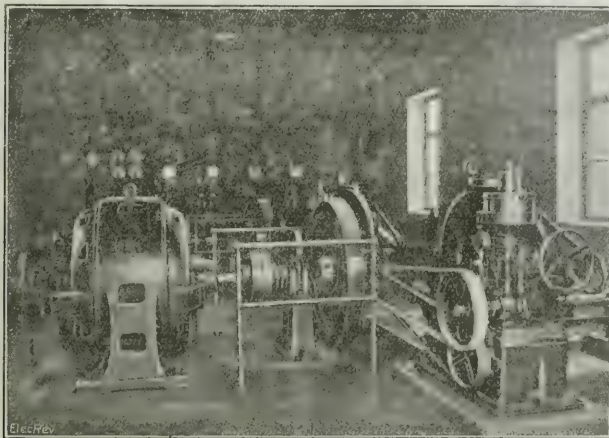


FIG. 2.—INTERIOR OF POWER HOUSE.

grade cable made by Messrs. W. T. Glover & Co., who have supplied all the cable connections needed for this contract. The six-panel switchboard, by the Metropolitan-Vickers Electrical Co., comprises a synchronising bracket, exciter cubicle (controlling the two exciters), two generator cubicles, two feeder cubicles (each of which is capable of dealing with the full output of the station), and, finally, a voltage regulator and lighting cubicle. The lighting supply for the power house is furnished by a 0.5-kVA, single-phase transformer. The apparatus on the two outgoing feeders comprise isolating links, choking coils, and lightning arresters.

The whole of the electrical equipment in the sub-stations was supplied by the Metropolitan-Vickers Electrical Co., Ltd.

Sub-stations Nos. 1 and 4 are duplicates of one another as far as equipment is concerned, although the position of No. 4 is not as yet settled, as it depends upon the final choice of the quarry site. Each of the sub-stations contains four 50-kVA, 3-phase transformers, with a ratio of 2,200/440 volts. They are star/star connected and oil-immersed in corrugated sheet-iron tanks of the self-cooled type. Each of these two sub-stations will contain the necessary isolating links, lightning arresters, and choking coils on both the h.p. and l.p. sides. As regards switchgear, on the h.p. side there are four 50-kVA transformer cubicles, while on the l.p. side there is a three-panel switchboard, two panels of which will each control two 50-kVA transformers, and the third panel will deal with one 50-kVA and one 200-kVA feeder.

Sub-station No. 2 has to supply power to the workshops and blondins, &c., as well as to a proportion of the cranes on the dam; it is of larger capacity than sub-station No. 1, though in general arrangement it is very similar. It contains five 50-kVA transformers and five h.p. transformer cubicles. The l.p. switchboard consists of four panels, two of which each control two 50-kVA transformers, while the third deals with one 50-kVA transformer and one 100-kVA feeder, and the fourth panel with two 200-kVA feeders.

Sub-station No. 3 is of a different character from the others, because it is intended solely for lighting. To



FIG. 3.—PORTION OF PIPE LINE.

final length is approximately 1,491 ft. long and the total length of the pipe-line is 4,775 ft., the pipes being of the mild-steel welded type with flanges riveted on to them.

Concrete anchor blocks, anchoring rings, and expansion joints are provided, and the pipe-line is supported on rubble masonry piers and concrete saddles, free movement being allowed for by inserting tough brown paper served with black lead and tallow between the pipe and the concrete saddles. The pipe-line in its

"HANDS OFF" THE ELECTRICAL INDUSTRY.

THE INSTITUTION LAYS THE MATTER BEFORE THE
PREMIER.

In our leader columns again to-day we discuss the German desires that reparations in kind may be permitted to take the form of electrical power stations and railway electrification in the United Kingdom, and the schemes under which it is hoped to establish a permanent German electrical and other manufacturing hold upon Russia. It is as well that the subject of reparations in kind in relation to France and Russia, and the present and future state of British electrical export trade, should receive attention in its entirety and by all classes of the community.

It is not a matter to be left in the hands of statesmen and politicians—it vitally affects the interests of whole communities engaged in industry and trading. It is a matter of the utmost seriousness for working men and working women, because it threatens the British manufacturing position when confidence in the future of our industries is most necessary for reviving trade and increasing employment. The subject is a most suitable one for co-operative action between employers and employed, and we are pleased to see that such action has been taken. We hope the whole story will be related by trade-union officials to their members in the interests of the industry that affords them their livelihood. It is often said that we are backward with regard to convincing propaganda. Here is a plain straightforward subject indicating beyond dispute where the interests of all classes lie.

The harm done by the speech of Sir Peter Rylands in singling out our power supply and our electrical industry for attention cannot be estimated at the moment. Measures were promptly taken by the Press and by leading representatives of the industry to see that Ministers of State were not blind to the dangers that beset their path if they dallied with such projects.

We are glad that the Council of the Institution of Electrical Engineers has seen fit to bring its weighty influence to bear upon the mind of the Prime Minister with regard to the matter. The statement sent to Mr. Lloyd George, signed by Mr. Highfield as President, is reprinted herewith. It will be found to deal first with the principle of reparations in kind and the importance of their not being permitted to interfere with British employment. It proceeds to correct the impression that may have arisen from the speech of Sir Peter Rylands that cheaper transport and power would be rendered available by the carrying out of the German plans. It emphasises the needs of the British electrical industry which is at present running its works in expectation of a trade revival, and the disadvantageous position in which it would be placed in the export markets if German productions were officially accepted on a large scale, forming for them a world-wide advertisement. The experience of the British nation during the war demonstrated the need for electrical engineers of the highest skill for manifold kinds of vital service. The Institution having had a large part to play in organising our human scientific resources in this connection can justly claim the right to speak to the Premier, who did so much to win the war, with a voice of authority. The Institution, in its communication, does not mince matters. It uses the word "*ruin*" for Britain as the consequence of a large German electrical reparations payment.

We believe that in the views stated in this letter the Institution Council speaks what is in the mind of all grades of its membership and acts in the interests of the hundreds of thousands of professional men and employees engaged in the electrical and allied industries.

We hope that the Government will adopt the Institution's advice and make a pronouncement as soon as possible in such clear and definite terms as shall bring about a complete restoration of confidence.

(COPY.)

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Founded 1871.

Incorporated by Royal Charter, 1921.

Savoy Place,
Victoria Embankment, London, W.C.2.
9th December, 1921.

The Right Honourable David Lloyd George, O.M., P.C., &c.,
First Lord of the Treasury.

So, The Treasury,
Whitehall, S.W.1.
GERMAN REPARATIONS IN KIND.

The Council of the Institution of Electrical Engineers have had their attention directed to certain public declarations and Press communications proposing that the German Reparation Indemnity should be partly provided by the construction in this country of generating stations and the carrying out of railway electrification by German contractors; and, having appointed a Committee to report to them thereon, desire to put before the Government their considered view on these proposals as follows:—

On the general principle of reparations in kind, they have to remind the Government that at the present time, when unemployment is so extensive, any reparations in kind should be of such a nature that they do not compete with any productions in this country involving employment on a great scale of labour, both skilled and unskilled.

With regard to the proposals that large electric power stations should be erected and that railway electrification should be undertaken by German contractors, they desire to make the following observations: It is possible that the proposals for the acceptance of German plant on account of reparation may have arisen from a hasty impression that such action would confer benefits on this country in the form of cheaper transport and power. But if such plant is to stand as a contribution towards reparations its value must be debited to the undertakings using it. In no other way can such value be put to the credit of National indebtedness. There is, therefore, no good reason to suppose that the use of German plant obtained in that way would result in the users of it being able to give a cheaper service than with new equipment of British manufacture.

There are, however, other considerations which my Council desire to urge. The electrical industry in this country is at the present time suffering from a grave lack of employment in all branches, but nevertheless many works are being run in the expectation of a trade revival. Should it be decided to accept German machinery on a large scale, there is no doubt that a large additional amount of unemployment would immediately result, and that both the workpeople and technical staffs at present being kept together would be disbanded. Moreover, the effect of the acceptance for the public service of this country of electrical machinery of German manufacture would be a world-wide advertisement for such goods, and would fatally diminish the present prestige of British electrical goods, with most serious effects on our export markets.

The experience of the war showed the necessity of this country having a large number of highly skilled and trained electrical engineers available, and the members of the Institution of Electrical Engineers were called upon during the war to undertake work for the national forces requiring the highest skill.

A proposal which would have the effect of crippling many of the most important electrical manufacturing concerns and leaving this country dependent for electrical services upon German industry would result in discouraging the training of electrical engineers for what, in war time, is a vital necessity.

In view of the points briefly set out above, the Council of the Institution of Electrical Engineers, representing all branches of the electrical industry, desire to urge most strongly on H.M. Government the disastrous consequences which would ensue to the industry if electrical construction in this country on an extensive scale is entrusted to German manufacturers. Any possible immediate advantage anticipated by the proposers of the scheme of reparation could not offset the ruin of those industries in this country which are engaged in the manufacture of steam turbine plant and heavy electrical machinery, both of which had their sole origin in British science and inventiveness.

The Council of the Institution trust that in view of the discussions which have been published, H.M. Government will remove the great uncertainty which has been created in the industry by an immediate statement that such proposals will not be entertained. If, however, proposals of the kind should be considered by the Government, my Council ask that they should be given an opportunity of being heard by yourself or the Chancellor of the Exchequer before any action is taken.

I am, Sir,

Your obedient servant,

(Sgn.) J. S. HIGHFIELD,
President.

The matter has also been dealt with by a meeting of representatives of the Joint Industrial Councils and other bodies in the electrical industry, as the following quotation from the *Daily Telegraph* (December 14th) will show:

"With reference to the suggestions made that the German reparation indemnity should be partly provided by the construction in this country of generating stations and the carrying out of railway electrification by German contractors, a meeting has been held representative of the Joint Industrial Councils and other bodies in the electrical industry, and comprising therefore both the trade unions' and the employers' side of these matters, at which the subject was discussed. A resolution adopted by the meeting called 'attention of the Government to the irreparable injury which would be done to the British electrical industry now and in the future if any such proposals were seriously entertained, and which if put into effect would result in the closing down of important electrical works in this country and consequent increase of unemployment.' The conference further invited the Government to make an immediate and unequivocal statement that acceptance of reparation payments by handing over such public service works to German contractors will not be entertained."

AN ELECTRICAL REVIEW OF E.H.P. TRANSMISSION.

BY R. BORLASE MATTHEWS.
Wh. Ex., A.M. Inst. C.E., M.I.E.E., F.R.A.S.

(Concluded from p. 797.)

(II.) *The Mechanical Construction of e.h.p. Lines.*

While there does not seem to be any official definition, on the Continent, all lines operating at 40,000 volts or over, are usually classed as extra-high-pressure. At a conference held at Brussels in 1920, an attempt was made to standardise the line voltages as 45,000, 60,000, 80,000, 100,000, and 120,000 volts, with proportionately higher voltages at the generating stations. However, this proposed standardisation did not meet with the approval of the French engineers, and seems to be as yet undecided. A fundamental factor underlying this question is the relation between the pressure, the length of the line and the amount of power to be transmitted. With these main variables, and also associated with them a number of minor variables, it is little to be wondered that recent discussions have thrown into relief the extreme complexity of the matter. Of course the main object is to obtain a design of line, that not only functions properly, but also operates economically. The cost price of the transmission must, of course, be as low as possible, taking into account the losses of energy and the annual overhead charges for depreciation, operation of the line and of the necessary stations. French engineers have attempted to design the ideal line on a mathematical basis, not, however, with much success, as there are so many variables, not the least of which is the fluctuations of market prices of materials. On account of the cost of installation, maintenance, and consumption of synchronous condensers, Lavenchy, in his paper, favours aiming at a power factor lower than unity, even though a high power factor would reduce the line losses and the necessary capacity in kilo-volt-amperes of the transformers and alternators. As regards the maximum power which can be transmitted by a three-phase line for a given voltage, Blondel is quoted as having demonstrated that, all other things being equal, the maximum power that a line can transport is proportional to the square of the voltage at the generating extremity. Continental engineers seem to have adopted Lord Kelvin's rule, as a first approximation in deciding the most economical section of a line, viz., as that for which the annual interest and depreciation on the conductors and such part of the supports, &c., as varies with the section of the conductors are equal to the price of the energy consumed annually by ohmic losses. This rule does not of course take into account possible future expansion of supply. Further, pole costs often increase out of proportion as the conductor section increases, hence the cross section finally selected is usually a trifle less than that called for by the application of the rule. Based on Still's (U.S.A.) formula, Lavenchy has proposed a rule, which quickly indicates the required voltage for the transmission of a given amount of power over a given distance, e.g., if 26,000 kW has to be transmitted 100 km. (175 miles), the above gives the required voltage as 115,000. 200,000 volts is considered to be the present practical limit of pressure for transmission under present conditions. Hence, this pressure would only be advocated for considerable power, with high load factor and long distances.

Except for temporary work, wooden poles for transmission lines operating at over 45,000 volts have been superseded by either reinforced concrete or steel poles. The reinforced con-

crete poles are largely employed on lines of 45,000 to 65,000 volts. They are considered to be the type of pole which requires the least maintenance. Their excessive weight is, however, especially in mountainous districts, a serious obstacle to their use. These concrete poles are made in every conceivable cross section. The heights of the steel poles are usually 25 to 30 feet, for a 40,000-volt line carried on pin insulators; or for a 120,000-volt line with six conductors, carried by insulators of the suspended type, the heights are normally 75 to 80 feet.

Anchor poles are usually fixed at intervals of about one kilometre. In this way the stringing tension of each section can be adjusted independently.

Most of the lines are nowadays provided with one or two earth wires, in the form of galvanised steel cables. This ground wire not only acts as a protective device, but also provides a good contact from pole to pole, which is useful should any pole be insufficiently earthed. Sheets of copper about two feet square are employed as earth plates (in Holland the plates used are considerably larger). These sheets are bedded in coke, in pits dug outside the pole foundations, so as to permit of easy inspection. The sheets are connected to the poles by No. 0 A.W.G. copper wire.

As a means of economy in constructing the concrete foundations for poles a central hole is left, which is filled up with stones. Occasionally iron shoes are employed as pole foundations, in place of concrete. A curious trouble has arisen in Holland, where the poles were painted with iron oxide paint, in that the cattle lick off the paint on account of its sweet taste, and thereby are poisoned. The question which is the best method of preserving a steel pole is by no means settled, i.e., whether it should be painted or galvanised, and, if the latter, which process should be adopted.

As regards insulators, the pin type is usually employed up to 70,000 volts, and above that pressure the suspended pattern is almost exclusively employed. The pin type insulators usually consist of at least three parts cemented together. Often they are formed of four or five parts. Their dimensions vary from a diameter of 270 mm. (say 10½ in.) and a height of 300 mm. (say 12 in.) for 45,000 volts, up to a diameter of 350 mm. (say 14 in.), and a height of 415 mm. (say 16½ in.) for 75,000 volts.

In the case of suspended insulators, six are employed for 90,000 volts, seven for 120,000 volts, and eight for 150,000 volts. Experimental work has shown that if the dielectric strength of insulators could be improved, it would be much more satisfactory to employ three only. This is for the reason that 50 per cent. of the potential distribution along the chain occurs at the first insulator, and 25 to 30 per cent. at the last, the intermediate insulators only averaging 5 per cent. A suggestion has been made to improve the potential distribution by employing metallic covers (which also serve to improve the rain protection) over each insulator in a chain. A very uncertain problem in the manufacture of insulators is the ageing of the porcelain. Also it is difficult to manufacture these insulators of any considerable thickness without the possibility of developing flaws. After four or five years the life of insulators becomes very doubtful, and they then need very careful watching and testing.

While very careful investigation has been made as to the relative advantages of copper and aluminium for overhead conductors, the situation may be summed up by saying that they are interchangeable for average spans, and there is no other metal that can be substituted for them. On long spans either of these metals is employed, with a twice galvanised steel centre core for strength—its conductivity is not taken into account. In an aluminium-steel cable the weight of the steel approximates 50 per cent. of that of the aluminium. In California 800 ft. has been calculated to be the most economical span for a three-conductor aluminium-steel line (cross section 700,000 c. mils) for a load of 100,000 kW at 200,000 V. In one transmission system, at any rate, the line is carried in roller bearings attached to the insulators on the poles between the anchor poles. (This is in Holland.)

Great improvements have been made of late in the construction of underground cables for operation at 45,000 volts and over. Messrs. Callender's have actually supplied 50,000-volt, 3-core cables to Holland. In France the tendency seems to be to lay single-core cables, lead-sheathed, but without steel armouring to prevent induced eddy currents. This method reduces the stress on the dielectric material, and avoids corona troubles. Further, an extra single conductor cable can be laid at the same time at a small additional cost, as a spare. The jointing is also much easier. Still, the three-core cable seems to be more of an engineering proposition, and if the cable is solidly filled, i.e., no space left between the three cores, there is no fear of corona trouble with its consequent weakening of the dielectric. Further, these cables can be made with steel armour, which is undoubtedly an advantage as a mechanical protection. It is anticipated, as the result of tests now in progress, that shortly it will be possible to manufacture 120,000-volt cables.

(iii.) *The Operation and Protection of e.h.p. Lines.*

A somewhat curious fact came to the attention of the writer when in Holland recently. A large number of cables have been laid in that country, at a cost which compared

favourably with overhead lines—owing to the difficulties in importing both poles and insulators. The distribution system has been laid down considerably in advance of the demand, with the result that on a Sunday morning a station with a normal week-day load of 5,000 or 6,000 kW has to operate a 1,400-kW steam turbine set to supply the wattless current due to the capacity of the cables.

On the Continent it seems to be the custom to maintain a close and regular inspection of the lines, e.g., a weekly visit is paid to each pole during the summer, and a bi-weekly visit during the winter. All details affecting the line have to be reported upon. Watchmen's time-clocks (into which a key has to be placed and turned to record the time of a visit) are fitted to the poles at the wireless station at St. Assise. In addition, a night inspection is made once a month to detect any corona and brush discharges which may occur at defective points.

Owing to the uncertainty as to the life of insulators, periodical tests have to be made. These are carried out either by (a) the megger method; or (b) the buzz-stick method. For the megger test the line has to be dead, which is a disadvantage. In addition, the test does not seem to be effective on certain types of insulators. The buzz-stick method, as may well be anticipated from its name, comes from America. The testing appliance consists simply of a 10-ft. insulated rod, of about 1½ in. in diameter. At the upper end of this pole a metal fork is fixed, whose prongs are about a foot apart. The test is carried out in two stages: (1) "feeling-out," and (2) "shorting-out." The first test consists in touching successively with one of the prongs of the fork, first the conductor and then the head of each insulator. On withdrawing the fork a characteristic buzzing sound is heard, which diminishes as successive insulators are touched (of course the buzzing will increase slightly at the last insulator, as compared with the intermediate ones, as the potential gradient is greater there). If this test indicates that the greater proportion of the insulators in a chain are faulty, the second, or "shorting-out" test, must not be applied. The "shorting-out" test consists in successively short-circuiting all the insulators in a chain by means of the fork. An arc will be made, when making and breaking the short-circuit, if the insulators are sound. The arcs decrease (in a good chain) as in the case of the "buzz" test. Similarly, the arc produced on the last insulator is greater than on the penultimate one.

It is found that an earthed overhead guard wire is the best protection against lightning. Many other, and more complicated methods have been employed, but, as a rule, they are being gradually discarded. The horn-shaped lightning arrester, though still employed on medium-pressure systems, is entirely eliminated from those of extra-high pressure. Electrolytic arresters—which are really valves—are used to a considerable extent in America. There are also a few installations in Europe, though they have a number of disadvantages. Wave-damping devices, in the form of condensers, are favoured in Central Europe.

In the maintenance of effective service on an e.h.t. transmission system, the use of the telephone is of all importance. Latour and others have given considerable attention to this matter, and the systems they advocate include the use of three-electrode vacuum tubes. On independent telephone lines these electronic tube amplifiers super-amplify the speech signals, so that the latter eclipse in strength the disturbances due to the neighbouring high-tension lines. The other scheme is the high-frequency method of telephone communication over the high-tension lines. This apparatus is often associated with wireless telephony, since both the sending and receiving apparatus are similar.

(IV.) Legislation Affecting e.h.p. Lines.

Of late most countries have been revising their laws, to permit of the installation and operation of lines at higher pressures than had previously been conceived. At the Paris Conference reports were made as to the form of these laws, a summary of which should be useful to legislators, and for the convincing of tardy legislators by those who appreciate the real necessity for a nation to have a cheap supply of electricity.

The question as to the best arrangements for dealing with and compensating land owners for setting up poles and crossing their land is a very thorny one. No country seems to have solved it legally except Germany. There it is merely a question whether or not a line is to the best interests of a community. If it is, the land owner gets ridden over rough-shod, without any concern for his feelings or pocket. As a matter of fact it is eventually as much to his interests as to others, to have an ample supply of electricity available. However, the Government has decided that the coming of an electric line shall not enrich the land owner at the expense of his neighbours. After all, it is but chance that he happens to own land over which a line passes—it is certainly not due to any enterprise on his part. Apart from legal powers, negotiations with landowners seem to be most easily effected in countries where the co-operative idea is well implanted, such as parts of Denmark and the Netherlands. Further, these countries have already discovered what a valuable thing it is to have a supply of electricity available for everybody—even for the farmer—which is a stage considerably in advance of most other countries up to the present.

As a matter of interest it may be mentioned that in France steel pole rights are purchasable for 80 to 100 francs; anchor pole rights vary from 80 to 130 francs; for the crossing over of the line a franc per 10 meters. Wood pole rights are generally arranged at about 10 francs, with 20 francs for anchor poles. In forest land it generally costs about 30 francs per pole, as trees, &c., have to be cleared. In vineyards two to six francs is paid for each vine plant that has to be removed.

In Conclusion.

The general impression that the writer gained from the Paris Conference was that European engineers do not know as much about extra-high-pressure lines as is known in America. Further, this class of work seemed generally to be a part of the work of a busy engineer, who also had charge of a complete local system of supply, i.e., the generating station and low-pressure distribution network, &c., of a city or town. His interest in extra-high-pressure work arose from the fact that, generally, the conclusion is that, as generating stations become larger and larger, and the generating units likewise, it is not so economical to provide for spare plant in case of mishaps. Hence it is becoming necessary for these stations to link up with each other. It is most pleasing and interesting to note this spirit—which, after all, is in the best interest of the populations they serve. Even municipal jealousies on the Continent seem to be getting suppressed (even though it may be slowly) in a genuine effort to attain this ideal. It is to be hoped that the same thing will soon occur in England.

The promoters of the Paris Extra-High-Tension Conference are to be congratulated upon the great success of their first meeting. Undoubtedly this first general interchange of ideas between nations on this subject will lead to even more effective progress at the next meeting, for they have all, as it were, thrown their cards on the table, and disclosed the main lines upon which they are working. On this basis it is to be anticipated that next year's papers will be less insular (if it may be so described) in tone.

The proceedings of this Conference will be published in February next, both in the French and English languages, at 50 francs per copy. Copies may be ordered from the secretary of the Conference, 7, Rue de Madrid, Paris. This book should prove to be a very useful and interesting compilation.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR NOVEMBER, 1921.

In most respects the Board of Trade statistics for November varied but slightly from those for October. There was a small increase under all three main heads. The only noteworthy single item was the value of exported motors and generators, which showed an increase of nearly £100,000. The "Imports" section revealed increases in the items Electrical Machinery (unenumerated); Switchboards, and Batteries. The increase in the total value of re-exported goods was fairly evenly distributed among the constituent items.

VALUES OF ELECTRICAL EXPORTS AND IMPORTS FOR NOVEMBER, 1921.

	Exports.	Imports.	Re-exports.
	£	£	£
Electrical goods and apparatus	119,486	49,914	3,819
Insulated wire	207,414	18,054	100
Glow lamps	27,957	21,505	444
Arc lamps and parts	781	414	—
Batteries	38,186	12,285	—
Meters	33,236	3,197	804
Carbons	5,668	1,215	1,503
<i>Electrical Machinery:—</i>			
Railway and tramway motors...	6,373	—	—
Other motors and generators	275,333	—	—
Switchboards (not telegraph or telephone)	21,839	7,291	105
Electrical machinery (unenumerated)	167,989	46,871	3,438
<i>Telegraph and telephone cable material:—</i>			
Telegraph and telephone wires and cable (not submarine)	110,262	2,652	630
Submarine telegraph and telephone cable	42,028	—	—
Telegraph and telephone instruments and apparatus	184,738	17,389	3,901
Totals	£1,240,810	£179,707	£14,733

Employment in Lead Processes.—The Stationery Office issued, on December 8th, Factory Form 616, the approved form of Health Register for women and young persons employed in processes involving the use of lead compounds.

LEGAL.

POSTMASTER-GENERAL v. MAYOR AND CORPORATION OF LIVERPOOL.

As briefly reported last week, Mr. Justice Shearman and Mr. Justice Saker, sitting as a Divisional Court of King's Bench, continued the hearing of the appeal by the Postmaster-General against the judgment of the Liverpool County Court judge regarding a claim for the recovery of the cost of repairing certain damage to telephone plant belonging to the appellants caused by the Corporation's electric light mains.

Mr. JUSTICE SHEARMAN, on the case being called, said that the Court, after having considered the case, did not wish to hear appellants' counsel in reply to the case for the respondents. In giving judgment in favour of the Postmaster-General, his Lordship said the Court agreed with the finding of the County Court Judge that there was proof of nuisance. It might have been dangerous in itself, but the defence on that point was such as to prevent the action being successful in the claim for damages. Regarding the agreement entered into in 1886 between the National Telephone Co. and the Liverpool Corporation, it had been shown that while the Postmaster-General held a monopoly of the business of telegraphs and telephones for the State, he was authorised to issue licences, which had been done in this case to the National Telephone Co. This licence expired in 1911. In order to carry out its undertaking in Liverpool, the company came to an agreement with the Liverpool Corporation. This agreement was subject to certain conditions, one of which indemnified the Corporation against injury or damage which might be done by electric light plant. The agreement was entered into before the licence of the Postmaster-General was obtained, and the Court agreed with the contention of the Postmaster-General that he could not be bound by the agreement with the Corporation, to which he was not a party, and which came to an end by the flux of time when the licence to the Telephone Co. ended on the transference of its property. Under all the circumstances of the case his Lordship said he must hold that there was a proper claim under Section 8 of the Telegraphs Act and on the ground of nuisance. The Postmaster-General therefore succeeded, and the appeal must be allowed with the costs of the appeal.

On the application of Mr. Maughan, K.C., for the respondents, leave to appeal was granted in view, said Mr. Justice Shearman, of the public importance of the case.

CONNARE v. THOMAS.

In the King's Bench Divisional Court on December 8th, Justices Horridge and Shearman heard the appeal of Mr. H. E. Thomas, of Hemel Hempstead, from a decision of Judge Crawford at Watford County Court in an action brought against him by Mr. Joseph Connare, electrical engineer, of High Street, Watford.

Mr. LAWTON on behalf of the appellant, said the action was tried on October 27th. It was a claim by an electrical engineer for work done and the price of goods sold and delivered. The points for legal argument were, first, whether there was any consideration at all to support an oral agreement; and, secondly, where there was any oral consideration, whether that was in law sufficient. Mr. Thomas, the defendant, owned an estate called Hyde Farm, Hemel Hempstead, and started building upon it. He proposed to put up two kinds of villas and bungalows, and it was necessary to install electric light in them. The plaintiff approached him to see if he could get the contract, and an estimate was given by the plaintiff on March 13th, 1920, and accepted for the work to be done at 2s. 10d. per light. That was always the basis of the arrangement. At a later date, in September, a conversation was alleged to have taken place between the plaintiff and the defendant, the effect of which was to substitute for that contract an oral agreement which he was now attacking. It was alleged that the plaintiff said to the defendant that the cost of labour and materials had gone up, and that defendant said "Very well. I will let you off putting the fittings in each house, but I shall never pay you for them." Counsel contended that the Judge was wrong in holding there was any consideration for the oral agreement. He denied that there was any further agreement in September.

Mr. H. I. P. HALLETT supported the Judge's decision.

Mr. JUSTICE HORRIDGE, in giving judgment, said he regretted that the appeal had been brought, because it seemed to him as if it was a question of going to the state of the account between the two parties. But a point of law had been excited out of it, because it was said there was no consideration for the bargain which the Judge had found. In order to support the judgment it was necessary to find that a good agreement was made about September, 1920. The agreement that was alleged to have been made was that the contractor should get the same price for the electrical installation without putting in electric light fittings as he had previously quoted to install electric light fittings, and it was said there was no consideration for that bargain. The Judge's note said "Defendant told me I was not to put in fittings, tenants to pay for them. I was to allow him 15 per cent. commission." The Court could not assume that

note to be incorrect upon the mere statement of counsel upon one side which counsel upon the other side said he could not admit. It seemed to his Lordship that the whole case was consistent with there being this consideration, because in November the defendant asked for a new quotation for the work that was to be omitted, and he knew perfectly well that he had made this bargain in September. He (his Lordship) was not going to assume here that the Judge did not consider the question of consideration and found correctly that there was consideration. The appeal must be dismissed.

CHAMBERLAIN & HOOKHAM v. SOLAR-ZAHLERWERKE.

THE *Birmingham Post* reports the hearing of this case of a British company against a German company before the Anglo-German Mixed Arbitral Tribunal on December 9th.

Mr. DOUGLAS HOGG, K.C., said the claim was for £26,921, and interest. There was no serious dispute as to the amount, but there were certain points to be cleared up. The German firm's objections were that its shares were owned by the English firm and that when the shareholders in a German company were English the company was not a German company. It further objected that where the shareholders in a German company were in the position of the claimants there was no debt. Those were propositions which were not in accordance with English or German law or with the provisions of the treaty.

Messrs. Chamberlain & Hookham carried on the business mainly of makers of electricity meters. In 1908, in association with a German firm in Hamburg, a German company was formed, and the respondent company was incorporated with a capital of 50,000 marks held by three or four shareholders, Mr. John Chamberlain holding 30,000. The German company bought from Chamberlain & Hookham the whole of the patent rights in respect of these electricity meters for a number of Continental countries. The price was 49,000 marks, nearly the whole of the paid-up capital. The German company commenced business in Hamburg, its principal business being the assembly and sale of meters made under the Chamberlain patents. The German company did not at first make very much profit, but in 1914 it was apparently getting large orders, and looked like having a prosperous future. In 1912 the whole of the share capital in the German company was owned by Chamberlain & Hookham. At the outbreak of war there was owing to them the amount claimed. Counsel quoted legal decisions of the House of Lords on company law, and held that there could be no doubt that Messrs. Chamberlain & Hookham had the right to say that they had sold goods for which they had not been paid.

The decision will be announced later.

BIRKDALE & DISTRICT ELECTRICITY SUPPLY CO., LTD., v. SOUTHPORT CORPORATION.

THE motion on behalf of plaintiffs, postponed from the previous Friday, was mentioned to Mr. Justice Peterson in the Chancery Division on December 9th. Leave had been given to amend the writ by adding the Attorney-General as a plaintiff, and the Attorney-General's fiat was obtained, but further amendments were asked for. The writ only asked for an injunction to restrain supply and distribution by the Corporation, and it was desired to ask for a declaration. On the motion being called, counsel stated that the parties were not ready and a further adjournment for a week was granted by his lordship.

SHIRTLIFF BROS. v. ALBION MILLS CO.

AN appeal by the Albion Mills Co., of Cable Street, London, from a decision of Judge Jackson at the Mayor's and City of London Court in favour of the plaintiffs, Messrs. Shirtiliff Bros., manufacturers of electric baling presses, of Letchworth, came before Justices Horridge and Shearman, sitting as a King's Bench Divisional Court on December 9th.

Mr. G. W. H. JONES, for the appellants, said the claim was for £69, of which £50 was in respect of a bonus agreed to be paid by the defendants to plaintiffs for an electrical baling press for making rags into bales, and £19 as interest upon an acceptance. Judgment was given for the plaintiffs for £50 and £9 respectively. The Judge said it was sufficient if the plaintiffs were ready and willing to make delivery of the machine, and they said that they were, although it was not in fact delivered, and upon that he said they had fulfilled their contract as far as the bonus was concerned, and were entitled to the £50.

Mr. TRISTRAM BURSTON, for the respondents, contended that there was evidence upon which the Judge could find that the plaintiffs were ready to deliver, but that delivery was refused by the defendants.

Mr. JUSTICE HORRIDGE said the plaintiffs entered into a contract with the defendants to supply a machine, and defendants promised this bonus of £50 if delivery was made within six weeks. Although the machine was never delivered, the value of and that if the plaintiffs were ready and willing to deliver it was the same thing as if they had delivered. With that he (his Lordship) could not agree, the plaintiffs could only get their money if they delivered. The only way to get over the difficulty was to show that defendants had requested

them not to deliver by that date or that defendants had in some way broken their contract. Defendants never requested the plaintiffs to delay or prevented delivery, and the plaintiffs could have sent the machine and earned the bonus. They did not do so, and therefore the Court must set aside the judgment awarding them the £50, with costs. The rest of the judgment would stand.

CORRESPONDENCE.

Letters received by us after 5 p.m. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

One Solution of the Frequency Problem.

The most obvious method of obtaining two frequencies from one generating unit is of course that suggested by Mr. E. W. Dorey in his letter in your issue of December 2nd, but so far from being "One Solution of the Frequency Problem," it is only "One Solution of one Frequency Problem," because it is only possible when the non-standard frequency is 100 cycles.

In the scheme suggested in my article, I take advantage of the two independently driven alternators on the double-rotation turbine set to obtain any practical combination of frequencies with minimum capital outlay and also minimum losses.

In propounding my scheme, I sought to avoid odious comparisons between the axial-flow and double-rotation types of turbine, and as both are saleable in the same market, I made, and should have stated, the assumption that as regards efficiency and cost there is nothing to choose between them.

Before considering the various factors in detail, I should like to point out that Mr. Dorey's proposals for running the turbine set as a frequency changer are hardly practicable. The turbine designers would undoubtedly have something to say with regard to the windage losses in a turbine of the impulse type when run without steam, and to uncouple the turbine is a serious matter.

Most station buildings would require alteration to accommodate the long double-alternator set, but the coupler set can be stowed in any odd corner.

Let us compare Mr. Dorey's 100/50-cycle tandem scheme with my proposal of the synchronous coupler set:—

Capital Outlay.—The additional high-speed full-capacity alternator required in Mr. Dorey's scheme would cost nearly 50 per cent. more than the two low-speed alternators of half the power forming the synchronous coupler set.

Losses.—In the one case there are the losses of an additional full-capacity high-speed alternator, whilst in the other there are the losses of two half-capacity low-speed alternators. Assuming normal machines, the losses would be rather less in the low-speed machines. I agree with Mr. Dorey that there are no conversion losses in his scheme, but Mr. Dorey's machine load factor can never exceed 50 per cent.

Obsolete Plant.—Mr. Dorey states that the 100-cycle alternator could be re-wound for 50 cycles. Although the alternator could not be designed to be efficient at both frequencies, I accept this postulate and apply it to my scheme with equal effect. When there is no more need for the special-frequency supply, the obsolete plant will comprise:—

With Mr. Dorey's scheme—

One full-capacity high-speed alternator;

and with my scheme—

The coupler set (only half of which is of non-standard frequency).

Direct Current.—A dynamo can be added to the coupler set, and then the three classes of power can be taken from the set in any proportion. The only feasible method available to Mr. Dorey is to use a rotary converter. This could only be driven from the three-phase alternator, so that he would not obtain the maximum flexibility.

Power Factor.—As stated in my article, by transferring part of the wattless component of the load from the high-speed machine to the low-speed machine, a greater output can be obtained from a standard turbine set. See Mr. Dorey's article, *ELEC. REV.*, November 25th, 1921, p. 723.

Loughborough, Leics.

C. Sutton.

The Durability of Lead-covered Cable.

I have read with interest the various letters on the above subject, and quite agree with Mr. Parsons that the main points to be considered are:—

1. Good workmanship, which applies equally to any system.

2. The absolute necessity of seeing that the metal sheathing is properly bonded so as to give perfect continuity to earth.

I venture to say that over 90 per cent. of the failures of lead-covered systems are directly attributable to the fact that no attempt has been made to bond the sheathing, or when an effort has been made it has been done in a slipshod manner, and the blame is generally put down to faulty material.

To my mind, a lot of these failures would be eliminated if supply engineers and insurance inspectors insisted on proper bonding with fittings specially designed for the purpose, and did not pass installations where the only attempt at bonding was to twist a piece of wire round the sheathing.

In the past there was possibly some excuse for the contractor who thought any sort of bond would do, but now that we are blessed with untried systems, there would seem to be no loophole at all for shoddy work. My own experience is, however, to the contrary, as I have still to find the ideal system of fittings, and I think the cable makers would be well advised to give more attention to this, and when designing to try and remember that wiring is generally done from the top of a ladder and not at the bench.

The weak points in the various systems may be briefly enumerated as follows:—

To be in a position to take on a wiring job at short notice, a contractor must of necessity carry a multitude of special fittings, which in some systems means a special box for every position and bonding clips for each size of cable.

One maker attempts to get over this trouble by providing a box with four openings, with the result that when it is used for a tee joint one side is left open. This is not good practice, particularly if the box is used under a floor, and would not, I feel sure, be encouraged by the Fire Insurance Co.

Other makers try to solve the trouble by providing blank covers or boxes and special cutting pliers, but my experience is that these are more often than not missing when wanted, with the result that the wireman makes the best of a bad job by hacking a way in, with the assistance of a hammer and chisel. Only recently I came across a case where the wireman had adopted this method. The job, being duly completed, was tested, and found to be earthed, the fault being found after considerable trouble to be due to the ragged edge of the cover piercing the sheathing.

The question of bonding is not being treated as seriously as it deserves to be, as I find that in some of the later systems efficiency is being sacrificed for so-called simplicity. One firm provides a bonding ring and endeavours to get a satisfactory bond on 2, 3, or 4 cables by means of a centre screw with the wood block as the medium for applying the pressure. What is going to happen when the block shrinks, or when an elbow connection has to be made?

Another source of weakness is tapped holes in soft metal, as the screw threads are so easily stripped should the wireman happen to give the clamping screw an extra turn or two.

From my experience, the only satisfactory method of bonding is to use a separate clamp for each cable; you can then be sure that all are efficiently bonded even when they vary in size. The connectors in general use should also receive attention, as they are not always satisfactory due to missing or faulty screws.

I am also inclined to agree with "Manchester Inspector" that a pure lead sheathing is likely to last longer than an alloyed sheathing, as I have recently heard of two cases where alloyed sheathing has disintegrated. Both these were in coast towns, and the trouble may have been due to atmospheric conditions, but it would be interesting to hear whether any of your readers have experienced similar trouble.

R. Hampson, Manager,
The Bolton Electric Co., Ltd.

December 8th, 1921.

With reference to the correspondence in the *ELECTRICAL REVIEW* recently on lead-covered wires, the Lynton town hall is known to many of your readers, and they probably remember the fine oak work for which that hall is famous. The electric light wiring was done by a firm of South Wales contractors (name unknown to us now) and lead-covered wire was extensively used. Now that wiring is giving trouble, and we have been ordered by the Urban Council to re-wire parts of the hall.

Our men have to-day brought back some samples of the wire that they are removing; everywhere where the lead covering has come in contact with the oak it has undergone some chemical change. I have not the facilities for ascertaining just what has happened, but I am forwarding to you herewith some samples of the wire just as removed from the building, which I hope will be received without further damage, but the white covering is very fragile, and to keep it more or less intact I have wrapped each sample with paper.

Where the lead covering does not come in contact with the oak it seems to have kept fairly well.

As so many country houses have oak work as a feature this change that has occurred in these wires may be of importance in similar positions; if, on examining the wires, you can offer any conclusions it may be a help to those who are using lead coverings in contact with oak beams, &c.

I may add there was no system of bonding. The supply is a.c. single-phase, 100 volts, 100 cycles. The samples are from wires fixed to the open timber work in the roof.

P. T. Kimmins.

Electricity Works, Lynmouth.

December 10th, 1921.

[We shall refer to these interesting samples in a later issue.
—*EDS. ELEC. REV.*]

Business Methods.

For some time past we have been buying in small quantities small reversible ampere-hour meters for use with country-house batteries, these meters being of American manufacture. The importers keep a stock in England, and though the instrument is rather expensive, it does its work, and we get prompt delivery and satisfactory service.

A chance inquiry to one of our big English meter manufacturers recently brought to light the fact that they had started to manufacture a similar meter, and their quotation was 10 per cent. less than for the American instrument. Preferring to do business with English firms where possible, we placed a sample order on their promise of 14 days' delivery, and twice afterwards wrote pointing out the importance of delivery by November 30th, so that it could be fixed by a man who was already on the job. We also had a letter promising delivery by November 30th, and accordingly instructed our man to await the arrival of the meter. To-day (December 7th) we received a letter from the meter manufacturer enclosing a *pro forma* invoice. *Pro forma* invoices are no doubt quite in order between firms which have not done business before, but as four weeks had elapsed since we placed the order, and as delivery was exceptionally urgent, surely this firm could have asked for references or informed us a fortnight ago and asked for a cheque, which we should have been pleased to send. As it is, we have now had to order our man to come home, and a special journey will have to be made to fix this meter at a cost in railway fares alone of £2. (One wonders whether manufacturers realise that contractors pay their men 17s. a day and out allowance.)

Much as we would prefer to do business with English houses, until they wake up to the fact that this treatment is not businesslike, firms like ourselves are being reluctantly forced to place our orders with the more businesslike Yankee.

Matt Jennison.

Managing Director,
Matt Jennison, Ltd.

Grimsby.
December 7th, 1921.

Paper-insulated Wire for A.C. Rewinds.

I should much like to hear the views and experiences of your readers on the results obtained when using paper-insulated conductors in lieu of d.c.c. wires for re-winding a.c. motors. Just at that period subsequent to the armistice, when d.c.c. wire was practically unobtainable, I was called upon to re-wind a 20-h.p. machine removed from a sulphuric-acid plant. I could not obtain the correct gauge of standard d.c.c. copper. Realising that the re-wound motor would have to stand up to heavy duty, accompanied by acid fumes, I decided to experiment with paper-insulated copper of the correct gauge, that being the only type of insulation immediately available. I found it advisable to shellac varnish the paper-insulated conductors before use. Since the completion of the job I have heard nothing in the nature of a complaint or fault though d.c.c. re-winds effected at approximately the same date (nearly two years ago) show signs of failure in the same chemical works. The experience of others would be of much interest to myself.

W. E. Rogers.

London.
December 10th, 1921.

Leaves from an Inspector's Note Book.

This article leaves a nasty taste. "Anode" makes himself the judge of engineers who are very likely earning three times his salary. Perhaps if the "good" engineer had changed jobs and directors with the "bad" one, their qualifications, according to our super-inspector, would have been reversed.

Again the author appears to think it funny and not dishonourable to alter wrong connections behind his clients' backs, making his opportunity to do so by means of a trick! I was surprised to see that one of "Anode's" connections could be wrong after his ridicule and attempted wit at the expense of another person who also made a mistake. Being "Anode's" own error it would have been less cowardly and more truthful and honest on his part and pacifying to his indignant client to have admitted the mistake like a man, even to one so lacking in electrical experience as the work butcher mentioned. I should like to know what would have happened had his client discovered the dirty trick. The work butcher would probably have treated "Anode" like a pig, and the article which mistakes had taste for wit and smartness would never have been written!

I should like to tell from the other side of the fence. A firm or corporation has electrical plant and places in charge thereof an experienced engineer. The directors or persons in authority issue this hint. What sometimes happens? A young and brave inspector earning less than a fitter (see recent advertisement columns) comes along, lords it over a man who was an engineer before the inspector was born, rants his connections about wire naper under the brushes, removes the machines as though he was going to market them each a suit of clothes, and very often adds insult to

injury by complaining to his company that the engineer does not know his job because the balancer fuses are too heavy or because there are no fuses in the dynamo shunt leads, &c.

A short time ago an inspector reported in writing that a motor of one of our consumers was running too hot. I was called in, and after running the motor at full load for six hours the temperature rise was under 70 degrees F.—and this on a motor which only works normally for 2 or 3 hours a day! This inspector probably had cold hands, as these were his only instruments for a statement which might have been serious to his client.

I could name various other instances to show that even the best of inspectors, like other humans, are sometimes caught napping, but I will content myself by concluding that "Anode" is neither so smart nor so witty as he thinks himself, and in fact his article brands him as a person who tries to shine at the expense of the laymen and other alleged "dull dogs."

A. J. Abraham, M.I.E.E.

Electricity and Tramways Department,
Aberdeen.
December 12th, 1921.

A Disputed Meter Reading.

In reply to "Perplexed's" inquiry, I have had similar experience with several a.c. meters of another make, this being due to the meter disk refusing to stop when all load is switched off, owing to the magnetic brake failing to act.

Should this be the trouble, the Corporation load test would fail to show the error. By reinstalling the meter in circuit with a "check" meter on "Perplexed's" premises, or connecting it to the supply on no load for a few days, the approximate amount of error can easily be calculated.

E. T. B.

December 11th, 1921.

The Installation and Use of Electricity in Coal Mines.

I am entirely in agreement with Mr. Travis on the question of installing sufficiently large oil switches, especially below ground. The latest Coal Mines Regulations issued by the Home Office are very stringent with regard to the present-day "Safety First" cry.

It is now possible, however, to obtain an oil switch which is guaranteed flame and explosion proof and which complies with Rules 127 and 132. This is the well-known E.A.C. oil switch with machined flanges and fitted with E.A.C. relief bolts. This switch is theoretically right and has been proved by experiment.

My advice, therefore, to all colliery engineers is to install these switches. On the other hand, E.A.C. relief bolts can be fitted to any make of existing switchgear of suitable design, and having machined flanges. The switchgear then becomes safe. I would ask every colliery engineer: *Is all the apparatus in your mine safe? Does it comply with Rules 127 and 132?*

R. J. Millard.

Nottingham.
December 12th, 1921.

Electric Furnaces in Belfast.—On December 3rd the new steel foundry of Messrs. Sutherland, Ltd., Belfast, was formally opened. The melting is electrical, the furnaces being supplied by a two-phase, three-wire system. The furnace, which can deal with 30 cwt., has a tank furnace body, tilted by means of an electric motor. When the tank is tilted the steel runs into a ladle, which is conveyed to any part of the foundry by an electrical overhead travelling crane. After the opening ceremony, Mr. T. D. Robertson, of Electro Metals, Ltd., who built the furnace, read a very interesting paper on "Electric Steel." He said it was interesting to note that this was the first attempt to make steel in Belfast in commercial quantities.

Irish Water Power.—At a meeting in Dublin of the Institution of Civil Engineers (Ireland), Sir John P. Griffith, Chairman of the Board of Trade Sub-Committee on the Water Power Resources of Ireland, said that Ireland had been specially favoured by investigations of this kind. He did not want to belittle the country's resources of coal and peat, but it should be remembered that these were exhaustible sources of power, while water was perennial, and would last as long as solar influence evaporated water from the Atlantic. The keynote of the Sub-Committee's report was the storage of water. They must be prepared to sacrifice some interests to have proper storage, but he knew of hardly any country that was so favoured with the means of obtaining storage of water as Ireland. The Sub-Committee had only dealt with the large rivers, and he expressed his conviction that what it had done could be done for every reasonably-sized river in Ireland.

BUSINESS NOTES.

The "Electrical Review" Issue for December 30th.—We desire to direct the attention of our advertisers and readers to the announcement appearing in our advertisement pages to-day respecting the dates for sending in copy for our issue of December 30th. All editorial matter must reach us much earlier than usual, as the greater part of the Review will have to be "made up" before the Christmas Holidays begin.

Bankruptcy Proceedings.—A. V. FOWLER, electrical engineer, Seachife, Fitzroy Avenue, Kingsgate, Kent.—Receiving order made December 10th on creditor's petition.

WILLIAM BENNETT, residing at 1, Richardson Street, and carrying on business as an electrical contractor at Sitwell Street, Derby.—A meeting of the creditors was held at the offices of the Official Receiver at Nottingham, on Wednesday. The statement of affairs showed liabilities £129, and a deficiency of £99. Debtor, according to his statement of affairs, commenced business as an electrician and electrical contractor in Sitwell Street, Derby, in October, 1919, with a capital of £200, borrowed from a friend, which had since been repaid. He kept no books of account, he had no banking account, and he stated that for the first two years the net profits of the business did not amount to more ventures for £2,000 and rank as an ordinary creditor it a loss. The unsecured liabilities were all for trade and domestic debts. He attributes his insolvency to depression in trade, keen competition, and ill health. There being no quorum at the meeting, the matter was left in the hands of the Official Receiver.

JAMES JOSEPH SMITH, electrical engineer, trading at 1, Central Street, E.C., under the style of J. Smith & Son.—Creditors met last week at the London Bankruptcy Court before Mr. Warren, Official Receiver. The receiving order was made on November 24th upon the petition of the Sloan Electrical Co., Ltd. The debtor has stated that he commenced business as above in March, 1919, with £70 capital; it was successful during the first year, but the recent trouble in the coal and engineering industries practically killed it, and he had never been able to recover a sound position. The liabilities were estimated at £300, and in the absence of assets the case was left with the Official Receiver to be wound up in bankruptcy.

J. G. WILLIAMS, electrical engineer, 4, Blaenart Street, Duffryn, Cymmer, Port Talbot.—First meeting, December 21st, at the Official Receiver's Offices, Government Buildings, St. Mary Street, Swansea; public examination, January 17th, at the Town Hall, Neath.

W. HILL, "seedsmen and electrician," 3a, Leigh Road, Leigh.—Receiving order made December 9th on debtor's own petition.

H. E. CARR, electrical engineer, Carlisle Street, Goole.—First and final dividend of 5s. 5½d. in the £, payable at Carlisle Chambers, Goole.

Company Liquidations.—THE PHONOPORE CONSTRUCTION CO., LTD., the Phonopore Works, Southall, Middlesex.—The first meeting of the creditors of the above was held on December 5th at 29, Russell Square, London, W.C.1. The Official Receiver reported that the company seemed to have been incorporated on March 29th, 1916, and was formed with the object of carrying on business as manufacturers of telephone instruments. The company carried on business until June, 1917, when its works were taken over by the War Office, and it then practically ceased to do any trade until January, 1919, when the War Office gave back possession of the premises. Later £1,500 was awarded in respect of compensation, and he (the Official Receiver) understood there was a question of a further payment due to the company. A representative on behalf of the Crown said the War Office had three claims against the company, one of which was for £20,750. Mr. F. R. W. Robinson said the company still had a claim against the Crown for over £3,000, of which £700 was in respect of the balance of the award granted by the Royal Commission, and the remainder was for re-instatement. The Official Receiver, continuing, said debentures were issued, the holders of which were Mr. F. R. W. Robinson, Mrs. Robinson (his wife), and Mr. F. R. H. Robinson (son). Mr. F. R. W. Robinson was appointed Receiver by Mrs. Robinson under her first debenture, and he was now in possession of the company's assets. The statement of affairs had not been lodged, but the liabilities were stated to amount to £2,500. The company's failure was stated to have been due to the occupation by the War Department of the company's premises, loss of goodwill, and general depression in trade. Asked if he had any proposal to make to the creditors on behalf of the company, Mr. Robinson said he was in touch with several people, and he was doing his best. He was willing to give up his own debentures for £2,000 and rank as an ordinary creditor if a working agreement was arrived at. The creditors decided that no application be made to the Court to appoint a liquidator other than the Official Receiver. A committee of inspection was nominated.

ASSOCIATED TRADING & ENGINEERING CO., LTD.—A petition for the winding up of this company has been presented by Messrs. H. Barnett & Co., Ltd., of 8, Vine Street, Minorities, E., and will be heard in London on December 20th.

LEEDS ALLIANCE ELECTRICAL MANUFACTURING CO., LTD.—Meeting of members is called for January 17th at 1, Albion Street, Leeds, to hear an account of the winding-up from the Liquidator, Mr. S. S. Tadmam.

EGYPTIAN POWER & NITROGEN SYNDICATE, LTD.—Winding up voluntarily. Liquidator, Mr. J. S. Mallam, 1, Queen Victoria Street, E.C. Meeting of creditors December 28th, at 1, Queen Victoria Street, E.C.

ILFORD DRY BATTERY CO., LTD.—Winding up voluntarily, as the company cannot, by reason of its liabilities, continue the business. Liquidator, Mr. G. W. Roberts, 2, Guildhall Chambers, E.C. Meeting of creditors called for December 19th at the offices of the Liquidator. Particulars of claims must be sent to the Liquidator by January 31st.

POWER GAS ECONOMY, LTD.—Particulars of claims should be sent to Messrs. Thomson, McLintock & Co., 216, West George Street, Glasgow, by December 31st. A second and final dividend will be paid immediately on the expiry of the above date. Liquidator Mr. J. Duncan.

ARGENTINE ELECTRICITY CO., LTD.—Meeting called for January 16th at 62, New Broad Street, E.C., to hear an account of the winding up from the liquidator, Mr. T. S. Hamilton.

Dissolutions of Partnership.—H. & G. ASHWORTH, electrical engineers, 17, Mayville Road, Brierfield, and 33, Garrick Street, Nelson, Lancs.—Mr. H. Ashworth and Mr. G. Ashworth have dissolved partnership. The former will attend to debts.

J. W. HARGREAVES & Co., electrical engineers, 104, Park Lane, Leeds.—Mr. J. W. Hargreaves and Mr. R. D. Syson have dissolved partnership. Debts will be attended to by Mr. Hargreaves, who will continue the business under his own name.

Trade Announcements.—MESSRS. J. H. HAWKINS and C. M. HALLAHAN have opened an electrical department in connection with their business at 58, High Street, Aylesbury.

MR. REGINALD COX, who has been for many years connected with the English Electric & Siemens Supplies, Ltd., and their predecessors, has resigned his position in order to undertake the management of the London office of Tramway Supplies, Ltd. (of Leeds), at 93, Cannon Street, E.C.4, which office is being opened to deal with business in the south for home and export. Telephone No., "City 3014"; telegrams: "Tramsuphm, Cannon, London." In addition to tramway requirements, Mr. Cox will handle the T.S. oil switch equipment, distribution panels, underground cable boxes, and other manufactures.

THE YORKSHIRE ELECTRIC POWER CO.'s head office has been removed to 36 & 37, Park Place, Leeds. Telephone: "24,578 Leeds"; telegrams: "Yepower," Leeds.

The business of MESSRS. SUTCLIFFE BROS., 90 & 91, Queen Street, E.C.4, has been taken over by Messrs. E. G. Hoare and L. E. Milburn as from the 1st inst. It will be carried on exactly as before and under the same style.

MESSRS. W. H. ALLEN, SONS & CO., LTD., of Bedford, have appointed Mr. Harry Astbury, A.M.I.M.E., of 159, Gt. Charles Street, Birmingham, as their representative for the Birmingham district.

MESSRS. HUBBER & SON announce that the business of the late Mr. Frank Hubber, electrical engineer, of 85 and 86, South Street, Exeter, will be continued by them, with Mr. Walter H. Hubber as manager.

MESSRS. HIGGS BROS., of Sand Pits, Birmingham, are opening a branch at 3, York Street, Manchester, to deal with all sales in Lancashire and Cheshire.

MR. W. DOLAN, having started in business as an electrical wiring contractor, at 214, Somers Road, Southsea, desires catalogues of lighting, heating, telephone and other accessories and fittings.

MESSRS. GEORGE BROS. & Co. have removed to 65, Fenchurch Street, London, E.C.3. Telephone No.: Avenue 5731.

Catalogues and Lists.—MESSRS. NAIDLER BROS. & THOMPSON, LTD., 97a, Dalston Lane, E.8.—An illustrated booklet showing construction, connections, &c., of ammeters, voltmeters, power-factor meters, synchroscopes, and other power-station instruments, testing sets, &c.

MESSRS. BATES & NORTHCLIFFE, LTD., Perseverance Works, Brighouse, Yorks.—A price list of mild steel wire of various gauges, shapes, and finishes.

LEE TRANSPORT & DEPOSITORY, LTD., Castle Street, Long Acre, W.C.2.—A "manifesto" describing the various services which the firm provides, including motor, railway and sea transport, storage, &c.

SCALDIS WORKS (A. Bruynoghe), 11, Balfour Grove, S.W.12.—A price list of d.c. and a.c. motors.

SOCIÉTÉ INDUSTRIELLE D'ÉLECTRICITÉ (FRANCE). 23, Queen Anne's Gate, S.W. 1. A price list of "Eternos," "Radius," and "Perfectos" safety cartridge fuses.

THE Y-SWITCHGEAR CO., Temple Courts, Temple Row, Birmingham. 1. A book No. 101 1, giving illustrations, details, and prices of controller-type motor-control air switches.

MESSRS. RUSTON & HORNSEY, LTD., Lincoln.—A booklet setting out with the advantages of air fuel.

THE MITCHELL CONVEYOR & TRANSPORTER CO., LTD., Atlantic House, Holborn Viaduct, E.C.1.—An illustrated brochure giving many particulars regarding the cost and working of locomotive coal- and ash-handling plants.

MESSRS. WARD & GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester.—Circular announcing reduced prices of Isolux fuse units and boards. Illustrated.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., 20, Brazenose Street, Manchester.—A booklet containing illustrations and revised "versions of nursery rhymes, advertising "Cosmos" lamps. The booklet also includes particulars of a colouring competition for children.

THE CABLE ACCESSORIES CO., LTD., Britannia Works, Tipton, Staffs.—An illustrated and priced catalogue of "Revo" switch- and fuse-gear, sealing chambers, &c.

Calendars and Almanacs.—**MESSRS. MAWDSLEY'S, LTD.,** of Dursley, have issued a calendar for 1922, with a set of small monthly slips placed beneath a picture well executed in colour of "A Refreshing Interval" (Val Davis)—a lady artist enjoying a cup of tea.

MESSRS. ATTON & CO., LTD., of Derby, have issued a hanging wall calendar, the pictorial feature of which is a beautiful collotype reproduction of E. Henry Holder's painting, "The River Yealm, Devonshire."

A wall sheet calendar with monthly date slips for 1922 has been received from the NATIONAL ENGINEERING SUPPLY CO., of Cardiff.

Composition.—**K. H. KERR & CO.,** electrical accessories manufacturers, Barr Hill Works, Dalbeattie.—**MESSRS. W. & W. B. GALBRAITH,** chartered accountants, 87, St. Vincent Street, Glasgow, state that the committee of creditors has held various meetings. They have been instructed to pay the creditors as an instalment towards the composition of 10s. in the £, one-half, or 5s. per £, the balance to be paid by the debtor in six months or thereby.

Our Foreign Trade.—November figures.—The following were the values of imports and exports of electrical goods and machinery during November, 1921:—

	Nov. 1921.	Inc. or dec. 11 months, 1921.	Inc. or dec.
Imports.—	£	£	£
Electrical goods and apparatus ...	132,836	110,472	+ 263,093
Machinery ...	648,144	960,274	+ 7,970,130
Exports.—			
Electrical goods and apparatus ...	790,895	427,203	+ 2,050,560
Machinery ...	6,023,903	1,764,250	+ 13,088,414
Re-exports.—			
Electrical goods and apparatus ...	11,315	3,600	+ 69,343
Machinery ...	97,230	67,510	+ 389,854

Engineering Trade Ballot.—The Executive Council of the Amalgamated Engineering Union, in an official statement, strongly advises members to vote for the agreement on freedom of management and overtime, recently provisionally arrived at with the Engineering and the National Employers' Federations. The continuance of the negotiations on the question of machines, apprentices, and payment for holidays is contingent on acceptance of the agreement. "Therefore," the Executive Council say in conclusion, "it is imperative that the agreement should be accepted, and thus enable negotiations on these important matters to be proceeded with." The ballot on the question will be taken in the next week, and the result will not be known until early in the New Year.

Mr. J. J. Brownlie, President of the Amalgamated Engineering Union, in his monthly report, says the membership of the Union, which stood at 100,000 at the beginning of the year, declined to 930,000 at the beginning of December. Nearly 26 per cent of the members of the union are unemployed. —*Westminster Gazette.*

Electrical Supplies in South Africa. According to the *South African Mining and Engineering Journal*, of November 19th, the improvement in electrical goods noted during the preceding month of six weeks continued, and dealers appeared to be fairly busy as compared with recent months. Stocks held were plentiful, and continued to arrive in fair quantities. "Prices, merchants state, appear at present to be balancing themselves both at home and in Germany and Holland. America, as previously stated, is very seriously handicapped on account of the exchange. Although there are no big contracts going at present, there is a fair daily amount of house wiring."

For Sale. West Hantsport Corporation Electricity Department has for disposal a Tabor storage battery, capacity 2,500 amp-hours on a 10-hours rating. (See our advertisement pages today.)

Book Notices.—"The Electro-metallurgy of Steel," by C. C. Gow, p.p. xvi+351, 132 figs. London: Constable & Co., Ltd. Price 27s. 6d.

"Inaugural Address to the Institution of Electrical Engineers," by J. S. Highfield. (Reprinted from the *Journal*). (9 pp.). London: The Institution.

"The Book of the Ford Van," by R. T. Nicholson; second (revised) edition. London: Temple Press, Ltd. Price 3s. net.—The second edition of this work has been completely revised and enlarged. It deals in a comprehensive manner with the care and maintenance of the "Ford" van, and gives some idea of its commercial possibilities. The new electrical outfit is described, and it is noticed that the magneto is no longer the source of lighting current; it is possible to use the battery for starting, if desired.

The *Decimal Educator* for December contains a report of the annual meeting of the Decimal Association, at which it was resolved to concentrate attention in the first instance on the reform of the units of weight, and to support Mr. Harry Alcock's proposal for an increase in the value of the 'penny' to one-tenth of a shilling. Articles in support of these policies, by Mr. E. C. Barton and Mr. Alcock, and on the progress of the Metric Bill in the U.S. Senate, also appear. The journal is published by the Decimal Association, price 6d.

Insulating Tubes in Germany.—The Syndicate of Insulating Tube Works of Dortmund, announces an increase in prices of 20 per cent. owing to the greater cost of raw materials and the rise in wages. It is stated that a large quantity of raw materials has got into the possession of speculative dealers, some of whom have been reported to the public authorities for profiteering, and that the actual producers have assisted the practice.

Belgian Tramway Concessions in Russia.—According to reports from Moscow and Riga, the Soviet Government is in negotiation with the Berlin A.E.G., with a view to the transfer to the latter of the concessions for the working of tramways, formerly in Belgian ownership, in various towns in Russia. The Government is said to demand in return, a share of 50 per cent. of the net profits, and the company would have to undertake to feed the workmen and staff.

Czecho-Slovakia.—At the last meeting of the directorates of the Bohemian-Moravian Machine Works and of the Elektrizitätswerke Aktien Gesellschaft (formerly Kolben & Co.) it was decided to amalgamate the two concerns from January 1st next. The share capital of the Bohemian company is to be raised from 6,000,000 to 8,000,000 kronen.

The Japanese Delegation.—The delegation of 23 Japanese business men, who, together with a secretariat of 28, arrive in this country from the U.S.A. on Monday next, will have conferences with a large number of financial, commercial, shipping, and other authorities in London. They will also study traffic control, the underground system, and many other matters here, and will visit the important provincial centres in January, leaving for the Continent on January 21st. A programme of the visit appeared in *The Times* on Tuesday.

Chinese Notes.—Four electrical undertakings have recently been registered with the Chinese Ministry of Agriculture and Commerce, namely: the Shou-shing Telephone Co., Shou-shing, Chekiang; the Jui-An Electric Light Plant; Sui-an, Chekiang; the Chowshan Electric Co., Chowshan, Chekiang; and the Sun Fong Electric Co., Kiangsu. Other electric companies that have been organised are the Yau Tai Electric Light Co., at Tai Hsin, Kiangsu, and the Sing Yang Electric Light Co., of Sing Yang, Honan. Chen Yi-hee, president and organiser of the Sunning Railway, expects to organise a company with 2,000,000 dol. capital to develop a water-power project near the town of Sunning. As soon as the necessary capital has been fully subscribed it is planned that contracts for the equipment will be placed immediately.

For Eastern Review.

New French Companies.—The Etablissements Paul Cadot has been formed at Paris (108, Boulevard Haussmann), with a capital of 2,000,000 fr., with the object of manufacturing accumulators and electrical apparatus for motor-cars.

A French Failure.—The failure is announced of the Société Industrielle de Télégraphie Sans Fil et d'Electricité, 200,000 fr. capital, of 18, Rue Duphot, Paris. Liquidator, M. Gaubert, 1, Rue Dante, Paris.

Lead.—Messrs. James Forster & Co., reporting on December 10th, say:—"Trade demand continues very slack, but, slack as it is, it is well to remember that the consumption for sheet and pipe lead continues steadily round about 5,000 tons per month, and that for white lead probably about 3,000 tons monthly, making 8,000 tons, added to which is the electrical trade, which also at present is very slack. Against such figures we had 3,015 tons left for home absorption in October, and not much more for November, so the complete disappearance of all public stocks is not to be wondered at! France, Germany, Holland, and South America continue to buy, and English manufacturers are sold out for some time ahead. The Board of Trade returns for November are:—Imports, 8,852 tons; exports, 2,843 tons; leaving for home absorption, 6,009 tons."

The Russo-German Reconstruction Scheme.—In further reference to the A.E.G. Russian scheme, to which we refer in our leading columns to-day, the Berlin correspondent of the *Manchester Guardian Commercial* states that the driving force for the resumption of Russo-German trade relations and for the handling of the Russian problem on a generous scale is Herr Deutsch, the general director of the Allgemeine Electricitäts Gesellschaft, "who is of opinion that the trade opportunities offered by Russia are sufficient to give full occupation for a number of years to the industries of all countries. He does not see the need for acute competition, and believes that international co-operation is the solution to the problem. He has, therefore, worked out a plan, which he submitted, during a recent stay in London, to a number of leading English personalities, who were apparently quite enthusiastic about it. Roughly speaking, Deutsch considers that America would grant credit and supply raw materials; Great Britain would see to transport, grant credits, and also send manufactures; while Germany would act as manufacturer. All orders from Russia would go straight to this international organisation, and be executed at a certain fixed price, which could be somewhere between the British and German cost of production. Profits on German orders would compensate losses on British supplies." Sir Peter Rylands is stated to consider that, while some such scheme is desirable in the general interest of European trade, it should be carried out as part of the Reparations scheme, without aid from America, and under Allied supervision.

In an interview also published in the *Manchester Guardian Commercial*, Mr. Krassin, discussing the German proposals for developments in Russia, said that a trade arrangement of some sort was just as essential to Russia as it was vital to Germany; the 150 million peasants in Russia were in urgent need of the thousand and one things which they had been compelled to do without practically since the war started. Mr. Krassin also agreed that the prospect of obtaining necessary commodities and utensils would spur the average Russian peasant to increased production, and in this connection he gave his opinion that guarantees on Russia's part could safely be confined to repayment by means of surplus grain, &c., as rouble notes would be useless beyond the borders of Russia. He had discussed the formation of some such similar scheme with Herr Deutsch, of the Allgemeine Electricitäts Gesellschaft, and with many other business men on the Continent, who fully recognise the fact that the present state of affairs in Europe is bound to grow still worse unless a sane attempt can be made to bring Russia once again within the wheels of international trade.

Bennis Contracts.—A large number of orders have been recently received by Messrs. E. Bennis & Co., Ltd., for their stokers and compressed air furnaces for Lancashire boilers, chain grate stokers for water-tube boilers, and mechanical coal and ash handling machinery. The list of contracts before us includes equipment for collieries, mills, iron and steel works, and the Ashton-under-Lyne Electricity Works, the last-named order being for four chain grate stokers for Thompson water-tube boilers.

£2,000 per Annum.—It appears that employers experience difficulty in finding men qualified to occupy positions where their services will be worth £2,000 per annum to the businesses in which they are engaged. It seems to us that it is unreasonable to expect to find strong swimmers among those who paddle with the crowd on the water's edge. What brings out the strength of a man's character are opportunity and responsibility. Cadets are not expected to conduct campaigns, they must first serve as captains and colonels. Administrative ability needs cultivation and experience. Is it not time that some employers were bluntly told that they are themselves to blame for lack of promising material among their people? If managers and sub-managers are allowed to crush initiative, frown on ambition and penalise enterprise, employers must not expect to find potential £2,000 men in their employ. Intelligent young men do not stop with such firms. Incidentally, some readers might be glad to know where these employers conceal themselves when the £1,850 man is looking for a rise!—*The Times Trade Supplement*.

Wages in the Electricity Supply Industry.—At a meeting of E.T.U. shop stewards of the No. 10 (Greater London) Area, on December 5th, it was decided to call for the setting aside of the national agreement as to wage reductions arrived at by the N.J.L.C. for the industry, so far as No. 10 Area is concerned. The ground upon which this was demanded was that wages variations were already provided for in the special agreement for the No. 10 Area. It was declared at the meeting that any further wage reductions would be strenuously opposed.

A Ten per Cent. Paper Dividend.—The Rhensish-West-phalian Electricity Works Co., of Essen, which is largely a pit bank generating undertaking, has just declared a dividend at the rate of 10 per cent. for 1920-21. The chairman stated that a 10 per cent. dividend in paper was 4.2 per cent. in gold.

Price Reductions.—Messrs. DONOVAN & Co., of Birmingham, announce that though the recent award reducing wages has not yet had full effect, they are increasing discounts on "Safuse" and "Donlok" gear by 20 per cent. as from December 1st.

New Metropolitan-Vickers Showroom.—The Metropolitan-Vickers Electrical Co., Ltd., has just opened a showroom at No. 7, Saville Row, Newcastle-upon-Tyne. The new premises are most conveniently situated, being in the centre of the business section of the city. The showroom, elegantly fitted from the firm's own designs, is divided into three sections, representative, respectively, of the Adam, Jacobean, and Georgian styles of decoration, and in each case the electric-light fittings, pendants, shades, &c., are in harmony with the surroundings. The different styles of furnishing are found very advantageous in judging the exact effect of the fitting in varied surroundings. Beyond the sections devoted mainly to lighting fittings, is an industrial department. Here are shown many types of ironclad switchgear, cables, samples of conduit, and a large display of all sorts of bell pushes, switches, indicators, &c. The firm's "Cosmos" specialities are also displayed. Exhibitions of electric cooking are to be frequently given; an electrically-heated water supply and electric irons add to the general interest of the display.

Unemployment.—The latest statistics of unemployment issued by the Ministry of Labour show that the total number of unemployed persons on December 2nd was 1,835,200, an increase of about 2,000 on the week. Short-time workers numbered 265,500 on November 25th. Relief schemes estimated to employ about 41,000 men for periods averaging five months have been approved by the Unemployment Grants Committee.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries:—

Crypto. No. 408,423. Class 6. Induction motors, rotary transformers. October 5th, 1920. No. 419,518. Class 8. Fitted electrical switchboards and alternating-current starting apparatus. October 13th, 1921.—The Crypto Electrical Co., Ltd., Acton Lane, Willesden Junction, N.W.

Ebacol. No. 418,882. Class 6. Mechanical and electrical machinery of all kinds.—Edmiston Brown & Co., Ltd., 219, St. Vincent Street, Glasgow. September 27th, 1921.

Secura. No. 418,644. Class 50. Electrical insulating materials, sleeveings, and coverings made from a textile fabric impregnated with an insulating varnish.—Edward P. Brasse, Culvert Works, Culvert Road, Tottenham, N. September 17th, 1921.

Lew. No. 418,872. Class 5. Metallic wires. No. 418,873. Class 8. Electric light flexibles and telephone flexibles composed of two or more wires insulated with india-rubber with an outer covering of textile material. No. 418,874. Class 32. Wires covered with silk. No. 418,875. Class 40. Wires covered with india-rubber. No. 418,878. Class 50. Impregnated electrical insulating tape.—The London Electric Wire Co. & Smiths, Ltd., 7, Playhouse Yard, Golden Lane, London, E.C. September 26th, 1921.

Aron. No. 415,009. Class 8. Electricity meters.—Aron Electricity Meter, Ltd., 60, Salisbury Road, London, N.W. May 9th, 1921.

MV. (lettering and design). No. 418,908. Class 50. Electric insulators, electric insulating materials, and electric insulating preparations.—Metropolitan-Vickers Electrical Co., Ltd., 4, Central Buildings, Westminster, S.W. September 27th, 1921.

Milestone. No. 416,959. Class 8. Voltmeters.—H. Gordon, Ltd., 8, City Road, London, E.C. July 14th, 1921.

Sunco (lettering and design). No. 419,647. Class 18. Electric fires, being heating apparatus for buildings.—The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C. October 18th, 1921.

German Porcelain Insulators.—The prices of high-pressure porcelain insulators were increased in Germany by 20 per cent. at the beginning of this month.

Action by London Members of the E.T.U.—In the ELECTRICAL REVIEW for November 18th (p. 675), we published the chief reasons of the Executive of the Electrical Trades Union for suspending the London District Committee. It is stated in the *Electron* for December that in view of the action of the executive certain London members applied to the High Court to restrain the executive from carrying their resolution into effect. The application was heard by Mr. Justice Astbury, who ruled that the cause did not lie. In giving his ruling, the judge pointed out that, under the constitution, the executive had no power to suspend a district committee, but that the rules provided that such committee should consist of one delegate from each branch in the district, which branches alone had the power to suspend their elected delegates. A district committee for London would have to consist of 99 members—one from each of the 99 affiliated branches. The *Electron* adds: "Steps were accordingly taken to form such committee, and on Thursday, November 17th, the full district committee, constituted in accordance with rule, met for the first time. It included, naturally, the members 'suspended' by the E.C., whose branches were satisfied with their representatives, and who will do their own 'suspending' if and when they become dissatisfied."

LIGHTING AND POWER NOTES.

Aberdeen.—**MINERS' STRIKE.**—The Electricity Committee recently sought compensation for an alleged loss due to the action of the Coal Controller during the miners' strike in holding up supplies of coal to the electricity works. The War Compensation Court decided, however, that the Corporation had suffered no loss which could properly be made up from public funds.

Banff.—**PROPOSED ELECTRICITY SCHEME.**—A report has been prepared by Mr. Bell, of Aberdeen, upon a scheme of electricity supply for Banff and Macduff. The estimated cost is £20,000.

Bangor.—**BULK SUPPLY.**—On December 7th the City Council approved a recommendation of the Electricity Committee to conclude an agreement with the North Wales Power Co. for a bulk supply of electricity. The sum of £9,000 is to be borrowed to cover the cost of plant, cables, &c.

At the same meeting it was decided to apply for sanction to borrow £2,000, being the prospective expenditure upon mains, services and meters during the ensuing two years.

Barrow.—**PROPOSED PRICE INCREASE.**—A proposal to increase the price of electricity was brought before the Council on December 5th. It was stated that a loss of £10,000 had been incurred by the undertaking during the first half of the present working year. The Council, however, referred the proposal back to committee.

Barry.—**GAS VS. ELECTRICITY.**—A crowded meeting under the auspices of the Local Ratepayers' and Property Owners' Association was held at Barry on December 7th to discuss the proposal of the Urban District Council to expend £125,000 on the extension and improvement of the gas works. At the invitation of the Association, Mr. W. A. Chamen, general manager of the South Wales Electrical Power Co., Ltd., addressed the meeting. He stated that £60,000 would be sufficient to give a fair supply of electricity to the town, and a cable could be laid from Barry to Llanelli for an additional £25,000. He contended that electric lighting would be considerably cheaper for the town than gas. A resolution was passed unanimously calling upon the Council to stay its hand before spending such a large sum of money on the gas undertaking, pending advice upon estimates for electric lighting. Mr. C. B. Griffiths, chairman of the Council's Gas and Water Committee, challenged Mr. Chamen to meet him to debate the merits of gas *versus* electricity.

Bootle.—**PROPOSED TRANSFER.**—Proposals are under consideration for the transfer of the Corporation's electricity undertaking to the Liverpool Corporation.

Brackley.—**PROPOSED ELECTRICITY SUPPLY.**—The Town Council has decided to call a town meeting to consider the question of an electricity works for the town. The promoter of a scheme at Woodstock has offered to carry out a similar scheme at Brackley at a capital of between £4,000 and £5,000 is raised locally.

Burnham (Berks).—**ELECTRICITY SUPPLY.**—The Slough and Datchet Electric Light Co. has informed the Council that it cannot see its way clear to extend its cables to Burnham. The Council has decided to write to the Electricity Commissioners for advice as to the action to be taken to secure revocation of the company's powers of supply in this district.

Chester.—**EXTENSION OF SUPPLY AREA.**—The Corporation is applying to the Minister of Transport for a special order to extend the area of supply to include the urban district of Hoole and certain portions of the rural district of Chester.

Continental.—**FRANCE.**—A concession has been granted to the Société Normande d'Electricité to supply electricity for public purposes and to private consumers. The company's network (30,000/5,000 volts) comprises the communes of Mailletaye and Hearteauville in the Seine Inférieure département and sundry communes in the Quilleboëuf district of the Département de l'Eure.

A 120,000-kW generating station is shortly to be set up in the Sarte coalfields. The Administration Domaniale des Mines has engaged the Société Générale d'Entreprise, 56, Faubourg St. Honoré, Paris, as consulting engineers, on whom will fall the duty of choosing the *concessionnaire* after examination of the schemes submitted.

Croydon.—**DOMESTIC SUPPLY EXPERIMENT.**—As an experiment, the Electricity Committee has decided to supply electricity for both lighting and cooking through one meter to the houses on the Norbury estate, at a weekly charge of 1s. 6d. Energy used in excess of 12 units per annum will be charged for at the rate of 2d. per unit.

Darlington.—**YEAR'S WORKING.**—The net profit of the Corporation electricity department for the year ended March last amounted to £579, as against £5,365 in the previous year.

Dover.—**LOAN SANCTIONED.**—The Town Council has received sanction to borrow £1,000 for the extension of the electricity supply to St. Margarets and for mains and transformers.

Dublin.—**ELECTRICITY SUPPLY EXTENSIONS.**—The Corporation is being urged to extend the electric lighting system to the Inchicore district.

Dumfries.—**PRICE REVISION.**—The Electricity Supply Co., Ltd., has applied for permission to charge 1s. per unit, with a minimum payment of 10s. for each of the winter quarters, and 10s. for the summer quarters.

Edinburgh.—**YEAR'S WORKING.**—The accounts of the electricity undertakings (Engineer: Mr. F. A. Newington), for the year ended May 15th last, record, as regards the Edinburgh undertaking, a total revenue of £314,609, as compared with £234,247 in the preceding year. Working expenses amounted to £241,054, as against £162,020, leaving a gross profit of £73,615 (£72,227). After payment of capital charges, &c., a deficit of £963 was the net result; in 1919-20 a net profit of £10,551 was made. The total number of units sold rose from 24,101,273 to 29,627,250, of which 3,340,161 units was supplied in bulk to Leith.

The Leith accounts show a total revenue of £79,457 and working expenses £77,237, leaving a gross profit of £2,220. The net result was, with a credit balance of £6,175 brought forward, a deficit of £11,210. The number of units generated was 4,414,045.

Feltham.—**ORDER REVOKED.**—The Ministry of Transport has revoked the Electric Lighting Order of 1914.

Fraserburgh.—**ELECTRICITY SCHEME.**—The Town Council has under consideration a proposal for the installation of electric lighting in the town. It is estimated that the scheme would cost £8,000 and provide work for 300 men.

Hallifax.—**YEAR'S WORKING.**—The accounts of the Corporation Electricity Department (Engineer: Mr. W. M. Rogerson, M.I.E.E.) for the year ended March 31st last, show a total income of £182,998, as compared with £137,832 in 1919-20. Working expenses amounted to £126,983, as against £80,752 in the previous year, leaving a gross surplus of £56,015 (£57,080). After the payment of capital charges the net result was a profit of £20,124, as compared with £23,997 in the preceding year. The total number of units sold increased from 16,161,399 to 18,521,577, and the maximum demand from 7,760 to 8,790 kW.

India.—**KALLAR FALLS SCHEME.**—A conference was held last month to consider a scheme for utilising the Kallar Falls for the generation and supply of electricity to the whole of Travancore. It was decided to proceed with the scheme and to seek the permission of the Madras Government to erect a power house in a British District.

The Mulshi Scheme.—A statement regarding the acquisition of land for the formation of a lake in connection with the Mulshi hydro-electric scheme, was recently issued by the Tata Power Co., Ltd. This refutes exaggerated statements as to the area to be submerged, and states that liberal compensation has been made to the evicted landowners or tenants. The land will be gradually submerged, and the bulk of the area will be untouched for five years; in the meantime the tenants are being allowed to raise crops free of charge.

The Parbati River Project.—This scheme was described in a recent issue of the *Indian Textile Journal*. It is planned to utilise a fall of about 285 ft. in the Parbati River. The first part of the installation will consist of two horizontal-shaft turbines direct-coupled to 3-phase, 5,000-V, 600-kW alternators. The power will be stepped up to 30,000 V for transmission over a distance of 10 miles to Lashkar, where a distributing station is to be erected. Other schemes mentioned are the Sindh River project, developing from 50,000 to 70,000 h.p. under a head of 780 ft., and the Kuno River scheme, by which it is estimated 4,375 water h.p. can be developed, utilising a head of 55 ft.

Keighley.—**LOAN.**—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to borrow £10,000 for the erection of an overhead transmission line from Eastburn to Skipton, and for the necessary control gear, &c.

Lancaster.—**LOAN SANCTIONED.**—The Town Council has received sanction to borrow £7,600 in respect of the proposed extension at the electricity works.

Langholm.—**ELECTRICITY SUPPLY.**—The Town Council has requested the Lighting Committee to submit a report on a scheme for electricity supply to the Burgh.

Lincoln.—**LOAN.**—The City Council has decided to apply for sanction to borrow £132,229 in respect of St. Swithin's power station.

Maidstone.—**YEAR'S WORKING.**—We have received from the Borough Electrical Engineer (Mr. E. E. Headley, M.I.E.E.) a copy of the Electricity Department's report and accounts for the year ended March 31st last. The total income was £58,402, as compared with £43,935 in 1919-20. Working expenses totalled £46,374, as against £32,263, leaving a gross profit of £12,028 (£11,672). The net result was a loss of £526; in the preceding year there was a profit of £1,486. The total number of units sold was 4,993,740, an increase of 392,861. The report gives details of a number of large extensions in a.c. supply during the year, and attributes the loss incurred to trade depression and the miners' strike.

Loan Sanctioned.—The Town Council has received sanction to a loan of £5,134 for plant for the electricity works.

Mumbles (Glamorgan).—APPLICATIONS FOR ELECTRICITY.—At a recent meeting of the Swansea Electricity Committee it was stated that a number of residents at Mumbles had asked for a supply of electricity. The engineer said that the cost of providing this would be about £15,000, and at least 500 consumers would be necessary to make the scheme remunerative. A further report was asked for.

Newark.—ELECTRICITY SUPPLY.—The Lincoln City Council has decided to supply the Corporation with electricity on terms and conditions to be arranged, subject to the Corporation agreeing to provide and fix at its own expense the necessary transmission lines from St. Swithin's power station to Newark.

Rathmines (Co. Dublin).—NEW PLANT.—As the plant at present installed cannot now meet the demand for electricity, the Urban Council has decided to install a 750-kW turbo-generator at a cost of about £90,000. An amendment, seeking to defer the matter for six months, was lost.

Salford.—ERECTION OF NEW STATION APPROVED.—On December 7th the Council approved the recommendation of the Electricity Committee to proceed at once to prepare drawings and estimates for the erection of the new station at Agecroft. The chairman of the committee pointed out that the estimated cost of the station was £847,000, whereas a year ago the figure was put at £1,189,000. Because of this a member moved an amendment delaying erection for another year, but this was defeated. The scheme has already received the approval of the Electricity Commissioners.

PRICE REDUCTION.—The Town Council has decided to reduce the price of electricity by 15 per cent. as from January 1st. The new charges will be 75 per cent. above pre-war rates for lighting and 100 per cent. for power, heating and bulk supply.

Scarborough.—PRICE REVISION.—The Electric Supply Co. has applied for an Order to charge 15s. 6d. to 15s. 11d. in respect of the winter quarters, and 10s. 6d. to 10s. 11d. for the summer quarters, and 1s. 6d. per unit beyond these quantities.

Skipton.—LOAN.—In view of the agreement which has been entered into between the Urban District Council and the Keighley Corporation for a supply of electricity, the Urban District Council intends to apply for sanction to borrow £20,000, representing its portion of the cost of the scheme. The transmission line will be linked up to the old grammar school in Newmarket Street, from which electricity will be distributed to the town.

St. Annes-on-Sea.—LOAN SANCTIONED.—The Urban District Council has received the sanction of the Electricity Commissioners to the borrowing of £9,740 for the purposes of the electricity undertaking.

St. Helens.—LOAN.—The Council is seeking the sanction of the Electricity Commissioners to a loan of £40,000 for electricity purposes.

West Bromwich.—PRICE REDUCTION.—At its meeting on December 7th the Town Council approved a reduction of 12½ per cent. in the charges for electricity for power purposes. The opinion was expressed that a further reduction was essential to manufacturers, and that the price of lighting energy should also be reduced. The Mayor said that an increased demand would permit of these reductions.

Worthing.—LOAN.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to the borrowing of £17,000 for extensions to the electricity works.

York.—SUPPLY CONTRACT.—The Council has entered into an agreement with the War Department for the supply of electricity to the Government offices in the city for three years. It is estimated that 70,000 units will be taken each year.

TRAMWAY AND RAILWAY NOTES.

Blackburn.—REPORT ON UNDERTAKING.—In accordance with the request of the Tramways Committee, Mr. A. R. Fearnley, M.Inst.A.E., has presented a report upon the Corporation tramway system. He was asked:—(1) Whether any reconstruction of the present system was desirable and practicable; (2) whether extensions were desirable; (3) whether motor omnibuses should be run either as supplementary to or independently of the tramways; (4) to advise the Committee as to its general policy. Mr. Fearnley says that the track, rolling stock, and overhead line are in good working condition, but with regard to the last, suggests that the side poles and short brackets be replaced, to give greater flexibility in working, by poles with longer arms. The Darwen track is corrugated and needs grinding and the Darwen authorities should be approached upon the matter. As regards services, Mr. Fearnley suggests through-running between various well-populated districts. Referring to term of reference (1) he is of opinion that the system does not require reconstructing. With reference to (2) he considers that extensions from Cherry Tree Station to Pleasington, from Wiltshire Section to Whalley, and from the Preston Road Section to the borough boundary at Preston New Road, are desirable and would be a good investment. Mr. Fearnley suggests, with

regard to (3), that powers be obtained for running motor omnibuses on routes both within and outside the borough. On the question of general policy (4), Mr. Fearnley thinks that the existing uncertainty regarding the future of the tramways will be counteracted by the continued downward trend of the cost of materials, and he considers that by the time powers have been obtained for carrying out extensions, the laying of permanent way will only entail a reasonable expenditure.

Central London Railway.—EXTENSION OF TIME.—The Minister of Transport has extended the time of the Central London Railway Act, 1914, for the completion of the tunnels until July 1923.

Chesterfield.—NO PENNY FARES.—At a meeting of the Town Council on December 6th, an *ad hoc* sub-committee reported that it was unable to recommend the restoration of penny fares. It was stated that renewals, deferred during the war, would cost £10,000. The matter is to come up for consideration again next month.

Clay Cross.—LIGHT RAILWAY.—The Urban District Council has approved of a scheme for the construction of a light railway between Clay Cross and Ashover. The scheme is being promoted by the Clay Cross Co., Ltd., and the preliminary expenses are estimated at over £28,000.

Continental.—SWITZERLAND.—The completion of the second Simplon tunnel was announced on December 4th, by *The Times'* Berne correspondent. An inaugural train ran to Iselle. The first tunnel was opened in 1906; the new tunnel was commenced from the Swiss side in 1912.

ITALY.—*Il Sole* learns from Rome that a report has been laid before the Senate relating to the authorisation given to the Railway Administration to raise a sum of 440 million lire for special works. At present electric traction is employed on 559 km. of line with a track length of 1,045 km. The electrification of the direct lines Ronco-Arquata-Tortona, Tortona-Nowi, Voghera-Bivio-Bormida, and Genoa-Ovada-Alessandria has been begun. It is hoped to complete very shortly the electrification of the Rome-Tivoli and the Rome-Anzio-Nettuno lines, after which the works for the electrification of the direct Rome-Naples line will be pushed on. Thus at the beginning of 1923 another 500 km. of electrified lines may be completed with a track length of 1,370 km.

Since the construction of locomotives takes from 18 to 21 months, the Railway Administration has been obliged to give orders already, beginning with one for 111 locomotives at a total estimated cost of 165 million lire. The Government has authorised the Railway Administration by a decree law to raise 169 million lire for the acquisition of a further 120 electric locomotives.—*Reuter's Trade Service* (Milan).

Edgehill.—EXTENSION OF TIME.—The Light Railway Co. has applied to the Ministry of Transport for an extension of time by one year, from January 28th, 1922, for the compulsory purchase of lands in respect of the Order granted in 1919.

Glasgow.—TRAMWAY PURCHASE.—The Corporation has decided to purchase the Coatbridge and Airdrie tramways at a cost of £82,500.—*Daily Chronicle*.

London.—WORKING OF NEW "UNDERGROUND" TRAINS.—Careful analysis has been made of the working of the new trains on the District Railway, since their introduction, and it is stated that the results are very satisfactory. The new trains are providing in many ways that freedom of movement which is essential where there is great density of traffic. Figures prove that the new trains save from 2 to 3 seconds in loading and unloading at busy stations during the rush hours. That is a gain which is due largely to the door arrangement and to the improved facilities for egress and ingress. Furthermore, the new trains by their increased motor-power and improved braking are able both to start away and to slacken from full speed very much more quickly than the older stock.

FUTURE POSITION OF TRAMWAYS.—Giving evidence before the Royal Commission on London Government, which is considering the feasibility of a larger central administrative body for Greater London, Mr. Norman, L.C.C., said that the tramways in Greater London could be leased; there would be many applicants for them. It might be necessary for the proposed new Council to compulsorily acquire systems in outer London; special legislation would be necessary to secure this.

Luton.—SUNDAY SERVICES.—It has been decided not to run trams on Sundays during the winter.

Manchester.—CHRISTMAS SERVICES.—The Executive Committee of the Manchester branches of the United Vehicle Workers' Association has instructed the tramway employees to work on Christmas Day; a modified service will be run and the men will receive double pay.

The Stalybridge employees have also agreed to do duty on Christmas Day.

Newcastle-on-Tyne.—LONGER HOURS.—At a meeting of the City Council on December 7th, it was decided to rescind a previous resolution fixing the tramway employees' working week at a maximum of 44 hours. The chairman of the Transport and Electricity Committee said that it was necessary either to increase revenue or reduce expenditures. The imposition of higher fares was impracticable, but the working

of longer hours by the men would effect considerable economy. No men would be discharged as a direct consequence of this decision. The employees recently announced their intention to resist any attempt to lengthen the working week.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—LONG-DISTANCE WIRELESS.—In moving the approval by the Federal Government of the draft agreement with Amalgamated Wireless, Ltd., for the erection of high-power wireless telegraph stations in Australia, Mr. W. M. Hughes, Prime Minister, referred to the recent messages transmitted from England, which were successfully received in Australia, and said that such transmission had been considered impossible by the Imperial Conference. The proposed capital would be 1,000,000 £1 shares, the Commonwealth taking half, with the controlling interest, which would be preserved in the event of an increase of capital.

The Federal Parliament has referred to a joint committee of the Chambers the rival proposals which have been submitted for communication direct with Great Britain. If, after investigation, either scheme is recommended with or without alteration, the Prime Minister will have the power to sign the contract. It is interesting to note that messages transmitted from the Post Office arc station at Leafeld, which is working on low power pending the completion of the corresponding station in Egypt, are being received in Australia. According to a message from Sydney the morning newspapers in Australia are publishing news dispatched from Leafeld, which has been picked up by the Perth wireless station. It is well known that news has been received in Australia and New Zealand during the last three years from several of the stations in France and Italy, which are equipped with Elwell arcs similar to those at Leafeld.

Chile.—NEW WIRELESS STATIONS.—So as to enable Chile to correspond with the principal European and American stations, the Government is accelerating the installation of wireless stations in various parts of the Republic. The total cost of this project is estimated at £1,385,000, says *The Times*.

Christmas Telegrams.—The Post Office has made special arrangements with the Australian and New Zealand administrations for the delivery in those Dominions, on Christmas morning and New Year's Day, of telegrams of greeting sent from this country, at one-quarter of the usual rates. The price per word will be 9d. to Australia and 8d. to New Zealand. The telegrams may be handed in at any postal telegraph office not later than December 20th for delivery on Christmas Day, or December 28th for delivery on New Year's Day. The minimum charge will be 7s. 6d. to Australia and 6s. 8d. to New Zealand. Similar facilities are also provided for delivery in this country, on Christmas Day and New Year's Day, of greetings from Australia and New Zealand.

No special arrangements have been made for the delivery of greetings in Canada, but such messages can be sent by the deferred service "Via Imperial," for delivery on Christmas Day. The rate is 43d. a word, with no minimum number of words.

Telegraph offices will be open in this country on Boxing Day and Bank Holiday, December 26th and 27th, from 9.30 to 11 a.m. Exceptional arrangements will be made for London. On Boxing Day telegrams for addresses beyond a radius of four miles from the Central Telegraph Office or the West Strand branch office will not be delivered after 4 p.m. *The Times*.

Ireland.—TELEGRAPH CONTROL.—The annex to the agreement which was signed on December 6th by representatives of the British Government and by representatives of Dail Eireann on behalf of the Irish Free State states, in part, that (2) a convention shall be made between the British Government and the Government of the Irish Free State to give effect to the following conditions: (a) That submarine cables shall not be landed or wireless stations for communication with places outside Ireland be established except by agreement with the British Government; that the existing cable landing rights and wireless concessions shall not be withdrawn except by agreement with the British Government; and that the British Government shall be entitled to land additional submarine cables or establish additional wireless stations for communication with places outside Ireland.

(c) That war signal stations shall be closed down and left in charge of care and maintenance parties, the Government of the Irish Free State being offered the option of taking them over and working them for commercial purposes subject to Admiralty inspection and guaranteeing the upkeep of existing telegraphic communication therewith.

Italy.—TELEGRAPHIC COMMUNICATION.—The Chamber discussed on December 7th the agreement with the Eastern Telegraph Co. regarding the working of the cable between

Trieste and Corfu. Signor Giuffrida, Minister of Posts and Telegraphs, said it was simply a matter of substituting Italy for Austria-Hungary in the contract with the company. He added that the Government had obtained some concessions, and was convinced of the necessity of developing direct telegraphic communication between Italy and other countries, especially where there were important Italian interests. The agreement was approved.—*Reuter's Trade Service* (Rome).

Rhodesia.—TELEPHONE EXTENSIONS.—It is announced officially that the Administration of Southern Rhodesia is to spend £10,000 on telephone materials during the next year. The Government is borrowing £450,000 in three equal yearly instalments from the Imperial authorities, and out of the first advance the amount mentioned above has been allocated for "additions to telephone systems and new installations."

Russia.—TELEGRAPHIC COMMUNICATION.—The transmission of telegrams between Sweden and Russia is now possible, the Store Nordiske Co. having commenced a service of ordinary telegrams from Russia to Sweden. Radiograms have been sent since December 10th from Karlsburg to Petrograd by the Swedish Telegraph Office, and negotiations are in progress for the transmission of ordinary telegrams by the Store Nordiske Co. to Russia.—*Reuter's Trade Service* (Stockholm).

Sweden.—WIRELESS NAVIGATION REPORTS.—The Swedish Government has recently approved proposals made by the Swedish Pilotage Board for co-operation between countries on the North Sea and the Baltic with regard to ice signalling by wireless. The proposals, effect to which was to be given at the close of November, comprised the issue of reports covering the entire Swedish coast from Haparanda to the Norwegian frontier regarding the condition of the ice, to be issued daily in cipher, the key to which is being published in the Swedish "Notices to Mariners." The messages are also to include information regarding wrecks, the withdrawal of lightships, and obstacles to navigation.—*Board of Trade Journal*.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Australia.—MELBOURNE.—February 1st. Victorian Government Railways. Four motor-driven grinding machines, with accessories.*

February 15th. Postmaster-General's Department. Telephone apparatus and parts (Schedule 544). (December 9th.)

Blackpool.—December 23rd. Electricity Committee. One 5,900-kW, 3-phase turbo-alternator, surface-condensing plant with auxiliaries; one 2,000-kW, phase and frequency changer, complete with exciter and starting motor. (December 9th.)

Bradford.—December 24th. Electricity Department. Rotary converting plant (Cont. R.207.) (December 9th.)

Edinburgh.—December 19th. Electricity Supply Department. Insulated cable for five months. (December 9th.)

London.—SHOREDITCH.—January 3rd. Electricity Supply Department. One water-tube boiler of 33,000 lb. evaporative capacity. (December 9th.)

L.C.C.—January 12th. One electric passenger lift, capacity 114 cwt., with full automatic push-button control, to be completed within two months, at Geoffrey House, Tabard Garden Estate, Bermondsey, S.E. (See this issue.)

New Zealand.—WELLINGTON.—January 17th. Post and Telegraph Department, 25,000 dry cells for telephone work.*

Peterborough.—January 12th. Electricity Department. One 3,000-kW turbo-alternator with condensing plant, two 750-kW rotary converters, two 100-kW motor generators, e.h.p. and l.p. switchgear, steam, water, and drain pipes, foundations for the above plant, and structural alterations to existing buildings. (See this issue.)

South Africa.—JOHANNESBURG.—January 4th. Municipal Council. Two 2,000-kW converters, with switchgear and spares.*

Spain.—February 1st. Harbour Works authorities at Vigo. Supply and erection of a 15-ton electric crane. Particulars from the Junta de Obras del Puerto de Vigo.

Uruguay.—MONTE VIDEO.—December 30th. State Electricity Department. Power station plant: one 4-stroke Diesel engine, coupled to a 200-kW, 3-phase alternator, and one 4-stroke Diesel engine, coupled to a 300-kW, d.c. generator.*

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—P.M.G.'s Department, Queensland.

16 tons bronze wire, 40 lb. per mile, £2,000; 21 tons bronze wire, 70 lb. per mile, £2,478.—British Insulated & Helsby Cables, Ltd.

P.M.G.'s Department, South Australia.

Equipment in connection with the extension of the main distributing frame at Central Exchange, £365.—British General Electric Co., Ltd.

P.M.G.'s Department, Western Australia.

Equipment in connection with the installation of four additional primary line switches and associated parts at Perth automatic exchange, £9,754.—Automatic Telephones (Aust.), Ltd.

P.M.G.'s Department, N.S.W.

Material required in connection with the installation of impulse-sending devices at various branch exchanges in Sydney, £1,240.—Automatic Telephones (Aust.), Ltd.

Victorian Electricity Commission.

Engine-room Buildings at Newport "B" power station, £32,000.—Babcock and Wilcox.

Rubber conveyor belts, £4,500.—Piedrian Rubber Co., Ltd.
25-cycle induction motors, with slide rails and pulleys, £1,011.—British General Electric Co., Ltd.—Tenders.

Ashford (Kent).—East Ashford Board of Guardians. Accepted:—

Installing electric light at the workhouse, £838.—H. S. Tett & Co., Ltd.

Belgium.—No fewer than eleven firms submitted tenders last week to the municipal authorities of Saventhem for the supply of a 165-kW dynamo, with accessories. The prices ranged from 44,250 fr. to 92,500 fr., the lowest offer being that of M. E. Goussens, of Saventhem.**Bradford.**—Tramways Committee.

Copper rail bonds.—British Insulated & Helsby Cables, Ltd.
Steel cutters.—Crossley & Davenport.

Electricity Committee.

Transformers.—Hackbridge Electric Construction Co., Ltd.; Ferranti, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; British Electric Transformer Co., Ltd.

Dumfries.—Town Council. Accepted:—

Installing electric light at the slaughter house and stables, £155.—Dumfries Electricity Supply Co. (Electric Installations), Ltd.

London.—HACKNEY.—Electricity Committee. Accepted:—

Condensing water pipe work in connection with the extension of the Electricity Power House at Millfields Road, supply of pipes, £317.—Clay Cross Co., Ltd.

Valves for ditto: Two 36-in. valves, each with floor column and head-stock, two 30-in. ditto, two 26-in. ditto, £795.—Blakeborough & Sons.

Stafford.—The Electricity Committee has accepted the tender of Callender's Cable & Construction Co., Ltd., for the supply and laying of 1,000 yards of 1-p. cable in Newport Road.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, December 16th. At the Institution, Storey's Gate, St. James's Park, S.W. At 6 p.m. Papers on "Conveying and Elevating Machinery," by Mr. G. Mitchell and on "Discharge of Grain Barges in the Port of London by Pneumatic Elevators," by Mr. K. E. Knight.

Electro-Harmonic Society.—Friday, December 16th. At the Great Hall, Cannon Street Hotel. At 8 p.m. Smoking concert.

British Electrical Development Association.—Friday, December 16th. At the Institute of Patent Agents, Staple Inn Buildings, W.C.1. At 8 p.m. Paper on "Salesmanship in Relation to Electric Power-driven Machinery to the Home," by Mr. E. K. Morton.

Junior Institution of Engineers.—Friday, December 16th. At Caxton Hall, Westminster, S.W. At 8 p.m. Paper on "Notes on Searchlight Construction and Operation," by Mr. A. J. Simpson.

Friday, December 30th. At Caxton Hall. At 8 p.m. Questions and General Discussion.

Institution of Electrical Engineers (Scottish Centre).—Saturday, December 17th. At the Grosvenor Restaurant, Gordon Street, Glasgow. At 7 p.m. Smoking concert.

Edinburgh Electrical Society.—Friday, December 23rd. At the Philosophical Institute. At 8 p.m. Paper on "Watts on Wheels (Automobiles and Accumulators)," by Mr. F. O. Carford.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

QUERIES addressed to the ELECTRICAL REVIEW will be answered by post, if the desired information is available, provided the following simple rules are observed:—

1. Address your inquiries to the ELECTRICAL REVIEW, LTD., Service Department, and enclose a stamped addressed envelope.
2. Do not ask for information until you have satisfied yourself that it is not already contained in our advertisement pages.
3. If we are the means of putting you in touch with the firm or firms that you require, do us the favour of mentioning the ELECTRICAL REVIEW.

No charge is made for the service.

Among the inquiries received this week, we have been unable to trace the names of makers or suppliers of:—

The KYRON heat giver.

The MOTOPHONE gramophone motor.

EDDY-CURRENT BRAKES for small motors up to 10 h.p.

NOTES.

Fatality.—While assisting riveters engaged upon a pitch tank at the National Oil Refineries, Skewen, on December 6th, Cyril Kreischer (19) was killed. It was his duty to hold an electric hand lamp, and it is believed he received a shock by this means. The other men had left the tank, and he was stepping out when he fell. Artificial respiration was tried without avail. It is less than a month since another workman was killed by electric shock on the housing site at the refineries.

The Human Need of Heat.—On December 13th, Mr. J. W. Beauchamp, M.I.E.E., lectured to the National Association of Supervising Electricians on "Artificial Heat in Relation to Human Needs." The lecturer explained that his idea was not so much to present a treatise upon the subject as to reach his hearers in the manner of conveying facts about heating to the lay mind. He gave a semi-medical explanation of the heat-absorbing and emitting functions of the human body, pointing out that artificial heat was required to enable the body to work in a congenial atmosphere; at the same time a constant perfectly-regulated temperature would soon cause the mentioned functions of the body to fall into disuse. Mr. Beauchamp then dealt with the three methods of heat transference—conduction, convection, and radiation—and their relative efficiencies. Conduction was a little-used method. Convection was efficient in cases where the air could be fairly well retained, and where draughts were absent. The emission of radiant energy was the function of many types of modern electric and gas heaters. Air, being diathermanous, was but slightly heated by the passage of radiant energy, the latter being converted into heat upon contact with solid bodies, such as human beings, walls, furniture, &c. Upon the whole, the best conditions for health and work probably lay in a mixture of convective and radiant heat. The temperature of the surrounding air in any room or workshop should be maintained at a reasonable value by convective heating; central heating by means of hot water met this requirement. In addition to this, radiant electric heaters should be employed to permit of a fair amount of temperature variation to meet individual requirements. The appreciation of radiant heat for this purpose was shown by the immense numbers of bowl fires which have been sold, even for use where electricity charges are high. In the early days of electric heating, a common appliance was a combination of radiant energy transmission, provided by large carbon-filament lamps, and convective heating, by means of elements run at a comparatively low temperature. There appeared to be still room for devices of this nature. The speaker then gave a short dissertation on the way in which to familiarise the uninitiated with quantitative conceptions of heat, as contrasted with temperature. He also gave examples of calculations to ascertain the amount of heat required in definite cases, and showed that scientific investigation practically confirmed the empirical "1½ watts per cu. ft." used as a basis by heating engineers. He urged economy in the use of heat, saying that heat should be looked upon in much the same way as bread is. Speaking of modern applications of electric heating, Mr. Beauchamp instanced some Norwegian installations in which a constant supply of electricity was employed to heat the water in a large, central, lagged tank. The high load factor enabled electricity to be supplied at very reasonable rates. He also spoke of a similar experiment on a smaller scale in this country, where by means of alternate switching a constant supply of electricity could be used either for lighting, for heating the water in a small tank, or for both, by splitting the supply. A short discussion followed the lecture, and Mr. Beauchamp replied to a number of questions raised, admitting that the problem of what to do with excess heat in the hot-water systems mentioned, during summer, was a difficult one to solve in this country.

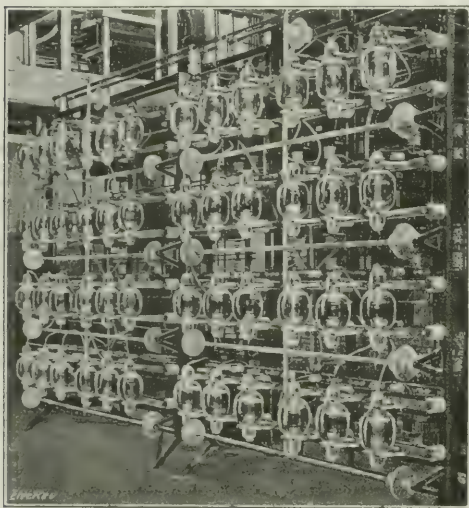
The Tramwaymen's Agreement.—At a conference of municipal tramway authorities convened by the Municipal Tramways Association last week, it was resolved that the 48-hour week should be retained, and that a committee of the National Industrial Council should be appointed to revise the agreement of March, 1919. A meeting of the Council was to be held yesterday in London.

Water-power Resources of the United Kingdom.—On Wednesday last the final report of the Water Power Resources Committee was issued. As it was received whilst we were going to press, we can only say, at the moment, that the Committee recommends that the collection of information regarding rainfall, &c., be continued; that financial aid be given by the State to undertakings during the constructional period; that long-term licences for the use of water-power be issued; that the Board of Trade or the Electricity Commissioners be charged with the supervision of water-power development, and that tidal power be investigated by a Technical Commission.

A Water Commission having jurisdiction over England and Wales only to have charge of the water resources of the country in the public interest, is also recommended.

Electric Vehicles in Italy.—A scheme for the reduction of the annual taxes on motor vehicles is at present being considered by the Italian Parliament. A feature of the new measure is that all taxes on electrically-propelled vehicles are to be abolished for a period of five years provided the vehicles are of Italian construction.

Direct Wireless to Australia.—In view of the interest that has been aroused by the proposal to form an Imperial chain of wireless telegraph stations, the announcement of the latest achievement of Marconi's Wireless Telegraph Co., Ltd., is of peculiar interest. Wireless test messages, prepared by an independent expert and transmitted in his presence, were sent direct to Australia on the evening of Sunday, November 20th, from the company's station at Carnarvon. Cable telegrams since received report the reception, complete on the first transmission, both at Sydney and Melbourne. The apparatus employed for this unique demonstration was a valve transmitter that is said to be the largest of its kind in the world. As will be seen from the accompanying illustration, it comprises a bank of 48 Marconi valves, (a development of Dr. Fleming's invention) and each of the four dozen globes is about the size of a Rugby football. The importance of this successful long-distance transmission of wireless telegraph messages is self-evident, and the Marconi Co. is to be congratulated upon the results obtained.



LONG RANGE MARCONI VALVE TRANSMITTER.

According to the *Daily Mail*, Mr. Hughes, Australian Premier, tabled in the House of Representatives on November 24th, a draft agreement providing for the establishment of direct wireless communication between the Commonwealth and England. The company concerned undertakes always to remain an independent British concern and to construct forthwith the necessary stations. The main trunk stations, in Australia and England are to be provided within two years, and an additional station in Canada, capable of communicating with Australia, is to be established. The charges for messages were not to exceed 2s. per word for the full rate; 1s. per word for the deferred rate; 6d. per word for the week-end rate; 1s. for Government, 5d. for Press, and 3d. for deferred Press messages.

The first Press message to be forwarded direct from England to Australia by wireless telegraphy was dispatched by the *Daily Mail* at the invitation of Marconi's Wireless Telegraph Co. on the evening of December 4th. It was handed in at Marconi's Fenchurch Street office and sent by wire to Carnarvon, whence it was transmitted by wireless by Captain Round. The message was received at the experimental station of the Marconi Wireless (Australian) Ltd., at Koo Wee Rup, Victoria, and at the Government station at Port Melbourne, in the south of Australia, the places being 1,800 miles apart. A power of 100 kW was required to send the message, but for the use of valves, its late arrival prevented the production of the time.

London and Home Counties Electricity District.—COMMISSIONERS. The following is a statement of the decisions of the London and Home Counties Electricity District Commissioners on the schemes submitted at the local inquiry that was held in June and July last in connection with the above-named area, which gave hope to the district of a new era in its late arrival and the production of the time.

Briefly, it may be explained that the Commissioners have confirmed the provisionally delimited district, subject to cer-

tain minor fringe amendments. They have rejected the Popular Borough Council's scheme and propose to establish a Joint Electricity Authority on the lines suggested in the schemes promoted by the L.C.C. and the Conference of Local Authorities. The Commissioners concur generally in the technical proposals for dealing with the requirements of the area during the first stage, terminating about 1925/6, for which they have already authorised the necessary generating plant. With regard to the second stage, however, the Commissioners differ from the promoters, who proposed to continue the development of existing "group" stations. The Commissioners' conclusion is that a better way is open—namely, to install the 199,000 kW of generating plant required in one or more capital stations, while retaining the "group" stations as developed during the first stage, and that the Barkingside site should be utilised for the construction of the first capital station, which will be required before 1926, and they will forthwith consent to its establishment by the County of London Electric Supply Co., Ltd. The Commissioners are not in accord with the view that a Joint Authority would be unable to generate electricity more cheaply than a railway company possessing its own generating station, and they are of the opinion that a supply from a common source will be advantageous to both parties. It appears to them that it should be possible by agreement to settle the terms of transfer of the selected stations, and negotiations on this matter are still proceeding. The Commissioners approve in principle of an extension of tenure as part of a settlement with the London companies, and the order establishing the Joint Authority is to be so drafted as not to interfere with the rights of the North Metropolitan Electric Power Supply Co., Ltd., or the bulk supply rights of the Metropolitan Electric Supply Co., Ltd. Regarding finance, it is proposed that authorised undertakers should find the funds for all extensions of generating plant at their stations while such stations remain in their possession, and for any inter-connecting mains required before the Joint Authority is in a position to act. The capital moneys necessary for the construction of additional inter-connecting mains and for the erection of the capital stations should be raised by the Joint Authority under borrowing powers, to be conferred by further legislation.

Appointments Vacant.—Cable jointer (84s. 8d.) and electrical and mechanical engineer (£500), for the Swindon Corporation Electricity and Tramway Department; assistant superintendent (450 Rs. per mensem), for the power station of the Madras Electric Supply Corporation, Ltd. (See our advertisement pages to-day.)

Power Factor and Charges for Electricity in Canada.—The Commercial Section of the Canadian Electrical Association has recently circulated a "questionnaire" on the above subject. Replies were received from eight of the largest supply companies in the Dominion.

Seven companies state they have clauses to correct for low power factor, while one company pays no attention to this subject as yet. Of the seven, two companies use the following clause in their agreements with power consumers:—

"All electrical apparatus made use of by the consumer shall be of good commercial efficiency, and such as to introduce no disturbing elements into the electrical system of the company. The minimum power factor of the motors when operating consumers' maximum load shall be as follows: Motors not exceeding five horse-power rated capacity, a power factor of not less than 75 per cent.; motors of over five horse-power and not exceeding ten horse-power rated capacity, a power factor of not less than 80 per cent.; motors over ten horse-power rated capacity, a power factor of not less than 85 per cent. If the power factor be found less than the above specified, then the power consumption shall be calculated on the basis of the minimum power factor so specified."

One company uses practically the same clause, stating that the consumer must maintain 80 per cent. power factor up to 10 horse-power rated capacity of motors and 85 per cent. power factor on motors over 10 horse-power rated capacity.

Another company uses the following clause:—"If at any time when power is being delivered to the customer at normal voltage and frequency the total volt-amperes so delivered exceeds that which would result if the power which the customer is then taking were delivered at a power factor of 85 per cent., the volt-amperes delivered shall be calculated as power upon the basis of 85 per cent. power factor."

Other clauses are:—"The minimum power factor determined monthly shall not be less than 85 per cent." "If the power factor at maximum kVA be less than 85 per cent., then the total amounts of the accounts due for service under this contract shall be increased by dividing such amounts by the power factor as found and multiplied by 85 per cent." "It is agreed that the rates for service herein provided for are conditional upon the consumer's apparatus taking power at no lower factor than 70 per cent., and should his requirements be such as to cause the power factor in his supply circuit to fall below 70 per cent., then the rates for service herein provided for may, at the company's option, be increased by the amount of five per cent. for each per cent. the power factor of such service falls below 70 per cent."

With reference to correcting against serious conditions of current unbalance, no specific clauses are used by any of the eight companies.

To Alarm Burglars.—According to the *Evening News*, an "Italian gentleman" has invented an elaborate burglar alarm system. It consists in coating the inner side of walls and windows with insulated tinfoil and metallic paint. An "ever-so-gentle electrical current" circulates through the tinfoil, and when the tinfoil is punctured the current is interrupted. "When the circuit is broken in any way a heavy plunger cushioned on oil begins falling slowly down in a cylinder in the cellar, making contact with wires, which explode three harmless bombs at intervals of 15 seconds, and then set a bell ringing hard."

This is ingenious, but it would probably be cheaper and better to let the burglar carry on.

Electric Ship Propulsion.—The United States coastguard cutter *Tamoa*, the first of four electrically-driven cutters to be placed in service by the Treasury Department, has just been delivered to the authorities at the port of New York. She was built by the Union Construction Co., Oakland, Cal., and is 240 ft. long, 39 ft. beam, 25 ft. 6 in. deep, displaces 1,600 tons at a mean draught of 14 ft., and has a speed of 16 knots. The main propelling machinery consists of two Babcock & Wilcox water-tube boilers burning oil, which supply steam to a turbine-driven alternating-current generator. This in turn operates a 2,600-h.p. synchronous motor at a propeller speed of 130 r.p.m.—*Reuter's Trade Service* (New York).

U.S. Electric Vehicle Market.—The manufacturers of electric vehicles have arranged to hold monthly meetings in New York City, commencing in December, when the most prominent men in the trade will speak briefly on various phases of the industry. An electric vehicle show will be held in New York City, probably towards the end of January; the exhibition will be sponsored by the Edison Electric Co. A similar show held early this year was reported to have been highly successful from the manufacturers' point of view, so it is probable that there will be a record number of exhibits at the next exhibition.—*Reuter's Trade Service* (New York).

"British Trade Ship."—The board of the *British Trade Ship* publishes information which may be regarded as a barometer showing the present and prospective fall in costs of production. The terms for exhibiting have been reduced from £2,100 and £1,350 for stalls to £1,400 and £900 respectively. The cost of showcases and counterbases is similarly reduced to an average charge of about £400. First-class cabin accommodation for a trade representative undertaking the whole voyage of 18 months is reduced to the sum of £1,000, including all meals taken on board the ship. The significance of this reduction is a good omen for British trade and industry in the New Year.

INSTITUTION NOTES.

The Institution of Electrical Engineers.—INFORMAL MEETING.—At the meeting of the Informal Section on Monday, December 5th, Mr. J. R. Bedford was in the chair, when Mr. C. L. Lipman opened a discussion on "Some Recent Developments in the Design of A.C. Instruments." The meeting was rather less crowded than recent meetings have been, and the discussion consisted mainly of interrogation from a few instrument experts. Mr. Lipman displayed numerous lantern slides showing the instruments in detail, and diagrams of connections, &c.; also, by the courtesy of Messrs. Nalder Bros. & Thompson, he was enabled to show some fine examples of the instruments. The power factor meters, frequency meters, synchronisers and synchroscopes described mainly embody an improved movement in which no moving coils are employed, with the result that extreme lightness, perfect balance and accuracy, and very small volt-ampere consumption are obtained. A special sensitive relay, primarily intended for use with Merz-Price and similar systems of protection, was exhibited; it was in principle similar to a moving-iron ammeter. The relay is self-setting, and is proof against violent external vibration. The Dransfield three-phase voltmeter was also exhibited.

SOUTH MIDLAND CENTRE.—*Students' Section.*—At a meeting held on December 13th there was a debate on the "Relative Advantages of A.C. and D.C. for Power Distribution and Lighting in Sub-Station Areas." Mr. E. A. Chattock, M.I.E.E., Chairman of the Centre, occupied the chair.

Junior Institution of Engineers.—At the recent annual general meeting the following officers were elected for Session 1921-22:—Chairman, Mr. E. C. West; vice-chairman, Mr. H. V. Pointon; librarian, Mr. H. P. Wright; hon. treasurer, Mr. W. A. Tookey; hon. auditors, Messrs. J. M. Seddon, W. M. Murrell, S. H. Hole, and R. Cook; members of Council, Messrs. A. J. Simpson, L. Turner, W. H. Ballantyne, and G. W. Tookey. Mr. W. A. Tookey, in presenting the past year's accounts, expressed satisfaction that the deficit was not so great as had been anticipated, owing principally to increased revenue from advertisements and the care exercised by the Secretary and Finance Committee.

On December 9th Mr. C. H. Wordingham, C.B.E., delivered his address as President. The speaker covered wide ground, outlining the position of the various engineering institutions;

the status of the engineer; the effects of industrial unrest; water power; fuel power; charges for power; power distribution; standardisation; the metric system; research; and other subjects of importance to engineers.

Institution of Rubber Industry.—At yesterday evening's meeting Mr. Fordyce Jones (chairman of the *Rubber Research Co., Ltd.*) was down to read a paper on "Widening the Field for Rubber Manufacturers."

Chelmsford Engineering Society.—On December 1st Mr. J. N. Houlton, M.I.E.E., of Messrs. Crompton & Co., Ltd., read a paper on "Small Public Electric Supply Undertakings." Mr. G. F. Barrett, O.B.E., the President, presiding. The lecturer dealt with the preliminaries necessary to start a small undertaking and the choice of prime movers; where steam was to be used the locomotive type of engine was recommended, and the "semi-Diesel" if oil fuel was decided upon, on account of low first cost and economy in running. D.C. supply was generally recommended, but for extensive districts an a.c. system was more economical. The question of mains was dealt with, and the author thought that in most cases a well-designed overhead system was more suitable, and considerably cheaper than underground mains, but it was essential for Government regulations to be modified, as they made the cost unnecessarily high. The lecture was illustrated by a large number of lantern slides, and an interesting discussion followed.

Birmingham and District Electric Club.—On December 10th Mr. N. Deykin was appointed chairman of the club. The membership has increased from 141 to 150, and the financial statement shows a credit balance.

Edinburgh Electrical Society.—At a meeting of the Society, held on December 9th, Mr. Arthur Whiteley gave an illustrated lecture on "Wireless." After dealing with the history and development of radio telegraphy and referring to the work of the outstanding inventors, the lecturer described the principles of spark and closed circuit transmission. Thermionic valves of various types and their application were shown. Mr. Whiteley gave descriptions of wireless stations in the East with which he had been connected, and concluded with a demonstration of a simple home-made receiver set. On behalf of the Edinburgh and District Radio Society, he invited his audience to an exhibition of wireless apparatus which is to be held in Gillespie's School on Saturday, December 17th.

Greenock Association of Electrical Engineers.—On December 6th Mr. Bucklitch, of the Post Office Engineering Department, read a paper on "Intercommunication Telephones." The author gave details of various systems, automatic and manual, including the Strowger type. A vigorous discussion followed the paper, ranging from faults to phenomena in telephony.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep-readers of the ELECTRICAL REVIEW posted as to their movements.

On Saturday last, at Cambridge University Church, Mr. W. L. BRAGG, Professor of Physics at Manchester University, and son of Sir William and Lady Bragg, was married to Miss Alice Hopkinson, elder daughter of Mr. and Mrs. A. Hopkinson, of Cambridge.

DR. JOHN B. WHITEHEAD, dean of the engineering school and professor of electrical engineering at Johns Hopkins University, U.S.A., has been awarded the five thousand francs prize of the Institute Electrotechnique Montefiore of Liège, Belgium, bestowed every three years for original work on the scientific advancement in the technical application of electricity. The prize was given for an essay on "The Corona Voltmeter and the Electric Strength of Air."—*Science*.

We are asked to contradict the statement appearing in our last issue respecting Mr. D. H. DAVIES's intentions to remain at Heywood, as he is taking up the appointment offered him at Chesterfield. Mr. Causton asks us to state that the Chesterfield vacancy for a general assistant advertised in November is therefore filled.

MR. FREDERIC J. BARNETT, who has been in the service of the Dominican Government for the past 74 years as telephone and electric light superintendent, and may be coming home in the spring of 1922 on holiday, was recently presented with a baton and address by the Dominica Orchestral Society, of which he is the founder and conductor.

MR. W. PRICE, meter testing superintendent to the Midland Electric Corporation for Power Distribution, Ltd., Ocker Hill, Tipton, is leaving to take up an appointment with the Bombay Electric Supply and Tramways Co. On Friday last a farewell dinner was given in his honour by his colleagues. The chief engineer, Mr. G. R. J. Parkinson, presided, and referred to Mr. Price's 19 years' satisfactory service with the company. The staff and employees had previously presented Mr. Price with a cabin trunk and dressing case.

Mr. R. W. EVERSON, formerly manager of the Merchandising Department of the Westinghouse Electric International Company, has left for Mexico City, where he has been assigned to the Mexican Office of the Westinghouse Electric International Company.

Mr. R. L. THOMAS (late G.E.C. Hull) has joined the staff of the Electrical Engineering & Equipment Co., Ltd., of London, and will be stationed in Leeds.

Obituary.—Mr. JOHN GIBSON.—We regret to record the death, at the age of 48 years, of Mr. John Gibson, which occurred very suddenly on Friday last in London from cerebral hemorrhage. In earlier days Mr. Gibson was connected with Messrs. Ernest Scott and Mountain, Newcastle-on-Tyne, and Messrs. Holden and Brooke, Manchester, but for the last 15 or 16 years he was prominently associated with the supply business of the Metropolitan-Vickers Electrical Co., and was a director of the "Cosmos" Lamp Co. He leaves a widow and three children, to whom the many friends of the deceased gentleman will desire to extend their deep sympathy. The funeral took place on Wednesday in the Peel Green Cemetery, near Eccles.

Mr. G. W. TALBOT.—We regret to note from the "Deaths" column of *The Times* that Mr. George Washing Talbot, Postmaster-General and Director of Telegraphs, Burma, passed away at Anerley, S.E., on December 12th, at the age of 49 years.

Mr. F. WORRALL.—The death took place on December 3rd of Mr. Frank Worrall, surveyor and electrical engineer to the Long Eaton Urban Council, with whom he had been for 24 years. He was 53 years of age.

Will.—The late Mr. J. H. BALFOUR-BROWNE, K.C., left £655,000.

NEW COMPANIES REGISTERED.

Dubilier Condenser Co. (1921), Ltd. (178,173).—Private company. Regd. December 2nd. Capital, £25,000 in £1 shares. To adopt an agreement with the Dubilier Condenser Co., Ltd., and to carry on the business of electricians, mechanical engineers, manufacturers of electrical condensers, electric, wireless and high tension protective apparatus, &c. The subscribers are (each with one share) are: A. C. Banks, 21, Woodland Road, New Southgate, N.11, clerk; L. O. C. Hathaway, 90, Cavendish Road, South Side, Clapham Common, S.W., clerk. The subscribers are to appoint the first directors. Qualification: £100. Remuneration as fixed by board meeting attended. Registered office: Ducon Works, Goldhawk Road, Shepherd's Bush, W.12.

Aqua Electric Co., Ltd. (178,170).—Private company. Registered December 2nd. Capital, £8,000 in £1 shares. To acquire the undertaking and all or any of the assets and liabilities of the Aqua Electric Co., Ltd. (incorporated in March, 1921), and to carry on the business of electrical, gas and water engineers, machinists, fitters, millwrights, mechanical engineers, &c. The subscribers (each with one share) are: Woolf Barnato, 14, Hanover Square, W., gent.; Ernest F. Spencer, 37, Park Mansions, Vauxhall Park, S.W.8, engineer. The subscribers are to appoint the first directors. Qualification: 100 shares. Remuneration 1 guinea each per board meeting attended. Registered office: 115, Putney Bridge Road, S.W.15.

Electric and Railway Finance Corporation, Ltd. (178,213).—Private company. Capital, £500,000 in £1 shares. The objects are: To carry on the business of a trust, finance, land, mortgage and agency company, to carry out financial and commercial operations of all kinds, to purchase, underwrite, subscribe for or otherwise acquire, hold and deal in investments and securities of all classes, whether British, Colonial or foreign, to establish or promote companies and to form and manage syndicates; also to carry on business (solely or jointly with others) as engineers, railway and building contractors, manufacturers and repairers of railway and other materials and rolling stock, manufacturers of electrical apparatus and machinery, general electrical engineers, ship builders and repairers, &c. The signatories to the Memorandum of Association (each subscriber for one share) are: J. J. Coneybeare, 32, Quinton Street, S.W.18; L. H. Butcher, 52, Gaskarth Road, S.W.12; and J. W. Sanders, 66, Henry Street, S.E.11 (all clerks). The first directors (to number not less than four nor more than nine) are to be appointed by the subscribers to the Memorandum of Association. Qualification: £100 registered shares or stock. Remuneration as fixed by the company. The registered office is at 2, Bond Court, Walbrook, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Oswestry Electric Lighting and Power Co., Ltd.—Debentures dated September 27th, 1921, in secure £1,500, charged on the company's undertaking and property, present and future, including uncalled and unpaid amounts. Holders: London County, Westminster and Parr's Bank.

Cox-Cavendish Electric Co., Ltd.—Particulars of £8,000 debentures. Anticipated September 16th, 1921. Present issue £2,150, charged on the company's undertaking and property, present and future, including uncalled capital.

Tramway Supplies, Ltd. (93,698).—Capital £10,000, in £1 shares. Return dated October 28th, 1921. 5,307 shares taken up. £2,307 paid. £2,000 cashed as paid. Mortgage and charges £8,308 15s. 5d.

George H. Scholes & Co., Ltd. (106,845).—Capital £6,000 in £1 shares. 5,000 pref. and 5,000 ord. Return dated September 14th, 1921. 2,336 ord. and 2,662 pref. shares taken up. 1,032 paid on 1,950 pref. and 2 ord. £1,358 received as paid on 386 pref. and 2,000 ord. Mortgage and charges.

Sentinel Instrument Co., Ltd.—Mortgage dated November 29th, 1921, in secure £2,500 and further advances charged on 43 45 Southgate Road, Weymouth-Newton-Town. Holders: Newcastle-upon-Tyne Permanent Building Society.

Cambridge Electric Supply Co., Ltd.—Particulars of £3,000 debentures authorised October 26th, 1921. Present issue £2,450, charged on company's undertaking and property, present and future.

Comac Manufacturing Co., Ltd.—T. L. Constable, of 110, Clifton Road, Norbiton, Surrey, was appointed receiver on October 25th under powers contained in debenture dated April 20th, 1921.

Cumberland Coal Power and Chemicals, Ltd.—Particulars of £200,000 8 per cent. six months' secured notes authorised November 22nd, 1921, and covered by trust deed of even date; present issue £180,000, charged on rights and interests in an agreement relating to the purchase of, and certain shares in, the S/A Tysejeldene Co. and the company's undertaking and property, present and future, including uncalled capital. Trustees: Sir Arthur T. Dawson, Bt., Vickers House, Westminster; and A. E. Barlow, Nitrogen House, 34 and 32, Grosvenor Place, S.W.

Frinton-on-Sea & District Electric Light & Power Co., Ltd. (70,689).—Return dated October 31st, 1921. Capital, £10,000 in £1 shares (7,300 preference and 2,700 ordinary). All shares taken up and paid for in full. Mortgage and charges, £10,000.

Magic Appliances, Ltd.—Particulars of £2,000 debentures, authorised October 20th, 1921; whole amount issued; charged on the company's property, present and future, including uncalled capital (subject to £2,000 prior debentures).

Lowth & Smith, Ltd.—Charge on the company's undertaking and property, present and future, including uncalled capital, dated December 2nd, 1921, to secure £500. Holder: T. Davies, Wesley Street, Levenshulme, Manchester.

James Keith & Blackman Co., Ltd.—Satisfaction in full on November 11th, 1921, of debentures dated October 29th, 1901, and January 1st, 1913, securing £500 and £50 respectively.

CITY NOTES.

THE COMMON FUND.—At meetings of the boards of directors of the City and South London, Central London, London Electric, and Metropolitan District Railway Companies, and the London General Omnibus Co., Ltd., last week, it was decided, after a review of the results of the operation of the common fund for the present year and of those of the last five years, to recommend to the stockholders that the following variation in the division between the companies of the common fund established under the London Electric Companies' Facilities Act, 1915, should be agreed. The common fund, as our readers know, is made up of the balances of the net revenues of the several companies after providing for interest and dividends on their prior charge securities (except Metropolitan District Railway Second Preference Stock) and for depreciation and reserve. The variations are shown in the table below:—

Company.	Original share.	Revised share.
	Per cent.	Per cent.
City and South London	6	6
Central London	20	16
London Electric	30	41
Metropolitan District	12	12
London General Omnibus	32	25
	100	100

While the percentage share of the Metropolitan District Railway Co. remains unchanged it is proposed that the Second Preference Stock of that company should be included as a revenue liability, so that the interest upon the stock is to be met prior to the distribution of the common fund. These revisions are to take effect from July 1st, 1921. It is also proposed at the same time to make certain minor amendments in the common fund agreement which the experience of the last six years has shown to be desirable. A circular will be issued to the stockholders setting out the whole position fully.

Cordoba Light, Power & Traction Co., Ltd.—The report for the year ended March 31st last records a trading profit of £123,923. After paying interest on debentures, promissory notes, &c., a balance of £54,625 remains, which, with £60,016 brought forward, totals £114,641. Of this £8,492 is appropriated for debenture stock redemption. Subject to approval the sum of £69,300 is transferred, in respect of 54 years' arrears of dividend on the preference shares, together with £6,300 from the profits of the past half-year. £5,000 is being transferred to the share redemption fund. The annual contribution of £5,000 is calculated to repay the whole of the share capital within the time of the concessions of subsidiary companies. Meeting: December 20th.

C. A. Vandervell & Co., Ltd.—The report of trading for the year ended March 31st shows a very considerable loss (£251,472). £75,000 has been withdrawn from reserve, and the £140,499 brought forward has also been absorbed to meet the deficiency. We shall quote the report more fully next week.

Manx Electric Railway Co.—The directors are paying a dividend of 54 per cent. on the preference shares for the year ended September, 1916, and carrying 1916 forward.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Interim dividend for the quarter ended September 30th of 5s. per share, free of income tax.

Prospectuses.—**Newcastle-upon-Tyne Electric Supply Co., Ltd.**—The list of applications opened on Monday, and was to remain open until to-morrow, in an issue of £750,000 of 6 per cent. second mortgage debenture stock at £85½ per cent. The issue is for the purpose of providing funds to meet the company's commitments incurred in connection with the extension of its generating stations, mains, and sub-stations, and for the development of the business generally. The issue was over-subscribed, and the list closed on Monday; but provincial applications were considered if received on Tuesday by first post.

Reading Electric Supply Co., Ltd.—This company has been offering for subscription (the list was announced to close to-morrow, 17th inst.) £100,000 7½ per cent. first mortgage debenture stock at 95 per cent. The issue has been made of the repayment of an advance of £15,000 to the bankers to redeem existing debentures amounting to £32,000 and to provide funds for extensions to the generating and distributing system. The list was closed on Monday; provincial applications were considered if received on Tuesday by first post.

Llanelli and District Electric Lighting and Traction Co., Ltd.—The subscription list was to close on or before December 17th in an issue of £125,000 7½ per cent. debenture stock at 94 per cent. The proceeds of the issue will be sufficient to discharge all capital commitments to date in respect of works recently completed (including repayment of loans expended on such works), and will be utilised for this purpose and for the general purposes of the company.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148a:—**Telephone Manufacturing Co. (1920).**—310,000 (Vendors') shares of £1 each, fully paid, Nos. 8 to 310,007.

Application has been made to the Committee to allow the following to be officially quoted:—

General Electric Co.—£3,500,000 7 per cent. mortgage debenture stock.

The undermentioned securities have been ordered to be officially quoted:—

General Electric Co.—50,000 6½ per cent. "A" cumulative preference shares of £1 each, fully paid (Nos. 1,655,791 to 1,705,790).

Lancashire Electric Light & Power Co.—65,025 6 per cent. (Income Tax free up to 6s. in the £) cumulative convertible first preference shares of £1 each, fully paid (Nos. 400,001 to 465,025).

North Metropolitan Electric Power Supply Co.—£228,460 7½ per cent. debenture stock.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—A meeting of the holders of the second mortgage debenture stock was held last week, and resolutions were passed modifying the rights of the holders of the second mortgage debenture stock. Mr. R. P. Sloan, C.B.E., who presided, said that the provisions were that the interest payable on the stock should be increased from 5 per cent. to 6 per cent., and that the authorised amount should be increased from £500,000 to £2,000,000. The company had on hand applications for large additional supplies, and it was necessary that further capital should be raised. The amount realised by the issue of second debenture stock would be spent entirely on new works.

Tees Power Station Co., Ltd.—The report for the year ended October 1st states that 167,827 fully-paid ordinary shares have been allotted to the Newcastle-upon-Tyne Electric Supply Co., making the total issued and paid-up capital £437,577. The amount received from the Newcastle company was £20,977, which, with a balance of £306 brought forward, gave a total of £21,283. Of this £20,800 will be absorbed by a dividend of 4½ per cent. on the paid-up shares, the balance being carried forward.

Para Telephone Co.—An interim dividend on the ordinary shares of 3 per cent., free of tax, is announced.

Italian Capital Increase.—The firm of Pirelli & Co., of Milan, who have a share capital of 100,000,000 lire, are offering for subscription 40,000 new shares of 500 lire, which will raise the capital to 120,000,000 lire.

Tube Investments, Ltd.—At the annual meeting, on December 7th, the chairman referred to the formation of Bromford, Ltd., as a separate concern, stating that £100,000 remained as a debt to the vendors, Tubes, Ltd. Orders were at present only sufficient to occupy half the factory, but improvement was expected.

A Swiss Investment Company.—The Columbus Electrical Undertakings Co., of Baden, reports net profits of 2,750,000 francs for 1920-21 and a dividend at the rate of 8 per cent. in the preceding year. The chief assets held are in the Compania Italo-Argentina de Electricidad, of Buenos Ayres.

Yorkshire (West Riding) Electric Tramways, Ltd.—A final dividend of 3 per cent. (at the rate of 6 per cent. per annum) on the preference shares, less tax, is announced for the past half year.

Electro-Bleach and By-Products, Ltd.—An interim dividend of 8½ per cent. is to be paid on the preference shares.

Norway.—The accounts of the Norsk Hydro-Elektrisk Kvaestof A.S., of Christiana, show a deficit of 1,308,000 kr. for 1920-21. It has, however, been decided to pay a dividend at the rate of 15 per cent., by the absorption of the profit-equalisation fund and an appropriation from the contingency fund.

Rees Roturbo Manufacturing Co., Ltd.—A dividend of 5 per cent. on the preference shares for 1917 is reported.

STOCKS AND SHARES.

TUESDAY EVENING.

The rise in gilt-edged securities goes on so regularly as to make its recording almost a matter of monotony, though this is broken by the pleasure it affords to chronicle movements which must be gratifying to wide circles of investors. For the rises in the War Loan and other gilt-edged securities have their effect upon investment stocks and shares of all classes. As prices of the former improve, so the attention of the investor tends to become directed more and more to other stocks and shares that have not advanced in the same ratio as those of the purely gilt-edged group. Of course, the improvement is sometimes contemporaneous, as may be instanced by the fact of the County of London 7 per cent. debenture stock, issued at 94, having risen this week to 104 premium, making the fully-paid stock equivalent to 104½.

The Midland County Electric 7½ per cent. mortgage debenture stock, issued at 96, has scarcely started to move, the premium to-day being about 108., at which price the yield on the money comes to 7½ per cent. The first coupon, due next March, is for £1 2s. 6d. per cent., after which, of course, the full 7½ per cent. will be paid every September and March. The security is good enough to warrant a rise of several points. The Shropshire, Worcestershire & Staffordshire Electric 7½ per cent. debenture stock, the price of which hung at a small discount for several weeks after the allotment, has now risen to 3 premium above the 97 at which the stock was offered. The yield here is 7½ per cent. with a small coupon due next March. The stock is redeemable in 1931 at 100, and it may be recalled that it carries the guarantee, both as to principal and interest, by the British Electric Traction Co., besides being convertible at any time into Shropshire shares. The Mersey Power 7½ debenture stock, also issued at 97, has advanced to 3 premium. General Electric 7 per cent. debenture is up to 93½, and the British Thomson-Houston, which came out at the beginning of the month at 92½, commands a small premium. The first interest on this scrip being a "broken amount," is due next May.

The Clyde Valley Electrical Power 8 per cent. second preferences, with £5 paid out of the £10 nominal value, can be bought at a shade over par, offering a trifle under 8 per cent. on the money, with a small dividend due this week. City of London 8 per cent. seconds at 23s. 6d. pay 6½ guineas per cent. on the money, and Notting Hill 6 per cent. non-cumulative preference at 74 afford practically 8 per cent. with a dividend due next month. The shares rank equally for repayment of capital with the company's 6 per cent. cumulative preference.

One of the Stock Exchange features of the past few days, has been a substantial rise in the price of District Railway ordinary stock. The Underground Railways has formulated a scheme varying the terms of the Common Fund to which all the tube railways contribute. A circular is on the point of issue in which full details will be given, and the arrangement is proposed on the ground that the division of distribution, as it stands at present is scarcely equitable to some of the companies concerned. The new proposals bring within sight a dividend on District ordinary in respect of the current year, and this has caused a rise of 4 points in Districts to 22. Underground Electric shares are 70s. higher at 23, the shilling shares advanced to 6s. and the Income Bonds are no less than 6 points better at 73½.

City of London Electric ordinary shares at 1 7/16 have risen a florin, and Kensington ordinary improved to 5. On the other hand, County of London ordinary at 83 are 1/16 down, there being two or three hundred shares in the market, which are being digested by quiet degrees. South Metropolitan preference stiffened to 17s. 6d. and the second preference rose to 13s. 6d.

English Electric Notes are better at 99. Yorkshire Electric Power ordinary shares at 84 are 5s. higher. The Newcastle-upon-Tyne Electric Co. has been offering £750,000 6 per cent. second mortgage debenture stock at 83½. The subscription-list was promptly filled and closed several days in advance of the full time to which it could have remained open. The Reading Electric Supply Co. offered £100,000 7½ per cent. first mortgage debenture stock at 95, and the Llanelli & District Electric Lighting & Traction Co. issued £125,000 7½ per cent. debenture stock at 91. In both cases, the stock was promptly snapped up, and the market for all such securities is a good one. Several others are expected to make their appearance in the near future.

Anglo-Argentine Tramway debenture stock has risen to 63½. British Columbia Electric deferred at 57½ and the debenture

stock at 6½ are both better. The Mexican group is not quite so excited this week, the only change being a rise of a point in Mexican Light & Power preferred shares.

The Cable group is rather better. Eastern ordinary recovered a couple of points, at 163½, but Globe ordinary at 164 fell ½, the other members being unchanged. Anglo-American Telegraph preferred at 83 is ½ higher, and the deferred at 18 shows another rise of 5s., owing to the advent of the dividend due early in the New Year. Business has been done in Indo-Europeans at 27 and the price of the shares is lowered to 27½ middle. As an important part of the company's concession runs out in 1925, it is being asked whether the present may not be an opportune time for making advance arrangements towards a voluntary dissolution of the company. On the company's balance-sheet, there should be well over £40 per share for the proprietors. The line runs through Germany and part of Russia, but it is understood that efforts are being directed towards straightening-out a position severely tangled-up by the war. The directors' task is manifestly a difficult one. Marconis hold their price at 111/16, and Mannes at 20s. 9d. have recovered, after being down to 19s. 6d.

The rubber share market is in a humdrum state, prices moving scarcely at all. Vickers rose 1/8 to 9s. 3d., on a report that the new ten million pounds loan which India is raising is required, in part, for railway construction, in which big British firms will be given a participation. Armstrongs improved at the same time. Babcock & Wilcox advanced to 2½, and the markets in manufacturing shares are as a whole decidedly brighter than they have been for some time past. Edisons at 6s. are nippence up. Electric Constructions strengthened to 18s. 3d. Cromptons continue depressed. General Electric gained sixpence, and Henley's preference are 2s. 6d. to the good.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend.	Price.	Rise or	Yield
	1919, 1920.	Dec. 15, 1921.	fall.	p.c.
Brompton Ordinary ..	12	12	68	8 17 0
Charing Cross Ordinary ..	7	8	14	8 17 0
do. do. 4½ Pref. ..	44	44	34	7 4 4
Chelsea ..	4	6	34	9 4 8
City of London ..	13	14	14	9 14 0
do. do. 6 per cent. Pref. ..	6	6	14	6 19 4
County of London ..	8	8	83	9 2 10
do. do. 5 per cent. Pref. ..	6	6	74	7 10 0
Kensington Ordinary ..	7	9	5	9 0 0
London Electric ..	24	24	—	7 10 0
do. do. 6 per cent. Pref. ..	6	6	8	10 0 0
Metropolitan ..	6	7	89	9 6 8
do. do. 4½ per cent. Pref. ..	44	44	24	7 19 2
St. James' and Pall Mall ..	13	12	58	8 17 0
South London ..	6	7	28	10 13 2
South Metropolitan Pref. ..	7	7	17 6	8 0 0
Westminster Ordinary ..	10	10	54	8 10 2

TELEGRAPHS AND TELEPHONES.

	Dividend.	Price.	Rise or	Yield
	1919, 1920.	Dec. 15, 1921.	fall.	p.c.
Anglo-Am. Tel. Pref. ..	6	6	83	7 4 7
do. do. Def. ..	14	14	14	8 5 4
Chile Telephone ..	6	6	14	5 17 3
Cuba Sub. Ord. ..	7	7	7	10 0 0
Eastern Extension ..	10	10	162	6 2 2
Eastern Tel. Ord. ..	10	10	162	6 2 4
Globe Tel. and T. Ord. ..	10	10	162	6 2 1
do. do. Pref. ..	6	6	92	6 9 9
Great Northern Tel. ..	22	24	25	9 12 0
Indo-European ..	10	10	274	9 3 0
Marconi ..	10	10	162	8 17 0
Oriental Telephone Ord. ..	12	12	2	6 0 0
United R. Plate Tel. ..	8	8	64	7 0 8
West India and Panama ..	Nil	Nil	67	Nil
Western Telegraph ..	10	10	162	6 2 2

HOME RAILWAYS.

	Dividend.	Price.	Rise or	Yield
	1919, 1920.	Dec. 15, 1921.	fall.	p.c.
Central London Ord. Assented ..	12	14	254	8 1 8
Metropolitan ..	Nil	Nil	22	Nil
do. District ..	Nil	Nil	24	Nil
Underground Electric Ordinary ..	Nil	Nil	24	Nil
do. do. "A" ..	Nil	Nil	67	Nil
do. do. Income ..	4	2	784	4 1 0

FOREIGN TRAMS, &c.

	Dividend.	Price.	Rise or	Yield
	1919, 1920.	Dec. 15, 1921.	fall.	p.c.
Anglo-Arg. Trams, First Pref. ..	54	124	98	10 9 6
do. do. 2nd Pref. ..	Nil	64	92	8 0 0
do. do. 6 per cent. Deb. ..	5	5	634	7 17 6
Brazil Traction ..	Nil	Nil	1	Nil
British Columbia Elec. Ry. Pref. ..	6	6	58	8 12 4
do. do. Preferred ..	6	6	58	8 12 4
do. do. Deferred ..	8	124	674	10 17 0
do. do. Deb. ..	10	10	162	6 18 3
Mexico Trams, 5 per cent. Bonds ..	Nil	Nil	274	Nil
do. do. 6 per cent. Bonds ..	Nil	Nil	274	Nil
Manila Light Company ..	Nil	Nil	18	Nil
do. do. Pref. ..	Nil	Nil	27	Nil
do. do. 1st Bonds ..	Nil	5	614	8 2 8

MANUFACTURING COMPANIES.

	Dividend.	Price.	Rise or	Yield
	1919, 1920.	Dec. 15, 1921.	fall.	p.c.
Babcock & Wilcox ..	15	16	92	6 14 9
Brush A. & S. Ord. ..	10	10	14/8	10 0 0
Brush Traction Ord. ..	15	15	14	10 0 0
do. do. Deb. ..	15	15	14	10 0 0
Crompton Co. ..	64	64	1460	5 18 8
Crompton Co. Deb. ..	10	10	1380	14 11 0
Edison-Swan ..	10	10	14/8	10 0 0
do. do. 5 per cent. Deb. ..	10	10	14/8	10 0 0
Electric Construction ..	8	8	10/6	16 0 0
English Electric ..	6	8	12/6	9 12 0
Gen. Elec. Pref. ..	10	10	17/6	11 8 6
do. do. Ord. ..	10	10	17/6	11 8 6
Henley ..	15	15	20/8	6 4 2
do. do. Pref. ..	15	15	20/8	6 4 2
India Rubber ..	10	10	17/6	11 8 6
Met. Vickers Pref. ..	8	8	12	9 2 10
Siemens Ord. ..	10	10	17/6	11 8 6
Telegraph Con. ..	20	20	214	6 11 9

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, December 14th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
Acid, Oxalic	per lb.	84d.
Ammoniac Sal	per ton	£50
Ammonia, Murate (large crystal) ..	..	£58
Bisulphide of Carbon .. .. .	..	£71
Borax .. .. .	..	£31
Copper Sulphate .. .. .	..	£20
Potash, Chlorate	per lb.	6d.
Perchlorate .. .. .	..	6d.
Shellac	per cwt	216 14s.
Sulphur, Sublimed Flowers .. .. .	..	£14 10s.
do. Lump .. .. .	..	£13 10s.
Soda, Chlorate	per lb.	3d.
do. Crystals	per ton	£7
Sodium Bichromate, cakes	per lb.	64d.
METALS, &c.		
Babbitt's Metal and Anti-friction Metal—		
Grade I	per ton net	£160
Grade II .. .. .	..	£118
Grade III .. .. .	..	£71
Brass (rolled metal 2½ to 19) bases ..	per lb.	1 1/2d.
do. Tubes (solid drawn) .. .. .	..	1 1/2d. to 1 1/4d.
do. Wire, basis .. .. .	..	1 1/4d.
Copper Tubes (solid drawn) .. .. .	..	1 1/2d.
do. Bars (best selected)	per ton	£101
do. Sheet .. .. .	..	£101
do. Rod .. .. .	..	£101
do. (Electrolytic) Bars .. .. .	..	£75 5s.
do. Sheets .. .. .	..	£145 10s.
do. Wire Rods .. .. .	..	£11 5s.
do. H.C. Wire	per lb.	1 1/4d.
Ebonite Rod .. .. .	..	2/9
do. Sheet .. .. .	..	2/9
German Silver Wire .. .. .	..	2/9
Gutta-percha, fine .. .. .	..	12/6
do. India-rubber, Para fine .. .. .	..	12/6
Iron Pig (Cleveland Warrants)	per ton	£27
do. Wire, galv. No. 8, P.O. qual. ..	..	£27
Lead, English Pig	per ton	£108
Mercury	per bot.	£10 8s. to £10 10s.
do. Mica (in original cases) small ..	per lb.	3d. to 3/8
do. " " medium .. .. .	..	4/8 to 8/8
do. " " large .. .. .	..	10/ to 30/ & up
Phosphor Bronze, plain castings ..	..	1 1/4d.
do. " drawn bars and rods ..	..	1 1/4d.
do. " rolled strip & sheet ..	..	1 1/2d.
do. Wire .. .. .	..	1 1/2d.
Silicon Bronze Wire	per lb.	1 1/2d.
Steel, Magnet, in bars .. .. .	..	1 1/2d.
Tin, Block (English)	per ton	£169
do. Wire, Nos. 1 to 16	per lb.	2/6

Quotations supplied by—

G. Boor & Co.	James & Shakespear.
Thos. Bolton & Sons, Ltd.	H. Edward Till & Co.
Fredrick Smith & Co.	J. Bolling & Lowe.
F. Wiggins & Sons.	Richard Johnson & Nephew, Ltd.
India-Rubber, Gutta-Percha and	P. Orlamston & Sons.
Telegraph Works Co., Ltd.	P. C. Clifford & Son, Ltd.
R. W. F. Dennis & Co.	

Appeal for the Blind.—It is hoped that the lamented death of Sir Arthur Pearson will not occasion any cessation of activity, or falling-off in generosity, on behalf of the Blind Soldiers' and Sailors' Hostel at Regent's Park. Sir Arthur will always be remembered for his zeal on behalf of those who suffered from the same tragic loss that darkened his own vision, and it is profoundly to be hoped that the appeal that has been issued by his son for full and continued support to be given to St. Dunstan's and the National Institute for the Blind will be readily responded to, both in memory of Sir Arthur and in the interests of our blinded heroes.

Fire.—Damage to the extent of £30,000 was caused by a fire at the Fellmongering Works of the Pontefract Co-operative Wholesale Society on December 6th. A wood building, containing newly-installed electric power plant, was totally destroyed.

Forthcoming Air Conference.—The Air Ministry announces that the first Air Conference proved so useful that the Air Council has decided to call together another conference, which will be held by permission of the Lord Mayor and Corporation, at the Guildhall, on February 7th and 8th, 1922. The conference will, on this occasion, be asked to address itself mainly to the question of the future of aviation, with special references to its development as a regular and speedy form of commercial transport. The papers will be divided into two main groups, the one dealing with civil aviation in general, and the other with technical problems, the papers on the former subject being delivered at the morning session of the first day, and the papers on the latter during the afternoon session of the same day. The proceedings on the second day will be devoted wholly to discussions arising out of the previous day's papers, the morning session being allotted to civil aviation, and the afternoon to discussions on technical papers. The Secretary of State for Air will preside during the civil aviation portion of the proceedings, and Lord Weir of Eastwood during the technical sessions.

ELECTRIC HEATING.

By JULIUS FRITH, M.Sc., M.I.E.E., M.Cons.E.

It is common to hear the opinion expressed that one radiator or type of radiator is more "efficient" than another. Every electrical engineer knows, however, that one kilowatt-hour yields 3,430 British thermal units, and that heat is the one thing that we can make with absolute 100 per cent. efficiency. Are, then, the people who profess to judge between the efficiency of one or the other radiator all either knaves or fools? I think not, and that there is more in this matter than meets the eye.

An electric radiator can give out its heat in two quite different ways, either as direct heat or as radiant energy, which is not heat at all, and only becomes heat when it strikes something material and, becoming absorbed, is converted into heat.

There is a wretched expression common amongst the thoughtless, namely, "radiant heat," which really carries its own condemnation, as heat, being a vibration of gross matter, cannot be radiant; radiant energy is a disturbance in the ether, which can be caused by a hot body and which can again heat a body, but which is no more heat than a belt is power. We do not know the precise mechanism by which a hot body can wag the ether and cause vibrations to be set up in it, but all hot bodies can do it, and the hotter they are the more they do it.

Heat is a vibration of the particles of gross matter, and so cannot exist apart from gross matter. The heat from the sun, or from the filament of a vacuum lamp, reaches us through a space empty of gross matter, and, therefore, cannot have been heat but must have been an ether vibration or radiant energy.

Therefore it is seen that the expression "radiant heat" is a blunder essentially similar to that involved in trying to catch a sunbeam with a pair of tongs.

But to return to our radiators: it is possible at will to convert the kilowatt-hour into either nearly all radiant energy or nearly all direct heat. As an example of the first, one might cite a thou and candle-power of metal-filament vacuum lamps and of the second 3,000 yards of No. 18 copper wire carrying 5 amperes. Each of these, if placed in a room, would liberate in that room 3,430 B.th.u. per hour; in the case of the lamps it might be necessary to pull the blinds down or a (very) small portion would escape through the windows as light.

Now, without stigmatising either of these as inferior or less efficient than the other, it is obvious that they would have different effects on the occupants of the room. I would even go so far as to say that one might be more suitable in one case and the other in another.

Let us try and see clearly in what the difference lies. In the case of the lamps, the radiant energy would travel through the glass and the air, if both were reasonably clean, without appreciably raising their temperature, and would finally strike either the furniture or other solid bodies in the room or else the walls. If these solids were dull black, the radiant energy would be almost immediately absorbed and converted into heat; if they were white and bright, a part of it would be so absorbed and converted at the first impact and part would be reflected back and forth till it was at last all absorbed. The air in the room would then be heated from the solids, but this, as will be shown presently, would be done only very slowly.

In the second case, all the electrical energy will be converted into low-temperature heat, which will be transmitted straight to the air in the room; the furniture and walls will be in time warmed from the air—just the reverse process from that described above.

Now for some figures:—Take a room 18 ft. by 10 ft. by 8 ft. 6 in. high. This will contain about 120 lb. of air and, say, 500 lb. of furniture. The brickwork in the walls, assuming $4\frac{1}{2}$ in. on two sides and $4\frac{1}{2}$ in. to a

cavity on the other two, would weigh about 20,000 lb., and a one-inch wooden floor and ceiling 1,300 lb. The specific heat of air is 0.24, brick 0.2, and wood 0.6. So that the air takes 29 B.th.u. to raise it one degree Fahrenheit, the furniture 300, and the walls, &c., 4,800.

The 1-kW radiator, allowing six changes of air per hour, would keep the air of the room 20° F. higher than outside, whilst it would take the same radiator 30 hours to raise the temperature of the walls and furniture by the same amount, even supposing that no heat was lost by cooling to the outside.

It is thus seen that if the warming of the air is the objective, it is much better to do it directly by a "convector" than indirectly by a "radiator." But there are some occasions when the radiant energy from a luminous type radiator is the more useful. Take, for instance, the case where an unfortunate child has to practise the piano for an hour a day in an otherwise unoccupied and therefore unheated room. It is equally out of the question, from the cost point of view, to attempt to heat either the walls or the air, but a 1-kW radiator will keep the child warm in an air temperature of 40° F. by being placed so that the direct radiant energy falls on her and warms her, without warming the air through which it passes. On the other hand, where it is intended to keep a building warm day and night throughout the winter, heating elements built into the (inside) walls have very much to recommend them.

Another point of view which it is important not to lose sight of is the psychological aspect. It is doubtful if one can be warm if one does not *feel* warm, and it is demonstrable that one can be made to feel warm without being warmed, e.g., the Berry imitation coal fire.

Another example of local heating is the use of electric foot warmers. We have kept a bench full of girls warm and cheerful in an otherwise unwarmed room in winter by letting them rest their feet on a long wooden trough lined with slab asbestos and covered with tin containing one 8-c.p. carbon lamp per girl. Examples of local heating under the drawing boards in a drawing office have proved equally effective and economical.

An interesting problem connected with electric heating is given by the gasfilled lamp; why does a 60-watt gasfilled lamp, whilst receiving the same energy as a 60-watt vacuum and giving (a little) more light, apparently give more heat also? The answer is really very simple: it doesn't! The lamp itself undoubtedly gets hotter; no lamp uses more than a small part of the energy it receives for making light, much the larger part is wasted; the vacuum lamp sends its wasted energy out as non-luminous radiant energy, which does not heat the glass it passes through; the gasfilled lamp uses more of its wasted energy in making heat locally, partly because its filament is hotter, but mostly because it is surrounded by gas which conducts the heat to the glass and cap of the lamp. Put into an enclosed shade, the gasfilled lamp gets too hot, whilst the vacuum lamp can get its waste out through the glass shade to warm the outside universe.

Ice Formation at Hydro-Electric Plant.—A plan for heating the dams, valves, and gates of electricity generating plant slightly above freezing point in order to keep them free from ice was outlined before the International Joint Waterways Commission in session at Ottawa, Canada, in November last. A new type of turbine, which the Ontario Hydro-Electric Commission proposes to use in the scheme, was described by Mr. F. H. Rogers, a Philadelphia engineer. Mr. John Murphy, electrical engineer to the Railway Commission, said that in addition to heating the dams and gates, the machinery within the power plant also would be kept at a temperature above freezing point, thus eliminating any ice formation. The subject of heating was brought up after Mr. Hugh L. Cooper, of New York, had predicted that ice jams would prove a serious problem in working out power development schemes.—*Reuter's Trade Service* (Ottawa).

INDIA: BRITAIN'S GREATEST MARKET.

Official Report of the Situation.

H.M. Secretary of Trade, Commissioner at Calcutta (Mr. T. M. Ainscough) in a report recently issued by the Department of Overseas Trade (H.M. Stationery Office, 3s.), and briefly referred to in our "Business Notices" last week, dwells upon the phenomenal trade activity which set in immediately after the armistice, the depression that followed when a world slump occurred in the raw materials market, and the ensuing deadlock in India's import trade. He records the developments in economic research and improvement of the natural resources of the country, surveys generally its industrial conditions, transport, communications, finance, and exchange, and finally submits some general suggestions regarding the probable trend of events.

First, it is worth noting that Mr. Ainscough favours the tendency towards direct trade between Indian importers and overseas suppliers, which has been one of the features of the past few years. In spite of unfortunate experiences with certain importers at the time of the recent crisis, he is convinced that direct trade, if carefully conducted on sound lines, and with responsible Indian firms, is reasonably safe, particularly in those cases where the home shipper has a resident representative in India to safeguard his interests. At the same time, Mr. Ainscough expresses the hope that British export houses will, in future, exercise greater discrimination in the granting of credit, and will, wherever practicable, appoint resident representatives to watch their interests.

The position of the four great Tata Hydro-Electric schemes is summarised in the report. Our Indian correspondent recently referred to this subject at length.

The Hydro-electric Survey of India, which was inaugurated in 1918, has proceeded steadily with its work. Much additional power has been located and assessed, and it is hoped that in another three years or so the initial part of the work will be completed.

After a preliminary investigation the Hydro-Electric Survey estimates that there are about 13 million electric horse-power actually in sight in India, but this is, of course, vastly below the actual available power which the final results of the survey will disclose. Moreover, the great perennial snow-fed rivers have been scarcely touched upon, and their potential power has not been determined. The following is an approximate estimate of the power of all kinds in use in India in 1919:—

Province.	Brake Horse-power.
Assam	22,550
Bengal	25,318 exclusive of Calcutta area.
Calcutta area ...	176,200
Bihar	2,325 apart from collieries, &c.
Bombay Presidency ...	32,872
Bombay City area ...	750,000
Burma	17,750 exclusive of rice mills, &c.
Central Provinces ...	32,773
Madras	39,568
North-West Frontier Province ...	—
Punjab	15,734 steam only
United Provinces ...	38,548
Total	1,153,638

Mr. Ainscough quotes as follows from the final paragraph of the preliminary report: "While this work is being carried out the interrelated question of industries is in strong hands, and the combination of power and industries is essential to the prosperity of both. . . . There will be keen competition in the market for orders, and British manufacturers of pipes, turbines, generators and switchgear must see to it that they are not left stranded. Hitherto they have been content to take the small orders and to let the large go to countries that have specialised in water power. It has even been asserted that engineers from abroad are essential to the proper erection of plants when received. It is high time that these fallacies should be dispensed."

These strictures are rather severe, but Mr. Ainscough very fairly adds that since they were written British makers of water power plant have made very great strides. "Water turbines of the largest size are now being made by two or three large firms in England. The hydraulic gear has always been a speciality of British makers, while the large British groups can manufacture generating sets as cheaply and well as any of their foreign competitors. It is only in extra high-tension equipment that they have hitherto not had much experience, but even here a determined effort has been made to manufacture apparatus even for the largest schemes."

The story of the iron and steel industry of India is largely the record of the Tata Iron and Steel Co., Ltd. Its progress is well known. Regarding the subsidiary industries which it was hoped to establish in the vicinity of Jamshedpur, the competition, and in some cases even the further consideration of these projects have been delayed chiefly owing to difficulties

in obtaining capital. The company is, however, still negotiating for the establishment of plants for the manufacture of railway wagons and locomotives, agricultural implements, wire products, tin plates, enamelled ironware, cables, and special steel for reinforcement.

Local and Other Competition.

The competition of Indian industries calls for serious consideration. Last year the demand for steel was so great that British shipments increased enormously, and the competition of the Tata steelworks, says Mr. Ainscough, was not realised. When the extensions to Jamshedpur are completed the production available will, however, be 125,000 tons of finished steel per annum. It is expected to work up to this production in four years' time. In addition, iron castings will be produced in steadily increasing quantities, both at Barakar and at the new Indian Iron and Steel Company's works at Asansol. The two large new projects for iron and steel works are still in the preliminary stage, but there would appear to be little doubt but that the schemes will be proceeded with, in which case, in the course of the next five to ten years, we shall see at least three steel works in India of the size of the Tata concern. Competition in steel bars, billets, plates and sections of all kinds will rapidly and steadily increase, and it must always be remembered that, whether a protective tariff is or is not imposed, Indian manufacturers always have a most substantial natural protection in the costs of freight and handling between the United Kingdom works and the market. The engineering shops in India are competing more and more in structural steelwork and simple steam engines of all kinds. The supply of steel on the spot in the shape of plates and sections will tend to stimulate this competition. Hitherto, most of the wagon-building in India has merely consisted of assembling parts and sections imported from home, but with a steel supply at their doors local engineers are bound to become more ambitious. Jute mill machinery will shortly be produced at Jamshedpur and tea machinery at Agartara, near Calcutta. There are also several works near Calcutta which are engaged on the manufacture of the essential parts and stores used in jute mills, and a number of jute looms have already been turned out.

The largest number of engineering workshops (including iron and brass foundries and shipbuilding works) is in Bengal (74 factories with 15,840 persons). Other important provinces stand thus in order of importance: Bombay (20 factories with 5,387 persons), Bihar and Orissa (7 factories with 5,278 persons), the United Provinces (7 factories with 1,610 operatives), and Madras (9 factories with 1,394 persons). There are two iron and steel producing works, one in Bihar and Orissa employing 10,775 persons, and the other in Bengal with 6,370 operatives.

Whilst buyers in India say that they can obtain earlier deliveries and greater consideration from German manufacturers, there is the great handicap when purchasing machinery and plant from Germany, that it cannot be erected by German mechanics in the employ of the manufacturers owing to the Government of India Act excluding German subjects from residing in India except under special licence for five years after the conclusion of peace.

Japan's trade in India during the war in electrical accessories and implements is cited as one in which she could never hope to compete in normal times.

Mr. Ainscough deals at length with the much-debated question of the purchase of Government stores, and gives in *extenso* the proposed rules for the supply of articles for the public service.

The Institution of Engineers (India).

Before leaving the subject of industrial developments in India mention is made of the inauguration of the Institution of Engineers (India) in February, 1921. It had been felt for some time that there was a growing need in India for an institution combining the civil, mechanical and electrical branches of the engineering profession. While it is true that most engineers in the country belong to one or another of the home institutions, it was found to be very difficult, with such a scattered European population and such great distances, to work successfully local branches of the home institutions so as to make them really influential bodies. Thanks to the energy and enterprise of one or two enthusiasts, ably backed by Sir Thomas Holland and the Board of Industries, a central Indian institution has now been successfully launched.

Prospects for Branch Works.

On the subject of the erection of branch factories in India, a short recapitulation of the Trade Commissioner's conclusions may be of advantage. Of cement, heavy castings, pipes, and tubes and certain types of constructional steelwork, prospects for local manufacture should be promising, because the principal raw materials are available in India, and that country affords a large steady

market for them all. Certain established industries in India require constant supplies of machinery and parts which might be worth manufacturing on the spot. Amongst them may be mentioned cotton and lute mill machinery, tea and rubber machinery, agricultural and hand tools. When it comes to heavier plant, e.g., locomotives, wagons, waterworks equipment, and small pumps, local manufacture might be successful, subject in some instances to the importation of certain parts which involve the application of highly skilled labour. An important consideration throughout is that if British manufacturers do not take advantage of such opportunities as India presents, our foreign competitors may do so, and thereby undersell our imported goods in the market. Further, protectionist feeling is running very strong in India. If and when such a tariff is imposed, the whole question of establishing branch works in India must be reviewed from an entirely fresh angle of vision, and manufacturers in many cases may find it to be more advantageous to produce within the tariff wall than without it. On the other hand, British firms have certainly had some discouraging experiences. Monetary stringency, difficulty in securing skilled labour, the growing unrest and general shortage of labour, and finally the disinclination of the Indian Government to guarantee to purchase a certain proportion of the output—all these factors have stood in the way of a successful launching of branch works in India.

Electrical Imports.

During the past year imports of British machinery generally not only expanded by over eleven millions sterling in value, but the percentage share has advanced to 78 per cent. of the total. It is highly satisfactory to be able to note that the United Kingdom regained her position as the principal supplier of electrical machinery, her shipments being valued at £1,490,473, as compared with £665,843 from the United States. In commenting on the statistics of imports of electrical apparatus and appliances (which were published in some detail in a recent issue of the ELECTRICAL REVIEW), Mr. Ainscough points out that in the five years preceding the war the United Kingdom supplied 82 per cent., the United States 6 per cent., and Japan 4 per cent. Last year the respective shares were: the United Kingdom 69 per cent., the United States

20 per cent., Japan 3 per cent., Holland and Italy each about 2 per cent. During the war the large trade in ceiling and desk fans was practically shared by the United States and Japan, with the United Kingdom a bad third. This position is now largely reversed, and although the Americans still head the list, the margin over the British imports is reduced to very little. In electric wires and cables, the British lead is still further established, although American and Japanese shipments, notably of bare copper wire, have increased enormously. The most important item is rubber insulated cable, of which the United Kingdom supplied 90 per cent., the United States 7 per cent., and Japan 2 per cent. As regards insulations other than rubber, 96 per cent. came from the United Kingdom and 2½ per cent. from Japan. The United Kingdom supplied virtually the whole of the telegraph and telephone wires and cables. Apart from copper wire, Japanese imports of cables are negligible. The strong British position in the cable trade is almost entirely due to the excellent organisation and activities of the Indian branches of the leading British cable makers. In lamps, too, the British position has improved. Imports of Dutch make have been largely replaced by British lamps, and the United Kingdom now supplies 55 per cent. of the total trade, Holland 28 per cent., the United States 5 per cent., and Japan 4 per cent. Again, British makers are successfully withstanding American competition in accumulators, batteries, telegraph and telephone instruments, lighting accessories and fittings, and meters. Mr. Ainscough mentions two minor lines in which there is room for development, viz., electro-medical apparatus and electrical porcelain. The report pays a tribute to the branches and agents in India of the leading British makers to whose sound organisation and active salesmanship a very great deal of the splendid recovery made is due. The electrical trade, both as regards machinery and apparatus, fittings, &c., may be regarded as a model from the point of view of representation. Almost all the leading makers have their own branches in India staffed with both technical and commercial men, and where this is not the case, the agency is entrusted to a local merchant house, who can provide a similar organisation. The figures and particulars given are sufficient proof of the value and efficiency of this system.

THE DESIGN OF LIQUID RHEOSTATS.

By W. WILSON, B.E., M.Sc., A.M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS AT BIRMINGHAM.)

The liquid rheostat is playing an increasingly important part in the operation of a.c. motors of large capacity. The smoothness of its control; its robustness, amounting almost to indestructibility; the facility with which its resistance can be varied within wide limits by modifying the strength of the electrolyte; its cheapness and ease of construction, &c., combine to render it a valuable piece of equipment. To-day, when motors of ever-increasing capacity are being used in heavy industries, dependent almost without exception on this type of rheostat for their control, its design is becoming more and more important. The author's object, therefore, in presenting the paper is the more definite determination of the constants of the liquid rheostat and the more exact prediction of its performance.

The various phenomena that take place when a current is passed through an electrolyte are:—

(1) *Thermal*.—The effect of the generation of heat is ebullition, the harmful effects of which disappear when the temperature falls again. The quantity of heat produced in a liquid varies with the number of watts dissipated. Thus the rise in temperature is dependent, not only on the current flowing, but also on the fall of potential between the electrodes.

(2) *Chemical*.—The chemical effect varies with the current only, and the practical results, as far as rheostats are concerned, are as follows:—

(a) The electrolyte itself is decomposed, so that in general it deteriorates with use. (b) The anode is eaten away. In most instances met with in practice both anode and liquid undergo more or less serious deterioration when in active use with direct current. (c) Gas is generally given off at the plates, depending partly on the density of the current per unit area of electrode, usually derived from the decomposition of water, and bubbles of hydrogen predominate. When gassing is excessive, one bubble may extend from plate to plate, and spontaneous ignition, or an explosion on a small scale, is then possible. If the production of gas is permitted to increase, large bubbles eventually set up a sub-aqueous arc between the plates, and thus form practically a dead short-circuit across the rheostat.

An objection to solutions of common salt for use in rheostats is that chlorine may be given off in sufficient quantity to endanger human life. The gases from sulphuric acid electrolytes are also objectionable.

All electrolytic phenomena are unidirectional, i.e., they are reversed if the direction of the current reverses. Hence the

effects of electrolysis are negligible with alternating current under ordinary conditions. Even when electrolysis is absent, a certain small amount of chemical action occurs between the plates and the liquid, chiefly of the nature of rusting. In nearly every practical apparatus, iron electrodes are employed, and one of the following electrolytes: sodium carbonate (washing soda), sodium chloride (common salt), or sodium hydrate (caustic soda). The second has by far the greatest corrosive effect upon the iron, and the other two are therefore preferable, but these have the property of disintegrating almost all plastic insulators such as varnish, cement, wax, &c., and they also exercise a deteriorating effect upon pottery. Most standard designs, however, do not suffer to any serious extent from corrosion by the carbonate or hydrate.

3. *Other phenomena*.—No new phenomena apart from those mentioned in sections 1 and 2 were observed. With a liquid resistance the limiting conditions are not simple, for all the phenomena mentioned in 1 and 2 above contribute towards the restriction of duty of a given apparatus. Thus it is not possible to lay down a general rule that in every case the current density must be of a certain value, or the total watts absorbed so much.

It can be safely concluded that at high alternating-current densities, i.e., up to 4,750 amperes per sq. ft., there is no appreciable amount of electrolysis or other phenomenon than that of the production of heat. The above does not suggest that electrolysis does not take place to a considerably greater extent than is indicated by the tests, but shows that the ultimate effects are negligible in practice.

The conditions were modified to introduce a high voltage gradient, i.e., 2,400 volts per in. Large bubbles of steam were produced by the 8.4 kW acting on the small volume of liquid between the plates; but although the power was supplied for some time, there was no sign of breakdown, and the closest inspection failed to reveal any arcing or other troublesome phenomenon. A small proportion of the bubbles evolved reached the surface of the liquid, and their amount was increased by reducing the separation of the plates. This explosive gas was due to the electrolytic decomposition of water, but the extent of the action was still far from being serious. In addition, the electrolytes employed in practice very rarely consist of other than alkaline solutions.

A further test bearing upon the ultimate capacity was carried out to search for any surface effect of the nature of "surface contact resistance," but the result shows almost conclusively that there is no surface effect.

Thus it has been established that with alternating current electrolytic effects are negligible and that all the resistance is due to the electrolyte. The first of these facts simplifies the problem of designing a liquid rheostat for use with alternating currents, for it proves that the evolution of heat is the only phenomenon to be reckoned with. Given the necessary facilities for the removal of the latter, current densities can be employed at least of the order of from 4,000 to 5,000 amperes per sq. ft., and probably higher if it should prove desirable.

Some of the above conclusions were confirmed by tests upon larger apparatus, using much higher voltages and powers, which finally dispose of the alleged surface effect, as far as the conditions of the commercial liquid rheostat are concerned. There is no doubt, however, as to the existence of a high surface resistance under special circumstances, such as those sometimes encountered when temporary rheostats are set up for the testing of large generators. For this purpose, small electrodes are partly immersed in plain water. The portions below the surface of the liquid are apparently surrounded by a "blanket" of steam which, owing to poor circulation, is not readily dissipated. It is not certain to what causes this "blanketing" is due. A potential of the order of 5,000 volts is one of the conditions of such tests, and the trouble seems to disappear at lower pressures. But such conditions are not encountered in the case of the apparatus described in this paper; nevertheless, confusion has been caused in the past through designers generalising on the strength of such results.

No limit for current density has yet been found. The cause of such breakdowns as have occurred within the author's knowledge has been arcing between electrodes due to the temporary removal of a portion of the electrolyte by the formation of gas, accompanied by an explosion of a large bubble of mixed gas, or of two large adjacent individual bubbles. It is conceivable that frothing, due to an insufficient supply of cool electrolyte, might provide means for the overheating of the liquid "conductor" in the case of an alternating-current rheostat, if the voltage gradient across the space between the electrodes were sufficient.

A test to study the modifications introduced by gassing was carried out by direct current representing 5,760 amperes per sq. ft. The result was the evolution of large volumes of gas from both electrodes, which rose to the surface in fairly small bubbles, and was apparently not capable of causing arcing or other breakdown. It appears certain that the mere presence of the gas is not sufficient to cause failure at the high current density employed, but that a high temperature, a dirty or stagnant electrolyte, or other additional agency, is necessary to facilitate the evolution of large bubbles, and consequent arcing. The conclusion appears inevitable, that, given a sufficiently plentiful stream of electrolyte at a temperature well within the specified working limits, current densities up to 4,500 amperes per sq. ft. are practicable, even with direct current. At least one type of rheostat complies with these conditions.

[The author next deals with the design of self-cooled liquid starters for motors of small and moderate sizes, and calculates the rating for infrequent duty. His calculations, when compared with the rating of the majority of starters in practical use, permit the carrying out of much heavier work than is the custom at present. He also accurately predicts the manner in which a starter will heat up for periodic duty, and from the data thus obtained, obtains by calculation a complete prediction of the performance. The calculation is deduced from first principles, and enables the performance to be readily predicted when the dimensions have been fixed according to the ordinary units employed in this country. A more mathematical treatment, which makes provision for a variation in the emissivity follows; it is analogous to Helmholtz's equation for the growth and decay of an electric current in an inductive circuit. It is suggested that a definite means of increasing the duty of a given rheostat would be to corrode or rib the surface of the tank.]

With regard to larger self-cooled liquid rheostats, vitrified earthenware pots are very commonly used to separate the phases, but are not always satisfactory owing to breakage due to heat applied to the inside only, or to heat expansion against the clamping of a rigid watertight joint. A certain amount of deterioration is caused, in addition, by chemical action on some species of earthenware. For the above reasons, treated wood has been substituted in an American design.

As the size increases, natural cooling of the starter becomes more difficult, since the heat developed is proportional to the cube of a given dimension, while the surface is only proportional to the square. For regulators and controllers which are required to be in circuit continuously, unaided cooling is almost impossible, except for the smallest capacities.

Liquid rheostats for increasing the slip of induction motors have been in use for quite a long time, primarily in connection with the Ilgner system, but it is doubtful whether their performance renders them preferable to a permanently-connected resistance, with its continual heavy waste of energy. The principal objections to the present design of rheostat are: (a) *Unreliability*, chiefly through metallic corrosion and the breakage of pots. The *range of action*. If there is any acceleration due to the 1 or 14 second which has been met with in practice, the full peak current, at least in the case of a rolling-mill load with its very rapid acceleration, will come on the line and will merely be curtailed in duration by the operation of the rheostat. Thus the apparatus will have

failed to justify the expenditure incurred in its installation and maintenance.

Spring control, preferably by the extension of a helical spring or springs, is suggested. Its effect upon the loading of the induction motor would be that a certain fraction of the overload would be taken by the motor, as an overload is necessary to maintain the deflection of the torque motor. Another method of realising the attainment of equilibrium. Another delaying its inception is by damping the movement of the dippers, already available in the "dash-pot" effect of nearly disk-shaped dippers moving through the liquid in a direction normal to their faces. The designer will have to choose between the two alternatives described above and a combination of both, according to the nature of the problem. For example, it would be fatal to throw all the overload upon the flywheel if the latter were not large enough to supply the whole peak. The usual design suffers through over-complication. A slip-regulator is a short-circuiting, and not a "straight-through" rheostat, hence there is no need for the phases to be insulated from one another. Thus at the outset the porcelain pots would appear unnecessary, and this is important in that much unreliability in the past has been due to their presence. Their insulating effect is neutralised by increasing the conductivity of the electrolyte, with the result that corrosion problems are accentuated. The design of a slip-regulator on simpler lines is possible. Such a rheostat would possess three or more fixed electrodes, which by themselves would interpose the full slip-resistance. A single moving electrode would approach them, and would reduce the resistance to a practical short-circuit.

A Continental slip-regulator does not contain porcelain pots, but the moving electrodes rotate, and the torque motor is geared to the rheostat shaft by means of a chain. This pattern is designed on more rational principles, as it does not incorporate the conflicting and troublesome features described above. If the simplifications indicated are carried out, inertia and corrosion are reduced and immersed insulators obviated. Thus the principal faults can be practically removed.

One or two examples of the liquid rheostat present unusual features, or indicate possibilities of extension in its use. An especially interesting example is the "counter cell" employed in connection with the constant-potential method of charging lead batteries. Use is made of lead-sulphuric acid-lead units, in which the lead plates are not "formed" in any way, and the cells simply function as though they were lead batteries perpetually undergoing overcharge. Each one thus interposes a constant negative potential, and decreases the effective charging voltage by a corresponding amount.

The design of these liquid resistances, as far as spacing and current density are concerned, may be deduced from that of the lead accumulator. The principle underlying their use is one which should render them serviceable in other branches of work, and it has been employed by the author for continuous and untended work in connection with direct-current organ-blowing motors. Its function is to start and then regulate the motor in such a way that the level of the bellows is constant whatever the demand for wind. Its operation is quite automatic, the releasing of a catch being alone required to put the apparatus in full commission. Tap water alone is used as the electrolyte, artificial cooling, when required, being brought about by passing automatically a small trickle of water through the tank when the outfit is in use, an expedient which also keeps the electrolyte clean. The electrodes were of sheet lead, in the form of a lining to the wooden tank, and a short cylinder respectively. The depth of water was from 4 to 6 in., and the moving electrode just grazed the surface when the bellows were full, but rested on the bottom of the tank when they were about two-thirds empty. The outstanding smoothness of acceleration given by the liquid rheostat was a valuable feature, in addition to the absence of arcing.

By employing the results of the tests and calculations described in the original paper, it is possible to design a liquid rheostat to give exactly the desired performance, and there is no reason why advantage should not be taken of this to render the apparatus as compact and inexpensive as the data will permit. In the past, extravagant standards have been employed. A much smaller factor of safety is appropriate with liquid than with solid resistances, a point of especial importance in the design of self-cooled apparatus. A specification permitting a working range of 120 deg. F. for certain of the smaller types of rheostats would be justifiable, but, if the present standard of 100 deg. F. is adhered to, the designer has in hand a considerable margin of safety to provide against improper use. It should be remembered also that the starter is only required to dissipate an average of about half the power passing through it during the period of starting. This point is emphasised, as many starters have been designed in the past on the assumption that they absorbed the whole of the energy at starting.

It is a common practice to require wire rheostats to effect an endless succession of periodic starts. This method of rating is not appropriate for liquid starters. A more suitable requirement would be the carrying out of a given number of successive starts, followed by a sufficient interval to enable the liquid to return to practically its normal temperature. It is impracticable to compile a specification to satisfy all the duties that may be required in practice. A compromise is therefore necessary, and it would be unfair to expect two dissimilar appliances to comply with exactly the same conditions.

No motor for which a liquid starter is used is ordinarily started up every 15 minutes or so throughout the day. If it were required to do so habitually, either an artificially-cooled liquid starter, or one designed for a larger capacity, or a solid pattern of rheostat, should be employed. At the worst, not more serious can happen than a slight amount of boiling near the conclusion of the later operations.

The author has endeavoured to show that the liquid rheostat is readily capable of mathematical design, enabling its performance to be exactly predetermined. It is his contention that advantage should be taken of this fact to fix the dimensions in close correspondence with the desired result, a reasonable margin only being allowed for contingencies.

DISCUSSION.

Mr. J. ANDERSON said the paper was useful on account of the new data brought forward, but in practice the ideal was far from being realised. Rider's tests assumed it was necessary to have an open position at "off" by withdrawing the dippers, but that seemed the worst way to use a liquid starter; it was simply asking for trouble, and liquid starters should always be interlocked with the breaker to ensure opening the circuit with the breaker and closing the circuit with the dippers in the right position for the desired initial current. Even interlocking was not a cure, as the level of the liquid might be allowed to fall too low, and as the dippers and solution required changing from time to time by the attendant, there could be no guarantee that they were not altered on site and the starter overloaded or the motor unduly stressed. The author's tests showing little corrosion with 25-cycle supply did not agree with a test made some two or three years ago by the speaker. A resistance element consisting of a porcelain cylinder wound with alloy resistance wire about No. 20 gauge was immersed in Birmingham tap water, and after a 25-cycle current had been passed through it for two hours the wire had rotted through and broken the circuit; speaking from memory, the potential between the ends of the cylinders was 100 volts. The d.c. corrosion was generally heavy, and the average life of cast-iron electrodes in haulages was not more than six months, so that a starter in frequent use must have ample facilities for changing the electrodes and the solution and clearing out sludge. Total enclosure to meet the Mining Rules was not easy with small horse-powers. The decrease of resistance with temperature must be troublesome and fatal to exact work. A soda solution did not freeze easily, but the possibility must be remembered if the starter was in an exposed position. The author rightly referred to the inequities of standard specifications, and it was a criminal waste of material to try to dissipate energy with a temperature rise of 100 deg. F., and to throw away the possibility of utilising the latent heat of the steam generated by short-rated starters.

Mr. H. C. FOX said the fact that the tests did not establish that with alternating current of any periodicity electrolytic action was negligible was of importance when the rheostat was in series with the rotor circuit of a lightly loaded induction motor. In such a case the frequency was of the order of one or two cycles per second unless the resistance value was very high, and in such circumstances a certain amount of electrolytic action might be anticipated as d.c. conditions were being approached. The author had assumed that the average h.p. dissipated during starting was 50 per cent. of the continuous h.p. of the motor when taking a current equal to that passed during the starting period. Since the resistance-time curve must be parabolic if the current was to remain constant during starting, it followed that the h.p. to be dissipated must be 66 per cent., not 50 per cent. That, of course, meant that the starter for a given motor would have to be 33 per cent. larger than the author's figures would give. The increased rating that would be obtained by ribbing the tank would not be worth the trouble; ribbing had much less effect than was commonly supposed.

Mr. O. SUTTON said that the paper would have served a very useful purpose if it convinced users that the liquid rheostat was a permanent article instead of only being of use in a test room. The author's principal criticisms of the stationary electrode type of rheostat seemed to be (1) a large pump was required to fill the electrode tanks quickly when a high rate of acceleration was required, and (2) mechanical force was required to operate the weirs. The speaker's tests of two resistances coupled together, one pump supplying the electrolyte for both and one hand wheel operating all the weirs, showed that the pump took 2 h.p. and filled the electrode chambers in less than ten seconds—less than one per cent. of the continuous capacity of the rheostat. The handwheel operating the weirs was also coupled to a shunt regulator on the switchboard, and no appreciable power was required to turn the handwheel. Stated shortly, the advantages seemed to be: 1. Compactness. 2. Ease of working and small moving parts. 3. Flexibility: the shape of the resistance curve could be varied over a wide range. 4. Ease of renewals; any electrode could be replaced in a few seconds. 5. Efficient cooling; all electrolyte came into direct contact with the cooling pipes and at a high speed. 6. The cooling pipes were straight and could be withdrawn very easily. 7. The apparatus was totally enclosed, with the exception of a vent pipe.

Mr. B. A. M. BOYCE had figures which showed that the

standard type of liquid rheostat was a *terrible* piece of apparatus. The company he was connected with had supplied to one client 262 starters during the last seven years, during which time the spare parts ordered had been four sets of contacts and nine sets of dippers. Assuming the whole of the 262 starters to have been in use for three years, gave a total of 786 starter-years, and the spares would be stated as 0.51 sets of contacts per 100 starter-years, and 1.15 sets of dippers per 100 starter-years. With regard to current density in the electrodes, it should be borne in mind that the density given in pocket books with full immersion would most likely be exceeded considerably when the electrodes were only partially immersed. He thought there was a critical frequency between 25 and 40 cycles, and that below that critical point the effects of alternating and direct current were similar.

Prof. W. CRAMP referred to the use of "plain water"—a very hazy term, as water in different localities varied widely in its behaviour as an electrolyte. He did not agree that the author's fig. 4 proved the absence of the "surface effect," but merely that in a.c. circuits the surface effects neutralised one another; the line did not pass through zero as it undoubtedly should if all surface effects were absent. Throughout the paper the bases for the calculation of the surface densities were unsatisfactory, for the protection of the backs of the plates with insulation did not mean that there would be no current therefrom.

Mr. T. SIMMONS, in a communication, did not consider liquid rheostats very adaptable for controlling motors driving main and tail drum haulages where the stops and starts were very frequent. He had in mind a 30-h.p. haulage set working underground; the interval between each start would not be more than from four to five minutes, and the motor had to start up with full load torque. Under those conditions the electrolyte evaporated rather quickly, and one could not depend upon a motor attendant to fill the container with electrolyte of the correct strength. That was where the trouble commenced. Where Rule 132 of the Electricity in Mines Regulations was in force, it would be impossible to comply with it by using a liquid rheostat. When the electrodes made or broke contact with the electrolyte, a spark was always present. Was there any reason why the electrodes should leave the electrolyte? Some wire-wound rotor starters were designed so that the motor started up when the line switch was closed—a design which might be applied to liquid starters. To stop the motor it was only necessary to open the line switch, but provision would have to be made to interlock the main switch with the starter, so that the line switch could not be closed with the starter in the "full on" position.

AERO ENGINE IGNITION.

(Continued from page 692.)

Spark Intensification.—The second report, No. 17, August, 1917 (I.C.E. 135), is by Dr. G. E. Bairsto, and was presented by the superintendent of the Royal Aircraft Factory; it is concerned with the intensification of the spark of a defective spark plug by the use of an additional spark gap in series with the plug.

The presence of oil on spark plug points may produce two effects: (1) it may (1) cling to the sparking points and insulate the gap, thereby causing misfiring; (2) become carbonised and deposited on the surface of the insulation causing short-

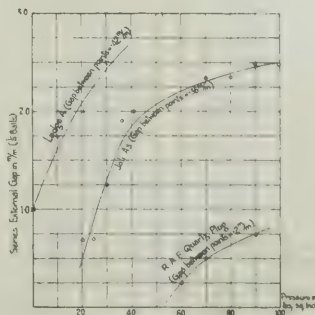


FIG. 2.

circuiting of the current across the insulation instead of across the spark points. The use of an additional spark gap in series with the plug has been advocated as a means of preventing this misfiring, and the following tests were made to determine the precise effect of the additional gap.

A number of defective plugs were tested under air pressure with an adjustable air gap ($\frac{1}{4}$ in. balls) in series. The air pressure was varied and the series gap adjusted to give regular

ring (if possible) on the plug points. A Bosch hand starter driven at a constant speed of 1,200 r.p.m. was used as the source of h.p. current.

The results indicated that the spark gap necessary for regular firing is very variable and depends very much on the value of the air pressure and on the magnitude of the gap between the sparking plug points. Fig. 2 shows graphically the results for three different plugs. The external spark gap for regular firing increases with increase of pressure, and is largest in the case where the spark plug gap is largest. The spark gaps given above are the minimum ones to just create regular firing. Actually the plug will give regular firing with still larger external gaps. This is illustrated by fig. 3. There is an upper limit, however, beyond which, if the gap is opened up any more, misfiring begins to take place.

During tests on new plugs, the surface insulation of which had been artificially carbonised, it was shown that it is much easier to produce a continuous conducting layer on a mica plug with its rough surface than on the smoother surface of a porcelain plug. With regard to tests on new plugs shunted with an artificial leak, the general nature of the curves of the results obtained from three different plugs, each shunted with a water resistance of 10,000 ohms, is similar to that of the curves in fig. 2, i.e., the higher the air pressure, the larger is the external gap necessary for regular firing, and also the plug with the widest gap requires the largest external gap. There is one point of difference, however; at low pressures the external gap becomes practically constant, whereas in fig. 2 it rapidly decreases to practically nothing. This would seem to be explained by the surface resistance of the carbonised insulation differing considerably with the varying conditions of voltage and current. Attempts were made to measure the resistance of a hot carbonised plug by means of an ordinary Wheatstone bridge, but in every case it was of

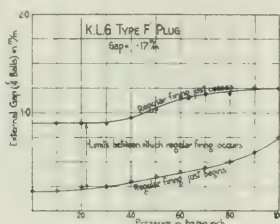


FIG. 3.

the order of 1–10 megohms, which is too high to have much effect on the firing of the plug. When under a very high voltage it undoubtedly falls to a much smaller figure owing to minute arcing from particle to particle.

In another set of measurements a given plug (gap = 0.17 mm.) was shunted with various resistances from 1,000 to 1,000,000 ohms, the higher one being obtained by means of a graphite resistance made with a soft carbon pencil line and the lower one by means of a water resistance. The external gap was plotted to air pressure, and it was shown that for any given resistance the external gap requisite for regular firing increases with the pressure. At any given pressure the gap rapidly increases as the leakage increases. When the leakage is very great, however, the firing becomes irregular again.

In explanation of these effects, it must be understood that the total energy of the transient wave of electromotive force which fires the plug is very limited in amount, and if the plug is leaky in the electrical sense, the e.m.f. at the points may never reach a value sufficiently high to spark across them. Inserting another spark-gap in series with the plug prevents this leakage, and the secondary is enabled to build up the e.m.f. necessary for disruption. The length of this must be large enough for the plug points to reach the requisite potential before the spark in the external gap has passed, because when once the external spark has passed, the gap becomes practically a conductor. The way in which the total e.m.f. divides up between the two gaps will be a function of the capacities between the two gaps and of the capacities to earth of the different sides of the gap and also of the resistance shunting the plug.

Because of air pressure, a length of spark plug gap means a greater e.m.f. necessary at the plug points and therefore a larger external gap. It has been pointed out that the external spark gap ensures the plug points reaching the necessary potential for breakdown, but it requires a certain time interval even then for the spark to take place, so that during that interval it is quite possible for the e.m.f. to fall (via the leak) before the spark has passed. Hence if the leak is large we need a bigger e.m.f. across the plug points than if it were not leaky, and this in turn requires a larger external gap. So at a constant pressure the necessary external gap increases with the leakage.

Another factor is high frequency currents that are set up when the spark takes place in the local circuit composed of the plug, external gap, and cable. The precise effect of these currents depends upon the capacity and inductance constants of the various parts of the circuit, and in one case that

arose during the tests very peculiar results were obtained which could only be explained by the presence of these oscillating currents. It was found that there was a particular range of resistance shunting the plug for which the external gap was a maximum, and above and below this resistance the gap decreased. The matter could not be studied any further, as the committee had no wavemeter for recording these high-frequency currents.

Engine Starting.—A third report, No. 3, April, 1917 (I.C.E. 73), was presented by the superintendent of the Royal Aircraft Factory. This points out that owing to the greatly increasing size of the engines used for aircraft, the present generally used method of starting the engine by means of turning the airscrew is inefficient, and it is imperative that some mechanical means of starting be developed.

With the medium-power engine (100–150 h.p.) a fairly easy start can be obtained by means of the magneto hand starter, provided the cylinders are first charged with an explosive mixture. It is the uncertainty of the latter requirement which is responsible for most of the failures to start which have been experienced.

Some tests were made with coal gas on a R.A.F.4 engine fitted with a light flywheel, and it was found possible to start the engine on the starting magneto without swinging the propeller, and run on coal gas alone. However, it was not found possible to start a 250-h.p. Rolls Royce engine by the same method, and it was considered that the results were sufficiently conclusive to condemn this method of starting.

Starting an engine by compressed air would appear to be the most satisfactory method to be adopted, and a complete starting unit could be fitted to any aeronautical engine up to 300 h.p. at a total weight not exceeding 10 lb. including the distributor, pipes, and adaptors for cylinders, but not the air reservoir. Compressed air starting is in fairly general use in naval aeroplanes.

Electrical starting is not possible owing to the excessive weight of the plant required. Messrs. C. A. Vandervell and Co. have designed a power unit which will turn a 120-h.p. Beardmore engine at 156 r.p.m. for two minutes. Although this unit weighs 84 lb., it is considered to be very light for the work required.

Although it is considered that a satisfactory method of starting an engine by means of explosive cartridges could be evolved, it is probable that the resulting weight, owing to the need for large area pipes and distributing valves, would be excessive.

(To be continued.)

THE FARADAY SOCIETY.

CATALYSIS AND THEORIES OF CHEMICAL ACTION.

THE meeting of the Faraday Society held on September 28th was devoted to the discussion of the above subject. The Society was fortunate in securing the presence of Prof. JEAN PERRIN, of Paris, and Dr. IRVINE LANGMUIR, the distinguished chief research chemist of the General Electric Co. of America, to take prominent parts in the proceedings, which were held in the hall of the Institution of Electrical Engineers, and attended by a large audience.

The subject under discussion naturally divided itself into two sections. The first, which occupied the afternoon session, was concerned with catalysis in homogeneous media—those consisting of one-phase, such as solutions or gases—and it practically amounted to a full-dress debate on the radiation hypothesis of chemical actions, first put forward by Prof. PERLIN, and applied to include catalytic action by Prof. W. C. McLELLAN, who also took a prominent part in the discussions.

When a unimolecular chemical reaction takes place, for example, the conversion of ozone into oxygen, it is generally agreed that the reaction is started by certain active molecules. In the case of a catalytic action, it may be that one or other of the "intermediate" compounds formed (if such are formed) acts as the activating agent. In any case the law of mass action so fruitful in explaining most cases of chemical kinetics is found not to be applicable here, and the question arises, whence comes the energy which "activates" these active molecules, and how is it communicated to the reactant unit? The radiation theory postulates the internal energy of the system, operating through radiation, to be the source of this activating energy, and its operation is explained and rendered quantitative by applying the conceptions of the quantum theory of radiation, which it will be remembered conceives molecular or atomic radiation to be emitted not continuously but intermittently in definite units of energy called quanta. This conception introduces into the law of mass action an exponential expression containing a term E which is energy of activation per gram-molecule characteristic of the reaction, and from which, if known numerically by experiment, the particular active wave length concerned can be calculated. We cannot here pursue this side of the subject in detail; suffice it to say that in their full papers Profs. Perrin and Lewis brought forward many examples where applications of the theory gave satisfactory numerical results. Nevertheless,

in the absence, at present, of crucial experimental evidence, the theory was subjected to some damaging criticism, especially by Dr. LANGMUIR, who regarded the exponential term in the amended law of mass action referred to above, not as testifying to radiation being the *cause* of chemical reactions, but merely as the *consequence* of what both of these have in common—namely, the quantum. The supporters of the theory, on the other hand, emphasised the fact that it is, after all, only an extension of photochemical action, the existence of which none can doubt. Much other more detailed criticism was put forward by Prof. F. A. LINDEMANN, among others, which was only met by *ad hoc* modifications of the original conception, and to a non-chemical outside observer the strong impression remained that while the theory has possibilities yet to be developed, and is likely to be fruitful in suggesting further experimental research, it cannot at present be accepted in any but a very tentative sense.

The evening discussion, opened in brilliant fashion by Dr. LANGMUIR, dealt with heterogeneous reactions and notably with surface catalytic actions which play so important a part in numerous industrial chemical processes. It was pointed out by Prof. W. A. BONE that the conceptions later developed in fuller detail by Dr. Langmuir were put forward by him independently long ago as a result of his well-known researches on surface combustion in its application to the more economical firing of boilers. The essential features of the way in which Dr. Langmuir pictures gas reactions on a surface which acts as catalyst—for example, the combination of hydrogen and oxygen or the oxidation of CO to CO₂ on a platinum surface—are: (1) The existence of very stable adsorbed films on solid surfaces; and (2) the supposition that such films may consist of a *monomolecular layer*. Considerable evidence as to the existence of stable films was marshalled by Dr. Langmuir; principally from the example of the oxygen film on tungsten, but a similar stable oxygen film can also form on carbon, while carbon monoxide, hydrogen, cyanogen, hydrogen sulphide, phosphine, and arsine form films on platinum. Indeed, all substances that have a poisoning effect on catalytic surfaces probably form films of this kind.

These films are imagined to be oriented molecules in chemical combination with the surface—hence their stability. Primary valencies are involved in their formation. Thus, in the case of CO on platinum, the carbon atom is directly attached to the

platinum, the oxygen projecting from the surface above the carbon. The surface of a catalyst may be looked upon as consisting of a kind of chess board in which some of the spaces are vacant, and others filled with atoms or molecules. Some of these are so firmly attached that they evaporate very slowly; others leave the surface from time to time, and the vacant spaces formed are filled by other molecules which strike and condense on the surface. If a film is formed that evaporates very slowly, the surface is no longer available for further condensations—the catalyst has, in fact, been "poisoned." It is clear that in some cases the adsorbed films will be extremely reactive, while in other cases they may be inert to outside influences, for the condensation of the gas molecules involves a rearrangement of their electrons, and the chemical properties may be completely modified. Thus oxygen adsorbed on platinum reacts readily with hydrogen or CO, while oxygen on tungsten or CO on platinum show little tendency to react with gases brought into contact with their surfaces. In many cases, especially where the molecules adsorbed are large (as they are, to quote an analogous example, in the case of lubricating oils) the orientation of the molecules on the surface is a vital factor in determining the activity of the surface towards reacting gases. The "activation" of a catalytic surface is similarly pictured as due to a geometrical rearrangement of the surface of the atoms due to the activating agent.

In a second paper Dr. Langmuir developed at length his theory of the mechanism of catalytic action as applied to the reactions $2\text{CO} + \text{O}_2 = 2\text{CO}_2$ and $2\text{H}_2 + \text{O} = 2\text{H}_2\text{O}$. In the former case the experimental results lead to the view that every oxygen atom which strikes a clean platinum surface condenses in the form of single atoms and combines firmly with separate platinum atoms, and even at 1,500 deg. (absolute) no oxygen evaporates. These adsorbed oxygen atoms are, however, very active and combine readily with every CO molecule striking the surface to form CO₂. On the other hand, CO molecules striking the platinum surface itself are not so firmly held (they evaporate at 500 deg.), and because of their orientation are inert towards oxygen. The second reaction is pictured on similar lines, and altogether the atomic conception put forward is greatly helpful in getting towards an understanding of the for long mysterious phenomena comprised in the word catalysis.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Wear of Bearings Alarm Device.

THE ARMATURE WINDING CO., LTD., of 44a, Bolton Street, Bury, Lancs., has developed a new device for giving warning when a bearing is worn to an undue extent, so that the disastrous consequences of letting it go too far may be avoided. The essence of the device, which is illustrated herewith, is

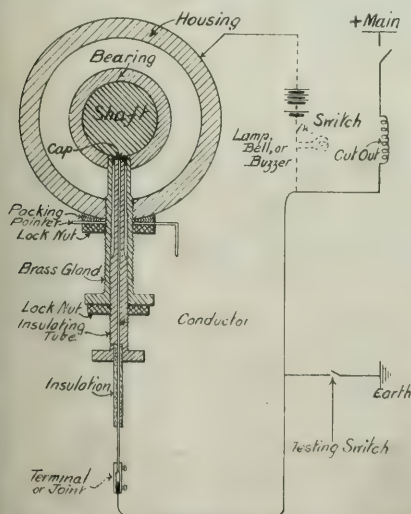


FIG. 1.—SECTION OF WORN-BEARING INDICATOR, IN POSITION.

to insert in the bottom of the housing a wire, of which the end is covered with a thin insulating cap. As the bearing wears down, this cap wears down too, until eventually the wire makes contact with the journal and a local circuit is

closed, lighting a lamp, ringing a bell, or, if desired, actuating an automatic cut-out which stops the machine. The device is very easily installed, being inserted in a hole, drilled and tapped, in the bottom of the bearing housing as shown in fig. 1; where this plan is not feasible, it can equally well be fitted externally, being supported by a bracket under the shaft. The thickness of the insulating cap determines the minimum wear allowed before the alarm is given; any greater allowance can be made by screwing the stem up until the cap touches the shaft, and then withdrawing it to a distance indicated by a pointer over a scale graduated in mils. In any case where a stoppage would entail serious consequences, the device offers a simple safeguard.

The "Universal" Electric Toaster.

A new toaster, recently placed on the market by Messrs. L. G. HAWKINS & Co., 116, Charing Cross Road, W.C.2, possesses the special feature of permitting the bread to be reversed without handling. This is accomplished by so hinging

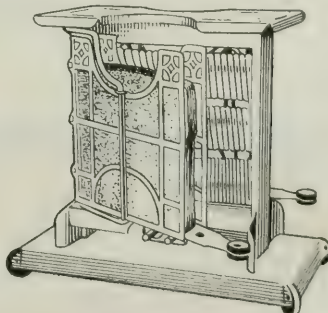
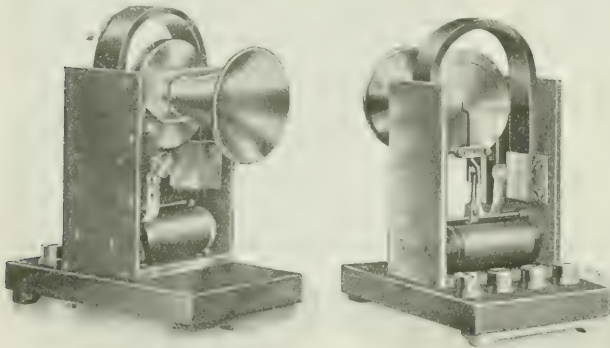


FIG. 2.—THE UNIVERSAL ELECTRIC TOASTER.

the two bread racks that they may be swung round to either side. The loading of the toaster is 340 W, it weighs 8 lb. with packing, and its height is 7 in. The appliance is nickel-plated.

A Direct Working Telegraph Sounder.

The moving part of an ordinary telegraph sounder consists of a lever which carries an iron armature and a milled head adjusting screw. The whole being of considerable weight, and owing to the lever being pivoted near one end, and the armature and milled head screw being fixed at some distance from the pivot, the moment of inertia is very large. In the direct working sounder, however, made by the INDIA-PACIFIC CABLES AND TELEGRAPH WORKS CO., LTD., the fixed part consists of two electromagnets placed side by side, and the movable part is constituted of two soft-iron armatures attached to a spindle pivoted at both ends and carrying in addition a projecting arm. The armatures are polarised by a fixed permanent magnet and play between the poles of the electromagnets, the whole arrangement being, therefore, both mechanically and magnetically, very similar to the well-known Post Office standard relay, the projecting arm corresponding to the tongue of the relay. This arm carries a steel head and constitutes a hammer which plays between the two limbs of a fork, striking first one and then the other under the influence of the line currents in the electromagnets.



FIGS. 3 AND 4.—A DIRECT-WORKING TELEGRAPH SOUNDER.

The fork forms the lower end of a light lever which is pivoted on a knife edge near its centre, the upper end of the lever being attached to the centre of a metallic diaphragm tightly clamped by its edges in a sound box. The blows of the hammer on the fork are thus transmitted to the diaphragm and this produces the sounds. The moving part of the new sounder has only about one-eighth the weight of the corresponding part of the ordinary sounder, and due to this, and to a better disposition of the moving parts around the pivot, the moment of inertia is less than one-fiftieth. In the sounder, as usually supplied, the adjustment is such that the 500+500 ohm instrument will work well at full key speed with about 3 milliamperes and upwards; or, when neutrally adjusted, it will work double current with from 1 to 30 milliamperes and upwards without alteration. Direct working without relays is, therefore, possible over long lines with comparatively small battery power. It also acts well with short discharges and is consequently suitable for working with condensers or induction coils.

An Electric Glossing Iron.

Attempts to produce a glossing iron for finishing off boots and other leather goods have usually resulted in an appliance much too heavy for use for any length of time. A glossing iron, the first recently put on the market by ELECTRO-HEAT,



FIG. 5.—THE ELECTRIC GLOSSING IRON.

LTD., King Street, Norwich, weighs only 1 lb. The sole plate is suitably curved, and has a bright polish so that there is no possibility of scratching the leather. A heat-insulating device is inserted between the sole and the handle, keeping the latter cool. The iron has a 40-W element.

Norwegian Electro-Chemical Industry.—The workmen in the industry have accepted the terms of a proposed new wages agreement, under which a slight reduction would have been made.

ELECTRICAL NOTES FROM INDIA.

(BY OUR SPECIAL CORRESPONDENT.)

The Prince's Visit.—H.R.H. the Prince of Wales arrived in Bombay Harbour this morning (November 17th) on board H.M.S. *Renown*, and the city is *en fete* in consequence. The streets forming the processional route have been gaily decorated, and most of the larger buildings and Government offices, &c., have been illuminated externally.

The contours of towers, minarets, domes and cupolas have been strung with small power lamps, the total temporary lighting reaching the respectable figure of about 2,000 kW.

Extraordinary precautions have been taken to safeguard the continuity of supply, because fears have arisen that the followers of the notorious Gandhi might make some attempt to shut down the Kussara power station of the Bombay Electric Supply and Tramways Co., upon which the whole of Bombay's lighting depends.

Gandhi and his ill-advised followers have made an abortive attempt to boycott the Prince's visit, and shortly after the procession had passed to Government House this morning some rioting took place, and an effort was made to burn four or five tramcars. The troops fired on the rioters, and shortly afterwards tramway service was almost completely suspended.

Although the charge engineers at Kussara power station are Europeans, with one exception, all the operating staff are either Eurasian, Goan, or native; and it is difficult to say who may, or may not, be a Gandhi-ite, although these misguided individuals generally wear a distinctive cap. But consider the gorgeous simplicity of stopping a circulating pump or tripping a generating switch, or some other equally simple operation, and the anxiety of the supply authorities is easily understood.

A detachment of Royal Artillery has been posted at the power station, together with some armed police, and the Naval authorities have arranged to send stokers to operate the boiler house should necessity arise.

Two rehearsals of the illuminations took place at midnight on the 14th and 15th, and all passed off fairly satisfactorily.

There is no more loyal body of men than European electrical engineers in Bombay; but owing to the machinations of Gandhi, who yields a most extraordinary power over the uneducated coolie class in India, the supply engineers will heave a sigh of relief when the Prince leaves on the 22nd inst. A "shut down" while H.R.H. is here would just about put the tin lid on everything, and cause the non-co-operators to howl with glee.

Later on a motor-car belonging to a tramway official was burnt, and many cars were damaged by stones, and the windows broken, &c.

Three native policemen were hammered to death and some eight or ten rioters were killed.

Writing on the following day, our correspondent stated that the full car service was again in operation, and peace apparently reigned once more.

Bombay, November 25th, 1921.

The unfortunate happenings among the lower class followers of Mr. Gandhi, the political leader, which terminated in bloodshed, and open faction fights between Mohammedans and Hindus, on one side, and Parsees, Eurasians, Anglo-Indians and Europeans on the other, somewhat marred the visit of the Prince of Wales, but they did not in any way interfere with the brilliant display of electric lighting, temporarily installed, on the exteriors of buildings. The connections made totalled something like 2,000 kW, and this extra load was met by the Bombay Electric Supply and Tramways Co., without a hitch of any sort. The *Times of India* describes the illuminations of the public buildings as a wonderful sight, whether viewed from the Bandstand, Wellington Fountain, Malabar Hill, or the broad open space in front of Victoria Terminus. It says that with the help of extensive illuminations on many business premises the general effect was such as has hardly been equalled in the history of the world.

The Government of Bengal has under consideration the question of adopting measures for proceeding with the hydro-electric survey of Bengal, in order to investigate and determine suitable sites for generating electric power. The question was discussed at the Conference of Members and Directors of Industries at Simla, and it was pointed out by the Chief Engineer, Hydro-electric Survey of India, that the responsibility for the survey rests with the Public Works Department, and that the Department of Industries is very closely connected with the question, as the possibilities of development of new industries, especially those for which electric power in large quantities is essential, depend greatly on the existence of cheap electric power.

To meet this interest, the Industrial Commission suggested the appointment of a joint committee, comprised of members

of the Public Works Department and the Department of Industries, to consider what measures should be taken to conduct and control the work of the hydro-electric survey in Bengal.

The Director of Industries suggested that the survey should be confined to the Hill Tippera area, round Comilla and Chattagong in the first instance.

The Government of Bengal has, after consideration, accepted the suggestion of the Industrial Commission; and the Governor in Council has been pleased to appoint a joint committee, consisting of the following members, to consider and submit a report on the matter:—

President: The Chief Engineer, Irrigation Department, Government of Bengal. Members: The Director of Industries, Bengal; the Electrical Adviser to the Government of India (Mr. J. W. Meares, M.I.E.E.), and the Electrical Inspector. Secretary: Under-Secretary to the Government of Bengal, Irrigation Department.

REVIEWS.

Electric Welding. By ETHAN VIALI. Pp. xii+417; 329 figs. London: McGraw Hill Book Co., Inc. Price 22s. net.

Mr. Viall is the editor of the *American Machinist*, and the author of a number of books on special engineering subjects. This volume shows the competent practical hand with access to ample sources of information which one naturally expects from such authorship.

It deals with electric welding processes generally, giving a sufficient and concise historical sketch of the origin and development of the processes, including some which have found no practical application, but are of interest as steps. Full credit is given to the pioneers of arc welding, all Europeans, and whilst to Elihu Thomson is quite rightly ascribed the invention of resistance welding, the interesting fact is recorded that Benardos patented spot welding in 1888, the essential difference between his apparatus and that in present-day use being that he used carbon electrode points instead of the copper electrodes which have made the process a practical one.

Much of the book is occupied with descriptions of equipments, tools, and appliances of American manufacture, doubtless based on information furnished by the makers, but inspired by a critical discrimination which makes them useful as guides for those who have to supply themselves in the United States. They have less interest for European purchasers. Some very useful hints about such auxiliary apparatus as electrode holders, shades, and so forth can, however, be gleaned from some of the descriptions.

With respect to arc welding, the carbon arc gets less than its due for some kinds of work; the covered metallic electrode shares a similar fate; and continuous current is advocated for metallic arc welding in preference to alternating. These features reflect American practice in arc welding, though from the number of alternating current equipments described many designers must have been at work, and there must be a considerable use of alternating current. The impression given is that on this side of the Atlantic there have been greater developments in the use of the carbon arc, the covered electrode, and alternating current arc welding, than on the other side.

There are two useful chapters on the training of arc welders and arc welding procedure, suggesting training exercises, and illustrated with some really informative figures. Suggestions for the design of welded joints are illustrated by many examples showing how the stresses in the work will be best resisted. This is a matter of great importance. It is the key to the successful extension of arc welding to structural work, of which only the beginning has yet been seen. It cannot be neglected with impunity in repair work, where it is more dependent on the mechanical sense and ingenuity of the operator than of a man at the drawing board. The author quite rightly insists on the necessity of training these qualities in would-be welders.

The illustrations in these chapters and that dealing with examples of actual work are of high educational value.

Chapters on the physical properties and metallography of "arc fused steel" so far as they are statements of fact, contain a large amount of information profusely illustrated. Some of the conclusions set out have a greater tone of finality than is warranted at present. It will not be accepted by all investigators that the metal of any arc weld is "essentially a casting." At least, it can be objected that the physical and metallographic characteristics of many welds are radically different from those of castings of the same composition. These characteristics are also susceptible of a greater amount of control than the author is disposed to admit. Nor will it be agreed on all hands that these "castings" are generally (or universally, as the author almost suggests) unsound from the presence of flaws of various kinds. Again, it is laid down that weld metal always, or nearly always, shows a considerable inclusion of nitride needles, and a notable quantity of nitrogen, with its well-known detrimental effects on the properties of the metal. It is stated that flux coating of the electrodes produces no material improvement in these characteristics of weld metal. This will certainly not be accepted on this side

of the Atlantic. It may be suggested that these unacceptable statements are closely connected with the comparative neglect in the United States of work on electrode and flux composition with reference to the stock metal and the qualities of the weld.

Automatic arc welding is a branch of the art in which the Americans have it all their own way at present. The chapter describing some machines and work done by them, therefore, has the interest of novelty, though a few have been imported hither for exhibition. There are possibilities in this direction, appealing principally to the manufacturers of certain articles. Generally these machines may be described as machine tools by which metal is deposited on the work from an electrode instead of being cut off the work by a cutting tool. For welding joints or building up on cylindrical and circular articles, they should be very useful. If required, it seems easy to design automatic welders of other forms, i.e., the analogues of planing machines, &c., as those described may be called the analogues of lathes. It is found possible to regulate the arc length and voltage to lower and more steady values than can be secured in hand welding, a circumstance favourable to sound welds and small waste of electrode. Whilst the chief field for these machines seems to be in repetition manufacture, it is possible that they will be found economical for building up worn shafts, tires, and so forth, where the quantities dealt with are considerable. If they can be adapted to use covered electrodes their value for such purposes will be greater.

The chapters dealing with resistance welding are almost entirely descriptive of the machines of various American makers. Most of these are special purpose machines, which is, of course, true of resistance welders in general. The illustrations of these machines are very good indeed.

There is good information about the energy consumption and the time element involved in welding various sections, the actual speed of operation, and on the strength of resistance welds.

It is hardly necessary to say that a book published by the McGraw Hill Co. is well printed, on good paper, comfortable to read and handle. It can be recommended as a book of reference, and those to whom it appeals will likely have their own views on matters controversial.—H. M. S.

Electricity in Steel Works. By W. McFARLANE, B.Sc. London. Pp. x+109; 21 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

High-tension Switchboards. By H. E. POOLE, B.Sc., A.C.G.I., A.M.I.E.E. Pp. ix+114; 22 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

The first of these publications, both of which are included in Pitman's Series of Technical Primers, is of the nature of a review of current electrical practice in steel works, and fulfils quite a useful function owing to the rapid progress that has been made in the electrification of such works during the last decade. The first chapter deals in a very interesting manner with the general question of electricity supply in steel works, particular attention being paid to the question of the proper utilisation of the surplus heat generated in certain processes, and is followed by others dealing in some detail with main and auxiliary motors and their control. Lifting magnets and lighting problems are also discussed.

Little fault can be found with the book apart from one or two instances of rather vague wording in connection with explanations of electrical working, which have doubtless been caused by the necessity of economising space. We notice that the possibilities of the eddy-current controller for three-phase slip-ring induction motors are mentioned, and it would have been interesting if some definite information had been given concerning the starting torque obtainable with this arrangement.

The work will be very useful to students and others desiring to obtain an insight into the possibilities of the applications of electricity for the purpose under notice.

The second book, which may be looked upon as a companion and supplementary volume to that on high-pressure switchgear in the same series and by the same author, is mainly occupied with an account of the general arrangements of types of boards suitable for central stations, factory, and mining purposes. The mechanical arrangements of boards are well, though briefly, described, but lack of space has prevented a full discussion of some technical points of interest at the present time. Thus we find that arrester gear is dealt with in a very brief manner, and the uses of reactance coils are discussed in a few lines.

One or two details call for modification when a further edition appears; thus we find the Board of Trade referred to (for example, in connection with a reference to mining gear) when the Home Office would be more appropriate, and an instrument for the measurement of energy, while usually referred to as an integrating wattmeter, is, in one place, termed an integrating watt-hour meter.

A short chapter at the end deals with common conventions used in connection arrangements for switchboards, and in making switchboard diagrams; these seem to be founded on the recommendations of the B.E.A.M.A., but the fact is not mentioned.

The book should be useful to those desiring to obtain a general idea of the types of high-pressure boards commonly used at the present time.

(NOT YET PUBLISHED.)

32,067 " High-frequency transformers " W. Döring, November 30th.
32,068 " Electric condensers " W. Döring, November 30th.
32,094 " Electric irons, ovens, hot-plates, &c." J. J. J. M. Khuijtmans and
L. Kappa Syndicate, Ltd. November 30th.
32,101 " Electric power-transmission mechanism." W. L. Baynham, No-
vember 30th.

1920.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 31,394. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.), November 23rd.

31,395. "Electro-static telephones." J. Engl. J. Massole, and H. Vogt. November 23rd.

31,407. "Electric accumulators." A. Neumann and O. Neumann. November 23rd. (Germany, August 17th.)

31,432. "Motor for utilising electromagnetic energy of the earth." W. E. Bland. November 24th.

31,437. "Electrically-driven gear for conversion of hand-operated knitting machines to power-driven." J. H. Borland. November 24th.

31,461. "Steam wagon electric lighting set." H. C. H. Bull. November 24th.

31,500. "Selecting devices for automatic, &c., telephone systems and circuits therefor." H. E. Humphries and Siemens Bros. & Co., Ltd. November 24th.

31,502. "Electric alternators." F. Contell. November 24th.

31,509. "Method of applying magnetic material to electrical conductors." Western Electric Co., Ltd. November 24th. (United States, December 8th, 1920.)

31,510. "Electromagnetic relay." Western Electric Co., Ltd. (Western Electric Co., Inc.) November 24th.

31,511. "Signalling systems." Western Electric Co., Ltd. (Western Electric Co., Inc.) November 24th.

31,517. "Electric lamps." K. Krauser. November 24th. (Germany, December 2nd, 1920.)

31,528. "High-frequency telephony." Ges. fur Drahtlose Telegraphie. November 24th. (Germany, February 5th.)

31,537. "Wireless direction-finding apparatus." Ges. fur Drahtlose Telegraphie. November 24th. (Germany, December 14th, 1920.)

31,538. "Thermionic generators." Ges. fur Drahtlose Telegraphie. November 24th. (Germany, January 11th.)

31,539. "Circuits for electrical oscillations." Ges. fur Drahtlose Telegraphie. November 24th. (Germany, November 25th, 1920.)

31,542. "Electric welding." A. E. McCarthy, H. Martin, and L. J. Steele. November 24th.

31,545. "Electric telegraphs." A. L. Davis. November 24th.

31,568. "Ignition apparatus." R. Bosch Akt.-Ges. November 25th. (Germany, November 25th, 1920.)

31,569. "Electric wall plugs, &c." W. H. T. Nant. November 25th.

31,595. "Electric switches." G. H. Ide and F. Painter. November 25th.

31,597. "Electric switches." W. Sparks and W. H. Tonks. November 25th.

31,604. "Electric switch locator." W. Helmore. November 25th.

31,607. "Thief-proof combination switch for motor-cars." I. H. B. Gayner. November 25th.

31,622. "Process for producing electrically-insulating and mechanically-adherent coated metal articles." F. Krupp Akt.-Ges. November 25th. (Germany, December 13th, 1920.)

31,630. "Apparatus for reproduction of sound waves." R. Mylo. November 25th. (Germany, December 2nd, 1920.)

31,642. "Electric fuses." W. M. Harrington, W. E. Bottom, and M. H. Goldberg. November 25th.

31,646. "Battery case carrier for road vehicles." A. H. Hunt. November 25th.

31,658. "Switching devices for overhead runways." W. S. Douglas. November 25th.

31,664. "Anti-vibration device for electric lamps." S. C. Simpson. November 26th.

31,665. "Telemotor apparatus." T. C. Fortesque and W. J. Paulin. November 26th.

31,730. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.), November 26th.

31,754. "Electric fuses or cut-outs." V. Hope. November 26th.

31,757. "Nonlead electric switches." V. Hope. November 26th.

31,758. "Ironless electric switches." V. Hope. November 26th.

31,772. "Electric switch boxes, distribution boxes, &c." L. J. Lepine. November 26th.

31,793. "Wooden poles for carrying overhead electric wires." Crompton and Co., Ltd. and J. N. A. Houlton. November 26th.

31,816. "Telephony." T. B. Dixon. November 26th.

31,824. "Telephone sub-station metering and/or tolling." E. Noble. November 26th.

31,831. "Condensers." Metropolitan-Vickers Electrical Co., Ltd. November 26th. (United States, December 3rd, 1920.)

31,834. "Electrical measuring-instruments." Metropolitan-Vickers Electrical Co., Ltd. November 26th. (United States, December 7th, 1920.)

31,841. "Electric welding of cast iron." Scuderie Autogene Francaise. November 26th. (France, December 24th, 1920.)

31,843. "Windings for armatures of dynamo-electric machines, &c." W. P. Sayers. November 26th.

31,851. "Ignition devices for explosion engines." S. Maroger. November 26th. (France, July 1st, 1920.)

31,873. "Power integrating and limiting systems." Forges et Ateliers de Constructions Electriques de Jeumont. November 29th. (France, December 3rd, 1920.)

31,879. "Switches." R. Bosch Akt.-Ges. November 29th. (Germany, November 29th, 1920.)

31,876. "Spark-plugs, &c." J. A. Horton. November 29th.

31,879. "Electric lighting systems." R. A. Macaulay. November 29th.

31,884. "Electric pipe, cigar, &c., lighter." R. M. Linfont. November 29th.

31,892. "Brake mechanism for tramway, &c., vehicles." C. H. Spencer. November 29th.

31,904. "Electric fuses." J. H. Williams. November 29th.

31,927. "Galvanic batteries." Fuller's United Electric Works, Ltd., and A. P. Welch. November 29th.

31,936. "Overload switches for protection of motors." F. Krupp Akt.-Ges. November 29th. (Germany, December 30th, 1920.)

31,938. "Electric motor for gramophones, &c." W. White. November 29th.

31,948. "Radio receiving systems, &c." L. E. Owen. November 29th.

31,950. "Multi-wire safety fuse." K. V. L. Jensen and Jensen Trading Company. November 29th.

31,960. "Mercury, &c., vapour electric lamps." F. A. King, F. Reynolds, and Silica Syndicate, Ltd. November 29th.

31,970. "Electric-motor controllers." British Thomson-Houston Co., Ltd. November 29th.

31,992. "Cooling electrical apparatus." F. A. Verbury. November 29th.

31,997. "Means for electromagnetically locking, &c., railway, &c., carriage doors." W. Duckenfield, H. Frolich, A. T. W. Jubb, and G. Ross. November 29th.

32,019. "Reducing capacity current losses in electric cables." A. M. X-ray centring-device." A. J. Walton. November 30th.

32,058. "Apparatus for electro-therapeutic use." W. G. Moore. November 30th.

32,100. "Electric fuses." J. H. Williams. November 30th.

32,129. "Spark-plugs for internal combustion engines." Sphinx Manufacturing Co., Ltd. and V. A. Jones. November 30th. (United States, December 1st, 1920.)

32,142. "Electric valves." M. J. Ford. March 1st, 1920. (100,465.)

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LONDON'S ELECTRICITY SUPPLY.

The publication of the decision of the Electricity Commissioners with regard to electricity supply in the London and Home Counties District cannot be regarded as other than an important event. The details are recorded elsewhere in this issue.

In commenting on the subject, our thoughts travel back to the equally epoch making decision of the Board of Trade, following the inquiry held by Major Marindin in 1889, which presents a startling contrast with the trend of policy to-day. In those early days, when the great future of electricity as a factor in the life of the community was hardly guessed at, the Government was keenly on the alert to checkmate the supposed rapacity of private undertakers, and to foster municipal trading; consequently the Board of Trade set its face rigidly against co-operation, and decreed that as far as possible a.c. and d.c. supply should be provided in every street where mains were laid, with a view to ensuring that competition should operate to bring down prices and prevent the companies from making large profits.

No more wasteful or inefficient course could have been conceived; more than anything else, this policy operated to perpetuate a multiplicity of systems of supply and to increase the difficulty of unification, whilst it also hampered the companies and seriously delayed the development of electricity supply in this country.

Now, at last, common-sense views prevail, and it is recognised that co-operation, unification, concentration, and freedom from competition are essential to the free and generous expansion of the electrical service. We can never hope to share in the advantages of a unified supply such as that of Chicago, but the policy of the authorities is set in the right direction, and in the distant future our descendants may enjoy those benefits.

The Commissioners have decided to set up a Joint Electricity Authority for the District, on which all interested parties will be represented (not, as stated in the *Daily Mail*, local authorities only—a serious mistake), and have approved of the technical proposals for dealing with the requirements up to about 1926; but with regard to the second stage, up to 1930, they prefer to install the additional plant, estimated at 199,000 kW, in a new capital station or stations on the riverside, which they believe would make for economy of capital outlay and running costs, representing an annual saving of more than £1,000,000. As immediate steps must be taken to commence work on the first new station, the Commissioners propose to authorise the County of London Electric Supply Co., Ltd., to proceed with its erection on the Barking site. They also favour the proposal to extend the tenure of the distributing powers held by the supply companies, coupled with a sliding scale of price and dividend. The rights of the Metropolitan and the North Metropolitan Electric Supply Companies will be respected, and they will be authorised to carry out the work of the Joint Authority in their respective areas.

On the whole, we think that the course adopted by the Commissioners represents a very satisfactory provisional solution of the difficult and complicated problem which confronts them, and tends to make the best use of the existing plant, whilst paving the way to the ultimate goal upon which the Government turned its back 30 years ago; but it must be regarded as only provisional, for the Commissioners have no compulsory powers, and the scheme is not only unworkable without further statutory powers, but is dependent upon acceptance by the various electricity supply undertakers con-

cerned. Unfortunately, in at least one quarter, that acceptance has already been definitely withheld. Writing to *The Times* on December 15th, Mr. W. F. Fladgate, chairman of the London Electricity Joint Committee, 1920, Ltd., on which nine companies are represented, stated that his board could not accept the plan outlined by the Commissioners. The companies, he said, had laid down the condition at the inquiry, as necessary for their taking part in a Joint Electricity Authority, "that the whole of the financial control of the Authority's work should be in the hands of those members of that body who provided the necessary capital." The Commissioners' scheme not only ignored this stipulation, but would commit the Authority to heavy capital expenditure, and Mr. Fladgate's Committee declined to undertake financial responsibility under such conditions. Negotiations were still in progress with the London County Council with a view to arriving at an amicable arrangement on the question of purchase, and the Committee had even prepared a Bill to facilitate the joint action of all the undertakers within the district; but that measure would now be withdrawn.

It is exceedingly regrettable that so serious a hitch should have arisen. The refusal of the companies to provide capital for other people to spend is readily understood; but any measure of co-operation necessarily involves the sacrifice of some portion of one's independence of action and freedom from control, and the companies were not asked to come in without compensation in the shape of extension of tenure. We cannot pass judgment upon their attitude in the absence of details, and we will not suggest that it is partly due to pique at the evident success of the County of London Company—we believe that the companies are as anxious as anyone to arrive at a satisfactory solution of the question, and we hope that as the result of their protest they will obtain from the Commissioners such assurances as will enable them to carry on. It should be observed that the Commissioners intend to invite the comments of all parties represented at the inquiry on the clauses of the Draft Order, and it may prove to be a matter for regret that the Joint Committee has embarrassed them by rushing into print.

ELECTRICITY IN MINES.

THE coal industry—like most other industries—is in a bad way, due mainly to the ignorance of our Trade-Union leaders of economic law, and to the practice of false doctrines by trade unionists in general. The total earnings of any industry are limited to the output, multiplied by the price obtainable for the products, and these earnings are divided between Capital and Labour, the latter *always* obtaining the larger share. Now, suppose Labour makes demands, which will not only absorb all the share due to Capital, but will, moreover, increase the price to such an extent that customers cannot afford to buy, there is an end to the industry; and this is what has nearly happened to our coal industry.

What has enabled wages to be increased and hours of labour to be reduced is the enormous introduction of labour-saving machinery due to the inventive capacity of the engineering profession and the genius of organisation of our great managers of industry. All that trade unionism has ever done is that it, to some extent by its demands, has stimulated the latter to find means to meet the wherewithal to satisfy those demands, and the credit is due mainly to the brains of the engineers, inventors, and managers, who have made use of capital to seek good advantage that the worker has benefited. In the coal-mining industry in particular the worst evil of trade unionism at the present time is the terrible demoralisation of its members; the insistence on a *minimum wage* is actually a curse to the individual who believes in and accepts it. The incidence of the minimum wage, and the reduction of hours from eight to seven per diem, have so raised the cost that the industry has almost come to a standstill.

All the strikes in the world cannot obtain for the worker one penny more, if that penny cannot be obtained in the operation of the industry. And now the only hope for the coal industry lies not with the Miners' Federation of Great Britain, but with the managers and engineers engaged in the direction and operation of the collieries, and we have no hesitation in saying that the restoration of the industry to renewed prosperity will be due mainly to the greatly extended use of electricity in reducing operation costs. In fact, were it not for the electrical machinery already in use in our mines, there would be fewer collieries working to-day, and very many more miners would be out of employment. From the General Report of H.M. Chief Inspector of Mines (p. 847) we see that the increase in the use of electricity steadily goes on, but whereas the increase in 1919 amounted to 6.58 per cent., in 1920 it was only 5.04 per cent. Probably for the present year it will be even less, due to the very unfortunate strike with its disastrous results. In 1910 there were approximately 2,000 coal-cutting machines at work (all types), in 1920 there were more than 5,000. In 1910 about 5½ per cent. of the total coal output was obtained by means of machinery; in 1920 this had increased to nearly 13 per cent. In 1919 the total electrical horse-power in use in mines was 1,028,927, being an increase of 6.58 per cent. on the previous year; in 1920 this had further increased to 1,080,822 h.p., or an increase—as previously mentioned—of 5.4 per cent., and the great proportion was in underground machinery. Again, to prove the advantage of the electrically-driven machines, it is important to notice that whereas in 1920 less than 5 per cent. of the coal output was obtained by compressed-air driven machines, over 9½ per cent. was obtained by electrically-driven machines. Electricity enters into practically every operation of colliery working—winding, ventilation, coal cutting, haulage, pumping (the latter to the extent of nearly one quarter of the total), lighting, and shot-firing. The use of electric safety lamps increased from 197,722 in 1919 to 245,000 in 1920, and no fewer than 28,387,259 shots were fired electrically, by means of a portable shot-firing battery or magneto. All this undoubtedly proves the enormous influence of the use of electricity in enabling the mines to be worked, and coal to be sold at a price that people can afford to pay, and the miner to be kept employed.

The Gasfilled British patent for the gasfilled lamp is sound or not has been settled by the final court of reference—the House of Lords; the verdict of two lower Courts has been reversed, and the validity of the patent has been affirmed.

The question being no longer *sub judice*, comment is permissible, and we feel bound to say that in our opinion, if ever there was a case in which inventive ability and perspicacity in research were displayed in their highest development, the invention of the gasfilled lamp by Dr. Langmuir was that case. The researches which led up to it have been described in our pages; they were of the type known as "industrial research"—i.e., research with a definite commercial purpose—as distinguished from "scientific research," which is taken to mean research prosecuted for its own sake alone, to add to the sum of knowledge, without an immediate commercial objective.

While the upholding of the patent is of immense importance to its owners, we think that no one will grudge them their due reward for a most remarkable and successful achievement; through the operation of the lamp-makers' agreement, we take it that British lamp-makers will have the use of the patent on reasonable terms. But we hope the moral of the affair will not be lost upon British manufacturers of every description—namely, that unless they carry out researches themselves, they will be dependent upon discoveries made abroad; and the nation that lags behind in the industrial race neither commands nor deserves prosperity.

ELECTRICITY SUPPLY AT CHESTER.

BULK SUPPLY FROM QUEEN'S FERRY.

THERE is one bright spot in that huge collection of now derelict buildings known as H.M. Factory, Queen's Ferry, formerly an important T.N.T. producing centre—and that is the power house, which, since December 9th, has been fulfilling a peace-time service for the ancient City of Chester. For several years the generating plant at the hydro-electric works and at the New Crane Street station of the Chester Corporation has been over-

supply to the neighbouring areas and for use on rotary converters running in parallel with the existing steam and water stations on the d.c. side.

A 440-volt bulk supply and metering panel was installed at the Queen's Ferry power station for the control of the 2,200 kVA step-up transformer. This panel is a standard black-enamelled slate panel equipped with a 3,000 amp. 1 p. automatic oil circuit breaker and with

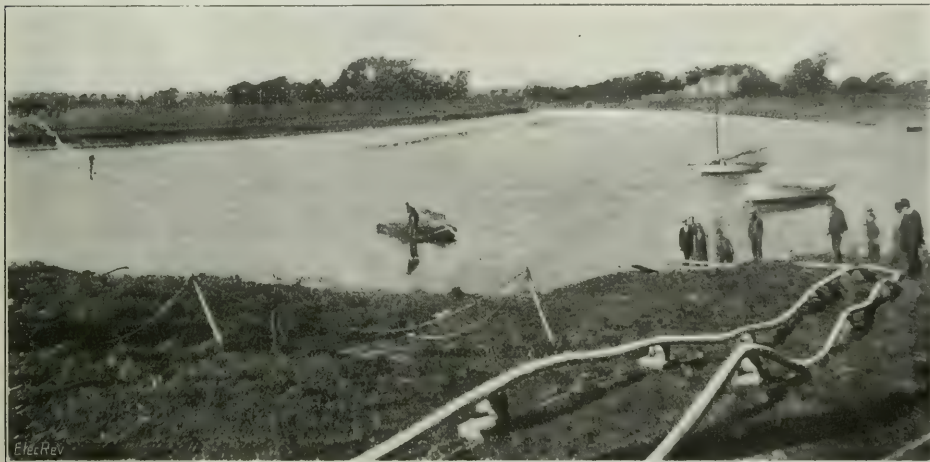


FIG. 1.—DUPLICATE 33,000-V CABLES CROSSING THE RIVER DEE.

loaded, and owing to the difficulty of obtaining plant at the required time, the Electricity (Supply) Act of 1919, and the formation of the Chester and North Wales Electricity District, it became necessary to discover new sources of supply. In August, 1919, negotiations were inaugurated for the acquisition of electricity supplies from H.M. Factory, Queen's Ferry, and Friday fortnight saw the consummation of those efforts.

The present scheme involved the following desiderata: increasing the available supply without, in view of prospective developments in the North Wales district, involving too great an expense in plant. The expenditure was £52,000. The existing steam-driven station at New Crane Street and the hydro-electric station on the River Dee are both d.c. stations. Consequently, it was desired to retain the local d.c. distribution scheme, but yet have the facilities which h.p. alternating current gives for transmission purposes in view of applications being received from outlying districts for a supply of power.

Although the distance between Queen's Ferry and Chester is only six or seven miles, it was decided to transmit the power at a pressure of 33,000 volts, the idea being that this short-length transmission line would be finally merged into the network of the North Wales and Chester Electricity District as delimited by the Electricity Commissioners. At Chester the line voltage is transformed down to 6,600 volts for power

indicating and integrating meters; the integrating watt-meter is fitted with a Merz maximum-demand indicator, with a 15-minutes' resetting period. The design of the panel is similar to that of the panels of the existing Queen's Ferry switchboard, fig. 8, thus giving a uniform appearance to the station, but the panel is mounted as



FIGS. 2 & 3.—TERMINAL POLES AND BUMPER LANE SUBSTATION

a separate unit, and not as an extension to this switchboard.

The transformers at Queen's Ferry and Bumpers Lane are 2,200-kVA, 3-phase, units, star-connected on the

33,000-volt side and delta connected to the 440 and 6,600-volt circuits. They are designed for indoor mounting, and are fitted with rollers for convenience when moving them about: the core-type method of construction has been adopted, with cruciform section cores and circular coils. This method of construction lends itself to a very robust design, and simplifies the insulation problem of the h.p. windings. Special provision is made in the coil supports for automatically taking up any shrinkage of the insulation due to pressure of the windings and the influence of the hot oil; the device, whilst taking up the shrinkage of the insulation, avoids the possibility of vibration or movement of the coils being caused by sudden loads on the system. The insu-

going feeders was already giving a bulk supply to Saltney at 6,600 volts previous to the installation of the present plant. This was obtained by means of a 250-kW

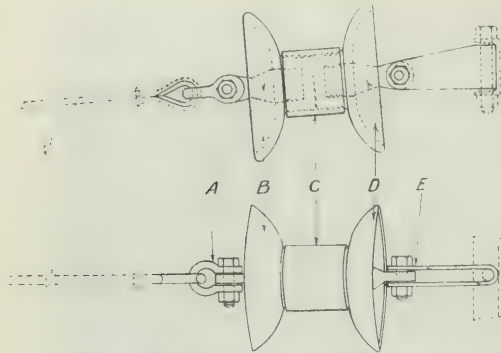


FIG. 4.—KALANITE 33,000-V END-STRAIN INSULATOR.

lation of the end turns of the 33,000-volt windings has been reinforced to withstand voltage stresses which may be caused by atmospheric disturbances or switching conditions, and the unit is contained in a boiler-plate tank fitted with external circulating and cooling pipes.

Isolating links are provided at both ends for discon-

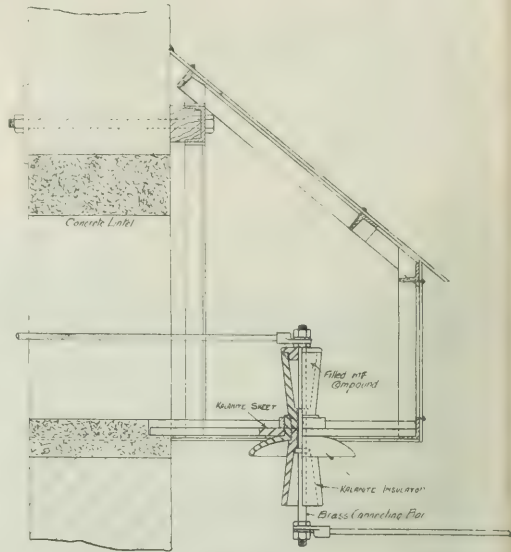


FIG. 5.—LEADING-IN 33,000-V KALANITE INSULATOR.



necting either overhead line or any of the cables; the sub-station was erected specially for this scheme, and allows for the accommodation of an additional transformer at a later date when it is found necessary to increase the demand on Queen's Ferry.

The main 6,600-volt distribution board at the New Crane Street generating station is equipped with oil circuit breakers, isolating switches, and instruments for controlling one incoming and three outgoing circuits. On account of the limited space available in the station, the board was so constructed that it could be placed directly against the station wall and access obtained to the interior of the cubicles from the front. Two of the circuits are outgoing feeders to the neighbouring districts, whilst the remaining feeder supplies a rotary converter in the station itself. One of the out-

going feeders was already giving a bulk supply to Saltney at 6,600 volts previous to the installation of the present plant. This was obtained by means of a 250-kW rotary converter, which was run inverted from the d.c. busbars. This machine will now be connected up to the 6,600-volt bars, and used for light load or emergency services when necessary. The second outgoing feeder gives a bulk supply to Messrs. Brook, Hirst & Co., Ltd., and the Hydraulic Engineering Co., Ltd. At each sub-station a 500-kW rotary converter is installed to convert the supply from 3-phase, 6,600 volts to one of 140/480 volts d.c. on a 3-wire system, and the machines are arranged to run in parallel with the existing d.c. supply at these works. The incoming supply is controlled by a self-supporting sheet-steel cubicle equipped with the necessary oil circuit breakers and indicating instruments. At both the power and sub-stations a

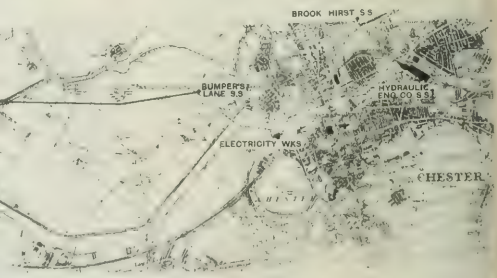


FIG. 6.—ROUTE MAP OF TRANSMISSION LINE.

separate panel controls the d.c. supply from the machines to the existing busbars.

The rotary converter cubicle at the power station controls a 1,000-kW, 6-phase rotary converter, also supplying a 440/480-volt, d.c., 3-wire system. This machine supplements the existing steam sets, and all the rotary converters are standard 6-phase, shunt-wound machines very similar to each other, and all arranged to start by the self-synchronising method. The voltage variation required on the d.c. side is obtained by means of field regulation; each machine is fitted with an overhung,

squirrel-cage starting motor, controlled by a special starting panel mounted between the 3, 6-phase transformer and the converter. Even wear on the commutator and slip-rings is obtained by a mechanical oscillating device fitted on the end of the converter shaft, and in order to prevent the possibility of the machine racing from any cause, a speed-limiting device is provided.

The transformers for stepping-down the 3-phase, 6,600-volt supply to the 6-phase voltage necessary for converter work are specially designed for use with such machines. When the d.c. voltage variation is obtained by means of field regulation, the transformer must be provided with sufficient internal reactance to meet the

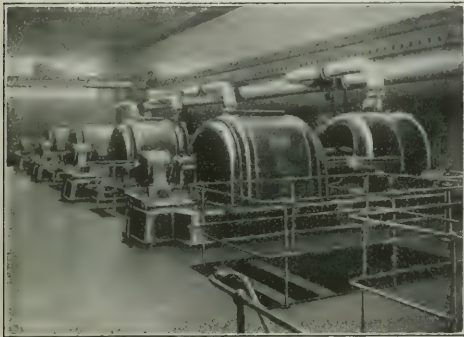


FIG. 7.—TURBO-GENERATORS AT QUEEN'S FERRY.

range of voltage required. This reactance is obtained by means of magnetic shunts placed in the transformer leakage field between the primary and secondary winding, and it is claimed that the multiple-gap construction patented by the Metropolitan-Vickers Electrical Co., Ltd., gives a straight-line characteristic, *i.e.*, the reactance voltage of the transformer increases proportionately with the load. It has given very satisfactory results in service, and does not interfere with the commutation of the converter; the method of fitting these shunts in the transformer permits of a sturdy design of transformer with improved efficiency. The transformers are oil-immersed, self-cooled, and mounted in tanks fitted with external circulating and cooling tubes. The neutral wire of the d.c. system is brought out from the mid-point of one of the l.p. transformer windings, so that the out-of-balance current is taken to a point, the voltage of which is practically fixed with reference to the positive and negative busbars. In order to maintain a good balance of pressures and correct commutating conditions, one half of the commutator-pole windings are connected in the positive lead and the other half in the negative lead. This method of balancing gives very satisfactory results, and the converter and transformer unit is capable of dealing satisfactorily with an out-of-balance current equal to approximately 25 per cent. of the full-load current.

The new station equipment for the Queen's Ferry and Chester ends, as described above, was supplied by the Metropolitan-Vickers Electrical Co., Ltd., to the requirements of Mr. S. E. Britton, the City Electrical Engineer to the Borough of Chester.

The e.h.p. cable and overhead transmission system was the work of Callender's Cable & Construction Co., Ltd., the cable portions having two working pressures. Duplicate (each 410 yd. long) 33,000-volt cables were laid underground from Queen's Ferry to the river bank, from which point the supply at the same pressure is carried by duplicate cables (each 200 yd. long) under water across the bed of the River Dee and up its opposite bank to the first terminal pole of the transmission line. This cable is 3-core, each conductor being 0.1 sq. in. in sectional area, and is paper-insulated, lead-sheathed, heavily taped and compounded, single-wire

armoured, and finally heavily taped and compounded over all. The conductors are circular in shape, and the cable was manufactured to work with the centre point unearthed. Where the cable is laid in the ground, the diameter of the armouring wire is 0.128 in., but where laid on the river bed, fig. 1, the armouring wires are increased to 0.192 in. in diameter. The straight joint box used for connecting the factory lengths of cable together is designed for a 33,000-volt working pressure; and the cables are finished off inside the Queensferry works in a standard 33,000-volt dividing box, filled up with a light compound.

The overhead portion of the transmission line consists of approximately 8,000 yd. of six bare, stranded, copper conductors, each made up of seven wires 0.135 in. in diameter, having a nominal sectional area of 0.1 sq. in., supported on a single line of Callender-Kay tubular steel four-legged towers (figs. 2 and 3), the average distance between poles being 475 ft., giving a clearance from the lowest conductor to the ground level in the centre of span of 20 ft. The poles are 45 ft. high, and run practically in a straight line along the top of a cop embankment. From the River Dee to the main sub-station there are 52 of these masts. A continuous earth-wire consisting of a solid copper conductor, No. 3 S.W.G., is carried below the power wires throughout the entire route. The conductors are supported on straight line poles by means of 33,000-volt pin-type porcelain insulators, and on terminal and heavy-angle poles by means of 33,000-volt Kalanite end-strain insulators; the latter were designed and manufactured by Messrs. Callender's, and are illustrated in fig. 4. This is the first occasion on which this particular type of insulator has been used on a 33,000-volt line, but it is to be widely adopted in South Wales and elsewhere—in fact, at Swansea it is to be used exclusively, and will eliminate the use of porcelain. The special features of this insulator are that it is easily assembled and installed, and that the material of which it is made possesses great mechanical strength, so that it will not chip when roughly handled; it may be used safely in tension, and its dielectric properties, it is claimed, are superior to those of porcelain. From fig. 4 it will be seen that the insulator comprises five component parts:

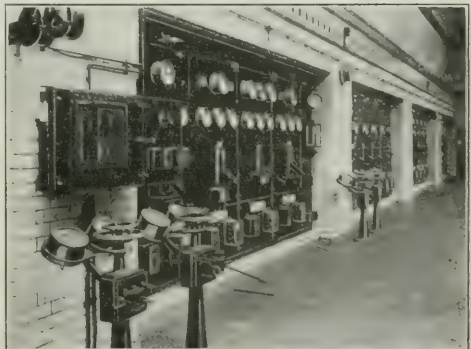


FIG. 8.—SWITCHBOARD AT QUEEN'S FERRY.

portions a c e are made of wrought iron, while b and d are made of Kalanite, and are moulded complete, including the screw threads. The method of assembling the insulator is as follows: Part A is screwed into b, c is screwed on to b, d is screwed on to c, and, lastly, e is screwed into d.

At Bumpers Lane sub-station, fig. 2, the six bare copper conductors are carried direct from the terminal pole into the building by means of a special leading-in arrangement, as indicated in fig. 5; the illustration shows that each conductor is led up through the centre of a Kalanite insulator, which is itself supported by a slab of the same material. The top portions of the insulators are filled with compound and covered by

hds, and we understand that the use of Kalanite in this instance avoided much complication in a difficult piece of work.

The map, fig. 6, shows the route of the transmission line, and it will be noticed that from the Bumpers Lane sub-station to the Corporation generating station, duplicate 6,600-volt cables are laid underground, each 1,200 yd. in length. Each cable crosses the River Dee twice, the actual length of cable under water being 4×114 or 456 yards. One 6,600-volt cable continues onwards from the generating station for a distance of 1,700 yd. to the Hydraulic Engineering Co.'s sub-station, where it is looped in before it runs on for another 1,600 yd. to Messrs. Brook, Hirst's sub-station.

Each conductor of the 3-core, 6,600-volt cable is 0.2 sq. in. in sectional area; the conductors are paper-insulated, lead-sheathed, served, single-wire armoured, and then served overall. The conductors are delta shaped, and the cable is intended to work with the centre point unearthed. Where the cables are laid direct in the ground, they are single-wire armoured, the diameter of each wire being 0.128 in., but where they cross the River Dee an additional layer of wire armouring of the same diameter is used. The factory lengths of the 6,600-volt cables are joined in standard joint boxes.

The Queen's Ferry plant consists of four B.T.H. turbo-alternators, fig. 7, one having a capacity of 1,000 kW and three of 1,500 kW. The alternators produce three-phase alternating current at 50 periods, and at 440

volts. At present only one set is in operation, and the others will be put in commission as the load warrants. Powers are now being sought to extend the area of supply, roughly over a radius of five miles from Chester.

The Queen's Ferry plant can be operated with great economy compared with the existing Corporation plant. At Queen's Ferry a kWh of electricity can be produced for about 3 lb. of coal, whereas the plant at New Crane Street used $5\frac{1}{2}$ lb. per kWh. The boilers at Queen's Ferry work at a steam pressure of 170 lb. per sq. in.; there are 32 Lancashire boilers (only three or four of which are at present in use, however). Each boiler is fitted with a Bennis sprinkler stoker and self-cleaning compressed air furnace, and is capable under normal conditions of evaporating approximately 10,000 lb. of water per hour.

The coal is handled throughout by Bennis coal and ash handling plant. The bunkers have a capacity of approximately 2,240 tons, equal to about seven days' supply for the whole of the plant.

The members of the Chester Corporation on December 9th visited the various electricity stations and sub-stations, including the hydro-electric works. Subsequently at the Town Hall the Mayor was cordially thanked for having inaugurated the supply from Queen's Ferry to Chester, and compliments were bestowed on the City Electrical Engineer, Mr. S. E. Britton, and all concerned in the acquisition of the Queen's Ferry supply.

WE SEE THEM ALL.

By W. A. C. PHILLPOT.

OUR firm has always extended politeness and a few minutes to all the many travellers calling upon us—a waste of time, no doubt. The custom is, of course, a relic of those happier days when business had not departed this life, and when there was still a chance of a traveller having something of interest to offer. Nowadays the chances are a million to one against, but, conservative to the backbone, and well brought up, we keep the old custom going.

There is a strange diversity of creatures sent hourly and empty away from our office, yet they all have points in common, the chief being ignorance of the goods they are trying to sell. A law of nature, apparently, has laid it down that technical knowledge and "push" should never exist in the same man. Let's have a look at a few types.

The hearty man comes first, and oftenest. He wants to sell us a battery, and has as much chance as he would have of selling cinders in Tophet. "Ah-hah, Mr. P., and how are we this morning—pretty well? Hah—that's good." He grips me fervently and gives his imitation of Douglas Gumbail's kinema grin. "Well, I've come to sell you that little battery you inquired about the other day—Hah-hah!" Intensely jocular beast this. Mr. P., restraining his joy and keeping his face ironed flat, mentions that he has no orders to place, and never expects to want another battery in his life. "Good morning." It is as well to choke this type severely: inveterate talkers and time-wasters, they never have anything to say. His report of the call will probably read: "Very interested—send all catalogues and literature." Curiously enough, seeing how this sort abound, they must be successful travellers, the jocularly overbearing manner evidently having some fatal fascination for the average buyer.

I return to my pen and dictate another letter and a half.

A pompous party, No. 2, with a special line in iron-clad switchgear. *I am* rather interested. He produces his sample switch and commences a speech on its merits. He rambles on for a minute or two before it begins to

dawn on me that his speech has been composed for him by the firm's technical man. I interpose a question to make sure, and am sorry as he frowns on me majestically and goes back to the beginning. As he has no more idea of what I mean than the cat, and an unbounded faith in the man who wrote his speech, he does this because he knows (the man has told him so) that every query that can possibly be raised is answered in the book of words. I discover that this is a fallacy by hearing him speak his piece to the end, and then gently pushing him. His price lists and illustrations are worth a look, but his firm would have done better with a two-penny stamp. Not all men are such good listeners as I.

A third party is the young man with the aggressive mean-to-get-there manner. He gets into our office anyway. No smile here—life is real—life is earnest. He has some fuse-boxes to sell at so much to me, I suppose, less to anybody else. I mention casually that I have a similar sample, rather better quality, on my desk. "Better quality than this!" he bellows, and hits it to show his contempt for such an obvious lie. I add that my sample is also cheaper, and he wants to fight me. Having been out of training for the last thirty years, I retire and do a little more work.

The commissionaire pokes another card at me, and I again rise cursing the occasion. This party is an enthusiast, a bit loose in his statements, but with good intentions. He takes his lampholder with the air of a local mayor presenting medals, and stands it on the window ledge as if he expected me to go on my knees to it. "There, Mr. P., what do you think of that for a lampholder?" with a tremendous beam and hand wave. I refrain from telling him that as a lampholder I think it would make a nice thimble (it would sound like sacrilege to him), and ask if there's anything special about it, and is that the best sample he's got.

He then explains the remarkable points of his lampholder, which is exactly like every other lampholder, and also that his sample is vastly inferior to the bulk of his production. Samples always are, incidentally. Price is a point to be airily dismissed by the enthusiast: "I think we're getting about 8s. 6d. for these generally,

but to you (how these fellows love me) I'll make it 7s. 6d." I explain as clearly as possible that (a) I think his holder is no good; (b) it is 100 per cent. too dear, and I would not buy if it were cheaper than that; (c) I have no orders to place. He brings out his ready reckoner to work out point (b), and retires with his better feelings wounded by a man of whom he expected different treatment. His looks say this.

Another type growing rapidly commoner, alas! is the man who has just learnt by heart "The Art of Salesmanship"—Chatter and Windy—9d. net. While waiting in the corridor he runs rapidly over the heads of chapter 84. "Study Your Man—Learn His Character (if any)—Find out his Likes and Dislikes—Interest Yourself in His Hobbies." When the first of these started to cross-examine me, I took him for a C.I.D. man, and, having done nothing, trembled for my liberty. The purport of his remarks broke in on me eventually, and, restraining the impulse to tell him to cut the cackle and come to business, I showed him a character from my last place, and offered as alternatives draughts and tossing the canber for hobbies, to both of which he had been devoted from childhood. He thought the latter was done with a penny, so I didn't explain that one threw bricks about on a frozen pond. [?Curling.—Eds.] It transpired that he wanted to sell me a shop sign, but as he hadn't had time to find out the price, and didn't know when he could deliver, he didn't.

The most irritating type is the long-winded person who never uses one word to explain his meaning where ten will do. Following his own mighty train of thought, he is quite unable to switch round to the buyer's point of view and offer what is wanted if it is not exactly what he has to sell. These never get orders from me if I can help it.

Not all travellers, however, are entirely obnoxious. Two of my callers I have a special regard for, and for

reasons which probably cause them to be considered unsuccessful travellers.

No. 1 is the essence of candour, and, unfortunately for himself, represents a battery manufacturer. When he first called I asked him what special reason there was for placing an order with his firm. "I get exactly the same prices from all you battery makers, and your batteries are all twins." He smiled naturally—not the usual traveller's business smirk—and said: "So they are, dammit—but I could do with a bit of commission these hard times."

No. 2, however, is my gem, and if ever I employ a traveller it shall be he, but I will send a prizefighter round with him. A quiet, unassuming little man, I doubt his ability to get past the usual mastiff commissionaire, but he knows his business from A to Z, and backwards. Although we are fairly old acquaintances by now, he never manifests that ghastly travesty of a friendly personal interest in myself that most travellers affect. A plain "Good morning," and he is down to business at once. He listens patiently and intelligently to my explanations of my requirements, has answers to all my questions on the tip of his tongue, and is always full of helpful suggestions without being too talkative (gives me a chance, in fact). If there is nothing for him, he wastes no time trying to force a sale—an impossible achievement at our firm—but goes, and I am grateful.

It is rather a rotten life for the traveller at present, anyhow, and the majority bear the annoyances, delays, and rebuffs common to their lot with amazing fortitude.

The ideal traveller needs the cunning of the fox, the courage and tenacity of the bulldog, the sensitiveness of the hippopotamus, and the modesty of the peacock. Rather a beastly catalogue this, but the ideal man undoubtedly cannot be the ideal traveller. I have tried travelling myself.

ELECTRICITY IN MINES.

Report of the Chief Inspector of Mines.

In the report of H.M. Chief Inspector of Mines for the year 1920 just issued it is interesting to note the gradual increase in the use of electricity in mines. This is shown in the following table:—

TABLE I.

Year.	Surface.		Underground.		Total.	
	H.P.	Per cent. increase on preceding year.	H.P.	Per cent. increase on preceding year.	H.P.	Per cent. increase on preceding year.
1919	441,606	5.96	587,321	7.06	1,028,927	6.58
1920	461,954	4.61	618,868	5.37	1,080,822	5.04

The application of electricity to the various operations of colliery working is more clearly shown in Table II, which also gives details of the use of electrical plant, in each inspection division, both for coal mines and metalliferous mines.

From this table it will be noticed that the greatest application is to haulage and pumping, two of the most costly operations in mining, the next in importance being ventilation with 80,309 h.p. It may also be noticed that more than half the h.p. applied to "winding" is in South Wales, whilst on the other hand, Scotland leads in portable machinery, which includes coal cutters, having more than half the total applied to this purpose.

As regards coal-cutting machinery, there will undoubtedly be a great increase in the use of these machines within the next few years. The total number of machines in use in 1920 was 5,073, compared with 4,482 in the previous year. As the Inspector remarks, "This increase indicates that experience is disclosing the

advantages of changed methods in working some seams. As time goes on, these advantages should be more and more recognised where the underground conditions are suitable for the introduction of machine coal-cutting." Tables III and IV give a complete analysis of the different types of machines in use in the various divisions and the quantity of coal won by each particular type. It will be noticed there was only one electrically-driven "percussive" machine at work. The production of a satisfactory machine of this type is no doubt a very difficult problem, but we sincerely hope it will some day be solved, as a satisfactory solution would supply a long-felt want. Table IV shows that the two most popular machines are the electrically-driven "disk" and "chain" types.

The most remarkable feature about these tables is the great development of electrical coal-cutting machinery in the Scottish collieries, where more than one half of the total number of machines are at work, and where more than one-third of the total machine-mined mineral was obtained.

There were unfortunately during the year 1920 nine fatal accidents due to electricity, which caused ten deaths, six of which were on the surface and three underground. In addition, electricity was a contributory cause of two accidents; one, an explosion of fire damp and air, ignited by open sparking at a direct-current motor used for driving an auxiliary ventilating fan, which caused the death of one person; the other due to the unexpected starting of a disk type coal-cutter, during replacement of the picks, which came about owing to faulty connections in the starting switch and the coincidence of a defect of insulation on the motor winding supplied from a direct-current earthed concentric

system. Of the electric shock accidents, these were in six cases due to defective insulation, one was apparently due to "practical joking," and one was due to "misunderstanding" coupled with the absence of "isolating links" or means of *locking* the switch in the *off* position. The remaining accident, which caused the death of two men, is rather unusual, it evidently being caused by "gas" originating from the oil in an oil-switch. The deceased, one an assistant electrician and the other an engine attendant, died as the result of injuries received from the flying fragments of a heavy cast-iron switch pillar in a surface engine room. This pillar exploded on being operated, the man operating the switch being killed outright: the explosion was due to the ignition of inflammable gas originating in an oil switch which

"The regulations require that earth conductors and metallic coverings shall be tested for continuity as often as may be necessary to prevent danger, and this duty is laid upon the authorised electrician.

"This requirement cannot be satisfactorily fulfilled unless suitable instruments are available, and the test of conductors, or points of contact of low resistance, cannot be made effectively with an instrument, such as an ohmmeter, designed to measure high resistance.

"A test for continuity of cable armouring should not be carried out with current from the power system owing to the danger of shock or from open sparking, and is of little value if made with a small current and sensitive galvanometer applied at one extremity of the cable system.

TABLE II.—COAL MINES.

Division.	No. of mines.	Surface.				Underground.							Gross total h.p.
		Wind-ing.	Venti-lation	Haul-age.	Coal wash-ing or screen-ing.	Miscel-laneous.	Total.	Haul-age.	Pump-ing.	Port-able mach-ery.	Miscel-laneous.	Total.	
1. Scotland	352	4,212	7,137	4,331	10,019	17,351	43,050	47,738	77,599	34,067	6,788	166,192	209,242
2. Northern	268	18,282	24,917	15,356	18,371	47,991	124,917	57,270	59,830	6,662	5,052	128,814	253,731
3. York and North Midland	246	1,990	16,238	4,896	27,374	59,080	109,578	48,716	29,195	12,350	3,764	91,025	203,603
4. Lancashire, N. Wales, and Ireland	139	335	5,028	1,669	1,969	12,985	24,986	14,935	17,082	1,819	455	34,291	59,277
5. South Wales	341	27,661	23,660	18,543	12,042	52,785	134,691	62,813	70,445	2,449	1,917	137,624	272,315
6. Midland and Southern	158	485	3,329	2,616	5,008	13,294	24,732	25,577	25,161	4,867	2,017	57,922	82,654
Total h.p.	1,504	52,965	80,309	47,411	77,783	203,486	461,954	257,049	279,612	62,214	19,993	618,868	1,080,882

METALLIFEROUS MINES.

1. Scotland	9	67	—	114	—	157	638	115	315	40	103	573	1,211
2. Northern	20	40	—	16	—	698	754	166	3,449	5	176	4,396	5,150
3. York and North Midland	9	27	2	51	—	302	382	7	211	20	238	620	620
4. Lancashire, N. Wales, and Ireland	13	1,101	—	201	—	1,319	2,621	1,004	1,067	9	356	2,436	5,057
5. South Wales	3	119	—	—	—	433	552	—	76	—	—	76	628
6. Midland and Southern	14	375	256	164	—	4,432	5,227	10	2,095	24	23	2,152	7,379
Total h.p.	68	1,729	258	546	—	7,641	10,174	1,602	7,213	98	958	9,871	20,045

TABLE III.

NUMBER OF COAL CUTTERS OF EACH TYPE IN USE, MINERAL OBTAINED, AND NUMBER OF CONVEYORS AT COAL FACE IN EACH DIVISION DURING THE YEAR 1920.

Division.	No. of mines at work in division	No. of mines using mach. in-ces.	Per-centage using mach. in-ces.	Type of machine.										Totals.		Mineral obtained.	No. of conveyors at coal face.
				Disk.		Bar.		Chain.		Percussive.		Rotary heading.		Elec-tricity	Com-pressed air		
				Elec-tricity	Com-pressed air	Elec-tricity	Com-pressed air	Elec-tricity	Com-pressed air	Elec-tricity	Com-pressed air	Elec-tricity	Com-pressed air				
Scotland	518	252	48%	631	37	366	3	151	5	—	30	1	1,149	131	10,859,652	169	
Northern	469	126	26%	51	43	29	23	135	11	—	921	1	215	1,042	5,195,720	99	
York and N. Midland	475	137	28%	156	119	78	31	232	168	—	193	8	3	174	7,815,613	191	
Lancas. and N. Wales	309	103	33%	8	109	33	61	28	82	—	546	—	10	69	2,938,714	53	
South Wales	614	65	10%	2	2	26	14	11	101	—	50	—	72	267	1,076,730	33	
Midland & Southern	466	77	16%	23	13	18	12	132	92	1	138	1	2	175	2,859,845	32	
Total in 1920	2,851	760	26%	871	383	550	144	722	492	1	1,881	10	19	2,154	29,191,712	823	
Percentage of total				1,254	691	1,211	1,882	29	5,073								
				24%	13%	23%	37%	0%	12%								
Total in preceding year	2,843	729	25%	876	388	489	128	573	400.	7	1,598	5	18	1,950	25,532	28,081,017	712
Percentage of total				1,264	617	973	1,605	23	4,482								
				28%	13%	21%	35%	0%	13%								

was housed with other details within the pillar. Owing to defective contact, continued minute arcing probably occurred, so that the oil was "cracked" and the products spread by diffusion into the housing, which was then subjected to heat sufficient to cause such an explosion. The inflammable gas was ignited by the break flash of the air-break isolating switch. This isolator was interlocked with the oil switch, but served to interrupt the circuit of a potential transformer.

One cause of the accident is directly due to "defective earthing." The value of this safeguard and the importance of adequately maintaining and regularly testing the earthing circuit continue to be impressed upon all users of electrical plant; and the following suggestion by H.M. Electrical Inspector of Mines, which aims at facilitating the routine tests of earthing conductors, will be found of interest to those concerned:—

"To illustrate the class of test desired, the following suggestion for a simple portable outfit may be of interest:

"To avoid the difficulty and delay entailed by carrying out a test from end to end of a long cable, or of a complete cable system, at frequent intervals tests might be made from point to point on the cable armouring by means of the following outfit: A 2-volt accumulator, an ammeter, and an adjustable rheostat with two contact spikes, the whole connected in series.

"To test conductivity across a joint, the contact spikes would be applied at convenient points, and the rheostat would be adjusted to pass a standard current.

"A direct comparison could be made with an un-jointed length of cable armouring or with the corresponding copper conductor.

If desired, the rheostat could be calibrated to show

the approximate ohmic value of the resistance under test.

"Such a test could be carried out without danger or interruption of service and, by suitable organisation, the whole cable system could be surveyed at reasonable intervals of time."

The reports on electrical accidents in mines should be carefully studied by all engaged in operating and supervising electrical plant, as in most cases the acci-

dent, that anyone should be so foolish as to attempt practical joking with electric current from main cables, whether for lighting or power purposes; yet the sad fact remains that several deaths have occurred at mines through this cause. Those engaged in designing electrical switchgear and plant for use in mines should pay particular attention to making as far as possible everything absolutely foolproof, and in portable machinery, where flexible connections are to be made, to see

TABLE IV.

QUANTITY OF MINERAL GOT BY EACH TYPE OF COAL CUTTER IN EACH DIVISION DURING THE YEAR 1920.

Division.	Description of mineral.	Type of machine and motive power.										Totals.			Grand totals.
		Diak.		Bar.		Chain.		Percussive.		Rotary heading.		Elec- tricity.	Com- pressed air.		
		Elec- tricity.	Com- pressed air.	Elec- tricity.	Com- pressed air.	Elec- tricity.	Com- pressed air.	Elec- tricity.	Com- pressed air.	Elec- tricity.	Com- pressed air.				
		Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.		
Scotland	Coal	6,249,247	670,261	2,681,908	11,450	1,156,325	41,334	—	41,584	331	—	9,399,811	770,649	10,859,652	
	Ironstone	63,372	15,208	37,321	1,056	—	—	—	—	—	—	100,693	16,264		
	Fireclay	10,846	—	21,389	—	—	—	—	—	—	—	32,235	—		
Northern	Coal	445,846	348,125	161,025	175,476	1,207,517	386,690	—	2,511,876	—	400	1,813,883	3,372,567	5,195,720	
	Fireclay	—	—	—	—	—	—	—	—	—	—	—	14		
	Ironstone	—	—	—	—	—	—	—	—	—	—	—	9,261		
York and North Midland ..	Coal	1,209,009	1,064,047	735,869	441,757	2,043,502	1,995,575	—	588,103	3,616	11,832	3,992,297	3,801,412	7,915,613	
	Fireclay	—	107	—	—	3,935	—	—	13,469	—	—	3,935	13,776		
	Ganister	—	—	—	—	—	—	—	4,193	—	—	—	4,193		
Lancs. and North Wales ..	Coal	59,485	613,017	213,970	419,747	160,915	599,061	—	878,234	—	4,300	424,365	2,514,349	2,988,714	
South Wales	Coal	20,500	8,416	100,199	46,750	223,368	611,458	—	65,839	—	—	344,067	732,463		
	Fireclay	—	—	—	—	—	—	—	200	—	—	—	200		
Midland and Southern ..	Coal	268,947	185,668	106,584	75,071	965,568	749,407	375	186,392	—	486	1,341,474	1,146,964	2,859,845	
	Ironstone	—	—	36,892	—	269,697	6,793	—	22,819	11,306	—	341,736	29,612		
	Ganister	—	—	—	—	—	—	—	—	—	—	—	—		
Total	Coal	8,252,529	2,839,534	3,849,556	1,173,051	5,749,496	4,336,833	375	3,971,968	3,947	17,018	17,855,902	12,338,404	30,194,306	
	Ironstone	61,372	15,208	74,212	1,056	293,597	6,793	—	32,070	11,806	—	442,488	55,127		
	Fireclay	10,846	107	21,389	—	—	—	—	13,883	—	—	36,170	13,990		
	Ganister	—	—	—	—	—	—	—	4,193	—	—	—	4,193		
Grand total in 1920 ..	All miner's ..	8,326,747	2,854,849	3,945,157	1,174,107	6,047,028	4,343,626	375	4,022,114	15,263	17,018	18,331,660	12,411,714	30,746,374	
		11,181,596	—	5,119,264	—	10,890,654	—	—	4,022,489	32,271	—	80,746,274	—	—	
Percentage of total ..		36.4	—	16.6	—	33.8	—	—	19.1	0.1	—	59.5	40.4	100.0	
Total in preceding year ..	All miner's ..	8,695,007	3,090,481	3,528,657	1,101,712	4,562,307	3,435,271	1,836	3,621,069	2,474	22,133	16,810,331	11,270,686	28,081,017	
		11,785,188	—	4,630,369	—	8,017,378	—	—	3,622,975	24,607	—	24,081,017	—	—	
Percentage of total ..		42.0	—	16.5	—	28.5	—	—	12.9	0.1	—	59.9	40.1	100.0	

dents are due to neglect on the part of someone, and all cables and connections should be either in such a position or so protected that it is impossible for foolish and ignorant boys or workmen to interfere in any way with them, and still less to be able to connect or manipulate live wires or make connections for the purpose of "practical joking." It seems strange to electrical engineers, who are aware of the dangers of electric

that these are of sound mechanical construction. Nothing shoddy or cheap is fit for the rough usage encountered in a coal mine.

The use of electric safety lamps is rapidly making headway, there being 245,900 in use in 1920, as compared with 197,722 in the previous year. The better light and the great security these lamps give are certainly worth the little extra cost.

ELECTRICALLY-DRIVEN FIRE-FIGHTING APPARATUS.

By E. KILBURN SCOTT.

THE New York fire-fighting department has not yet adopted electrically-driven engines, but some of the neighbouring towns have done so on a considerable scale. For example, Paterson, in New Jersey, has a completely "motorised" fire department. This city is a silk manufacturing centre, and has a large foreign population, many hilly streets, and a residential district where most of the houses are of frame construction.

The Fire Department consists of fifteen companies, and the electrically-propelled apparatus includes nine engines, ten combination wagons, and three ladder trucks. Most of them have been converted by removing the gasoline engines and installing the electric drive. They were originally built to be drawn by horses; later gasoline tractors replaced the horses, and finally electric motors and storage batteries have replaced the engines.

To electrify the pumping apparatus, all the running gear forward of the gooseneck was removed, and channel beams, long enough and heavy enough to carry the storage batteries, the chauffeur's seat, and the driving

and steering apparatus, were riveted on. The rear wheels, the boiler, and the pumps were not touched.

For the ladder trucks, the frame was extended to provide space for the driving mechanism, and the battery box was suspended under the frame and just forward of the rear wheels. An entirely new set of wheels was mounted, each wheel having its individual electric motor. Lengthening and strengthening the frames and the installation of motors for each of the rear wheels accomplished the same results for the combination wagons.

During 1919 the department responded to 511 alarms, and reached the fires so promptly that in only four cases did the blaze extend beyond the original building. The damage in the most disastrous fire of the year amounted to only 209,000 dols., and the average loss in the next four fires was less than 50,000 dols., while the average loss in all fires, including the big ones, was less than 900 dols.

In a recent test on Temple Street, having a gradient of fourteen per cent. and three blocks long, the truck

climbed the distance in one minute and fifteen seconds. Another incline of seventeen per cent. was negotiated in sixty-two seconds, and not only did the "electric" climb from a standing start, but it stopped in the middle of the hill and started again without any assistance. A speed of thirty-four miles per hour is maintained on the level.

The fire chief says that "the electric trucks are the most reliable, least expensive, and best type of vehicle for fire department usage." The labour of the department has decreased nearly seventy per cent. since the introduction of electric trucks three years ago, and with the exception of a smash into a tree, not one of the electric trucks has ever been out of service for as long as twenty-four hours.

About a dozen other cities in the Eastern States have adopted electrically-propelled fire-fighting apparatus.

CORRESPONDENCE.

Letters received by us after 5 p.m. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Fire at Carmarthen Electricity Works.

I shall be pleased if you will permit me, through the medium of your paper, to express my gratitude to the many sympathisers and for the offers of help I have received from both individuals and manufacturers, to which it is impossible for me to reply individually.

I must say it has surprised me, and I feel all the more grateful. The prompt action of Messrs. Mirrlees, Bickerton and Day, Ltd., our engine builders, and the Western Engineering Co., Swansea, who carried out the temporary electrical repairs, with the permanent staff under me, who worked as only Britons can do day and night, achieved a task I can only describe as wonderful, in renewing the supply after eight nights of darkness.

The seriousness of the fire, owing to the highly inflammable crude oil and the wood and slate roof, can hardly be described. Its effect has taught me a lesson, as well as those similarly situated as we were with this type of plant, and I shall be pleased to impart information to any engineer who will write me, to safeguard himself from any such like occurrence.

I must also say that my company is most grateful to the Corporation of Carmarthen, a deputation of which, including the Mayor, waited on the directors to express their sympathy and offer of help; also to the townspeople, who realised the serious situation and most patiently waited for the resumption of supply.

A. Preston, A.M.I.E.E.,

Manager and Engineer.

Electricity Works, Carmarthen.

December 16th, 1921.

The Durability of Lead-covered Cable.

The question of lead-covered wiring is of interest to us here, as we have been using the system in Salisbury since 1898, and I think well over 100 miles of this wire is in use on our consumers' premises.

We use lead-covered twin paper-insulated wire; the joints are covered with sheet lead, which is folded round them, and secured on to the lead of the wire by means of a small blow-pipe. The wire is sealed into varnished hard-wood blocks with insulating wax at the ceiling roses and switches; lead blocks can be used in damp places if desired. No looping is done.

The whole system is watertight and absolutely satisfactory. A number of installations have been in use for over 20 years, and are quite in order at the present time; none have had to be pulled out except where the fault has been quite definitely traced to bad workmanship.

The essentials for making a success of the system are—

1. Good workmanship, with a knowledge of the system.
2. Proper earthing of the lead covering.
3. The wire not to be covered with plaster or cement without proper protection.
4. The system not to be used in a place infested with rats or mice, as they eat the lead.

I have no doubt that these necessary conditions have not been complied with in the cases of trouble quoted by other correspondents. Good workmanship and a thorough knowledge of the system are absolutely essential, as it is obvious that if paper-insulated wire is not properly sealed up, there will soon be trouble if the slightest damp gets to it.

A. B. Randall.

Electricity Works, Salisbury.

December 17th, 1921.

One Solution of the Frequency Problem.

Replying to both Mr. A. L. Firth's letter of the 6th inst., and Mr. Sutton's letter of the 6th, the difficulties which are referred to in dealing with odd frequencies could be overcome with two alternators coupled in tandem in the manner I suggested, by utilising low-speed type alternators gear-driven from the turbine. Although I have no actual figures before me, I believe I am correct in saying that the combination of a low-speed type alternator with gear and a higher-speed turbine is as cheap as, say, a standard 3,000-r.p.m. turbine with direct-coupled alternator, and there is little difference in the overall efficiency. With low-speed type alternators the objections raised could be overcome.

It would be interesting to know how a set of this description would compare with the scheme outlined by Mr. Sutton, and as will be seen, the employment of low-speed alternators would enable a direct-current generator to be coupled up if required. The all-important fact remains that the losses with a coupler set must be very considerable, and if these are capitalised they should leave a very large margin in favour of a tandem scheme such as I suggest.

With regard to the question of power factor, I have always maintained that it is wrong to correct the power factor at the power station, but right to aim at raising the power factor at the point of consumption.

E. W. Dorey.

London,

December 17th, 1921.

Tracing Mains.

In the article on "Mains Photography," by Mr. A. F. Beach in your issue of December 2nd, 1921, the need for the use of photography appears to have risen out of a difficulty in finding the exact position of a power main under a field, owing to the cable having been laid in a position not in accordance with the plans. It is suggested that the position of the cable could have been found quite easily with the aid of a search coil, as there are very few underground power mains which cannot be detected by this simple piece of apparatus.

As I have frequently met power engineers who are ignorant of this method of detection, the following description of an efficient search coil may be found of value: Some 40 turns of covered wire, No. 22 S.W.G., should be wound on a rectangular light wooden frame with sides about 3 ft. by 1 ft. 6 in., and the wires should be connected to a 60-ohm telephone receiver. The best type of coil is one in which the impedance of the coil equals the impedance of the telephone receiver. The one described will be found convenient to handle, and, if a good telephone receiver is employed, very effective in use. A hum is heard when the coil is parallel with the main, with varying degrees of strength to silence between that position and when the coil is at right angles.

S. C. Bartholomew.

London,

December 15th, 1921.

Leaves from an Inspector's Note Book.

To insurance inspecting engineers, both "Anode's" articles and Mr. A. J. Abraham's letters are nauseous. "Anode's" tairy tales about changing-over starter connections and reversing 3-phase motors make engineer surveyors look the fools that Mr. Abraham thinks they are.

"Anode" states that after his experience at the pork butcher's he never made an inspection without seeing the machine run, yet later he admits passing for insurance a motor which he never even saw at work, which, to my mind, is more important than the checking of dimensions and a megger test.

The *non-de-plume* of the author prevents us of the inspecting fraternity from pulling his leg, as he appears to glory in doing to his company's clients and their engineers.

Now I wonder how much our friend Mr. Abraham knows about insurance companies' business or their inspectors' duties and salaries. It was he who, in a previous letter, compared insurance companies to Hebrew money lenders. It is quite obvious that any plant insured by his department is insured without his permission, and that probably at some time he has had his "throne" shaken by an inspector's report (in spite of the inspector only getting a third of his salary), hence the bee in his bonnet still continues to buzz. As to an inspector to-day earning less than a fitter, I challenge him to prove that he has an ordinary fitter in his employ earning even as much as a newly-appointed inspector for a normal working week, thanks to the efforts of the Engineer Surveyors' Association. It is very probable that comment has been made about his balancer fuses being too heavy, but I again challenge him to produce an insurance company's report suggesting fitting fuses in the shunt leads of a dynamo. As to his test of a motor reported to be hot, I would ask if he never heard of a motor being badly overloaded? The firm would not do this, naturally, when they knew his test was on; and as to the inspector's instruments for checking the temperature, a thermometer is part of his equipment for motor inspection, hence

his report is just as likely to be correct as that of a certain individual, who apparently rides the high horse pretty handsomely as far as Aberdare is concerned.

N. W. Walker, A.M.I.E.E.,

Engineer-Surveyor.

Sheffield.

December 17th, 1921.

Neon Night Lamps.

I should be obliged if you could offer any explanation of the following regarding a Neon lamp: (1) When switched on after a long period of rest the lamp refuses to light up. If the lamp is then momentarily connected to the secondary of a spark coil (giving about 3-16 in. spark) and then replaced on the lighting circuit the lamp lights up promptly. Circuit is 205 volts, 50 periods. (2) In the case of one lamp it became necessary to re-fix the brass cap, and on removing the globe from the cap previously to re-cementing, I find that there is a hobbin' round with very fine, enamel-insulated wire concealed within the cap of the lamp. Can you favour me with the object of this?

Charles W. Cook.

London, December 17th, 1921.

[The Neon lamp partakes of the nature of an arc lamp; there is no metallic connection between the electrodes. Hence the gas must be ionised before the arc can be struck, and this is effected by the process mentioned by our correspondent—but the case appears to be exceptional, as the lamps normally light up without difficulty.]

Presumably the fine wire is a ballast resistance, necessary to give stability to the "arc," which would have a so-called negative resistance. —EDS. *ELEC. REV.*]

[Our correspondent who signs himself "Ginger Beer" is informed that his letter cannot be published unless his name is in our possession. A letter sent to his address has been returned by the Post Office. —EDS. *ELEC. REV.*]

REVIEWS.

Thermionic Tubes in Radio Telegraphy and Telephony. By JOHN SCOTT-TAGGART. Pp. xxiii+424; figs. 344. London: Wireless Press, Ltd. Price 25s.

Since the war a considerable number of books has appeared on the subject of the thermionic valve and its various applications to wireless telegraphy and telephony. Nearly all these books have discussed the subject with the aid of more or less advanced mathematics, but although such a method of treatment is very necessary if exact ideas are to be obtained, yet it must be confessed that even the reader who is competent to cope easily with the mathematics does not always obtain in this way as clear a mental picture as is desirable of the phenomena involved, apart from the symbols in which they can be expressed, while for the reader whose mathematical attainments do not reach the necessary level, such books are almost useless. Now it will be readily admitted by anyone, who has had practical experience with wireless gear, that it is the possession of such clear conceptions of what is actually happening which is the really important mental equipment needed for such work. If this equipment can be obtained by the way of exact mathematical reasoning, so much the better. But a sufficiently good conception for practical purposes of what is occurring in the gear, and of the results produced by changes in the various adjustments, can be obtained without mathematical aid, if the explanation be given in a clear and logical manner. The author of the book under review has succeeded in doing this extremely well; in fact, we have no hesitation in saying that, for the average wireless operator, or for the amateur who wishes to be able to use his set in an intelligent manner, it is the best elementary book on the subject which has so far appeared.

The book is divided into fifteen chapters. In the first two, the general theory of thermionic currents and their practical application in two and three electrode valves are described. The next two chapters deal respectively with the valve as a detector and as an amplifier. The application of the principle of retro-action is next dealt with. Then follow chapters on multi-stage high and low frequency amplifiers, on combined high and low frequency amplifiers and on circuits using multi-stage amplification with retro-action.

The next two chapters describe the use of the thermionic valve for the reception and the generation of continuous waves. The following two deal respectively with various applications of the valve to the measurement of wave-length, capacity, &c., and the use of the valve in wireless telephony.

In the remaining two chapters the Dynatron, the Turner relay, and several other miscellaneous valve devices are described.

The book is well printed on good paper, and the numerous diagrams are clearly drawn and well reproduced. There is a refreshing absence of padding with photographs of apparatus which, however much they may appear to lighten a book, seldom convey any information of value to the reader.

We have only noticed two printer's errors. On page 55, line 33, a bracket has been misplaced. Incidentally, we think that the argument would be clearer if the last two expressions in this line were reversed, so that the line read:

$$I_X - 2AX = (I_B + BX).$$

On page 157 reference is made to a "coil R" in fig. 118. No coil lettered thus is shown in the diagram, and the "R" appears to be a printer's error for "AB."

We have only a few adverse criticisms to offer. On page 10 the author defines an electrostatic line of force as the line along which "a unit positive charge of electricity (*according to the old idea*), would travel." (The italics are ours.) Although modern ideas about electricity are somewhat different from the old ones, yet we think that positive charges of electricity still tend to move along the lines of an electrostatic field, in just the same way as they did in the old days.

On page 43 and again on page 84, the statement is made that the e.m.f. of a battery having appreciable internal resistance drops immediately an external circuit is connected across the battery terminals. Instead of the e.m.f., of course, the external voltage of the battery is meant, the e.m.f. remaining unchanged as long as polarisation effects do not occur.

On page 121 the symbol κ is used for the capacity of a condenser in farads, instead of the international symbol C. This is the more desirable as on other occasions, as, for example, on page 209, the symbol C is employed.

On page 394 reference is made to attempts "to obtain simultaneous transmission and reception in wireless telephony, so as to reproduce the conditions existing on an ordinary telephone circuit." (Our italics.) We think that if the author notices carefully what happens the next time he uses a telephone, he will realise that with an ordinary telephone circuit simultaneous transmission and reception, that is, duplex working, is not possible, even if two persons, one to speak and one to listen, be installed at each end of the line. With an ordinary telephone the listener can, if necessary, interrupt the speaker, and this is what is desired with wireless telephony, but such an arrangement is not duplex working.

With the exception of the foregoing small points, however, we have found nothing amiss with the book, which, we are sure, will meet with a warm welcome from elementary students of wireless telegraphy.

Relativity and the Electron Theory. By E. CUNNINGHAM, M.A. Pp. ix+146; figs. 9. London: Longmans, Green and Co. Price 10s. 6d. net.

The author will probably be known to many of our readers as the writer of a very concise account of the principle of relativity published in 1914. He furnished one of the readiest means available of becoming acquainted with this difficult subject at the time, and there must have been few who consulted the book who had not reason for being grateful to its author. The present volume is the second edition of a work designed to extend the usefulness of the first by expanding it to embrace the ever-growing complexities of the subject. An attempt has been made to set out the relation of the electron theory and the theory of gravitation to the principle of relativity, and mathematical analysis has been omitted to a large degree with the idea of making the book of greater interest to the general reader. The theory of relativity is, however, essentially mathematical. Take away the mathematics and there is really nothing left. So members of the general public who come to this book or any other that deals with the same subject, without bringing some knowledge of mathematics, are bound to be disappointed. In this edition, besides the special theory of relativity as first worked out, the general theory of relativity as developed by Einstein is explained, and the reasoning which led to its conception is clearly described.

This aspect of the theory is probably the one which will appeal most to those readers who are repelled by mathematical symbols. An exact physical law is a statement of equality which remains true, whatever means of expressing it may be adopted. Newton's laws hold good for some frames of reference, but not for others. It is repugnant to the scientific mind that physical truth should depend on the frame of reference chosen to express it. This was the essence of the problem Einstein set himself to solve, and he reached his solution by the aid of systems of pure mathematics devised by other persons having other aims in view. So true it is that he who helps himself helps another. The last chapter deals with Weyl's theory of electricity. Weyl has done for electricity what Einstein did for gravitation, namely, shown that a measure-system can be found in which the mathematical relations of nature can be expressed in the simplest possible form, in terms of poly-dimensional space and time. But so far no experimental test has been devised by which the accuracy of Weyl's hypothesis can be verified. Those who desire to follow this line of thought more closely will prefer Mr. Cunningham's larger book on the subject, but it may be safely conjectured that the curiosity of most people will be sufficiently satisfied by the perusal of the 146 pages contained in this.

BUSINESS NOTES.

Bankruptcy Proceedings.—THOMAS RAWSTHORNE, 67b, Paradise Street, West Bromwich, electrical engineer. The public examination of this debtor was held on December 14th at West Bromwich. The liabilities were returned at £244, and there was a deficiency of £203. Debtor attributed his failure to the fact that many works had had to close down, and the trouble had been made worse by strikes. He became aware of his position in June last.

JOSEPH OWEN (trading as J. Owen & Sons), 186, Westcombe Hill, and 3, The Grove, Greenwich, Kent, electrical engineer.—The following are creditors:—

Robert & Son, H. W.	18	Lindsay, —	250
Granges, C.	12	Marchant & Miller	14
Crow, Toogood & Co.	30	National Electric Co.	22
Lea & Co.	16	Rose & Sons	42
Edwin Stuart Electric Co.	12	S. Met. Electric Light Co.	30
Electrical Supplies Co.	123	S.E. & Chatham Railway	42
Balk, Stadelmann & Co.	40	Sunlight Manufacturing Co.	38
General Electric Co.	106	Watchtams	20
Hipkiss	230	Watts	100
Albert Lee & Co.	118		

J. H. HOPKINS (Electrical Maintenance Co.), 57, Castellaine Mansions, Maida Vale, and lately carrying on business at 140, Wandour Street W.—Receiving order made November 30th on creditor's petition. First meeting, December 30th. Public examination, March 3rd, both at Carey Street, W.C.

A. V. FOWLER (A. Vaughan Fowler), electrical engineer, Seafife, Fitzroy Avenue, Kingsgate, Kent.—First meeting, December 23rd, at the Official Receiver's Office, 68a, Castle Street, Canterbury. Public examination, January 7th, at the Guildhall, Canterbury.

J. H. TOMS, electrical engineer, 13, Gray's Inn Road, W.C.—Last day for proofs for dividend, December 31st. Trustee: Mr. H. J. de Courcy Moore, 2, Gresham Buildings, E.C.

S. H. DOUGHERTY (Mersey Electric Co.), electrical engineer, Liverpool.—First and final dividend of 9d. in the £, payable at 30, North John Street, Liverpool.

Dissolutions of Partnership.—FENELEY & Co., mechanical and electrical engineers, 40a, Windsor Bridge, Salford, and Hawthorn Road, Hale.—Mr. G. H. Feneley and Mr. H. T. Blood have dissolved partnership, and both will attend to debts, &c.

MANCHESTER ELECTRIC REPAIRING & MAINTENANCE Co., electric light and power engineers, 53, Regent Road, Morecambe.—Messrs. C. H. S. Naylor and J. E. Bradley have dissolved partnership. Mr. Bradley will attend to debts.

Trade Announcements.—MESSRS. HIGGS BROS., of Sand Pit, Birmingham, inform us the telephone number of their Manchester branch (3, York Street) is City 5713.

MESSRS. ENGINEERING SUPPLIES, LTD., have transferred their electrical branch to larger premises at 155a, Upper Thames Street, E.C.4, where they hold stocks of silk-covered wires, cables, and flexible cords.

MESSRS. BERRY'S ELECTRIC, LTD., have recently established a branch at 16, Donegall Square South, Belfast, for the control of their Irish business in switchgear, "Magneval" electric fires, &c.

THE HOTPOINT ELECTRIC APPLIANCE Co., LTD., has removed to 21, Berners Street, Oxford Street, London, W.1, where, in extensive showrooms, it will exhibit a complete range of Hotpoint electric appliances. A special model kitchen and dining room have been installed.

Mr. J. COOPER, of 10, Church Street, Haslingden, has taken over the Haslingden branch of the East Lancashire Electrical Co., and will carry on the business in his own name at the above address.

Mr. W. CRABTREE, electrical engineer, Barnsley, has opened new premises at 28, Peel Street.

Catalogues.—THE AJAX ELECTRICAL Co., 291-3, High Road, Ilford.—An illustrated price list of domestic electrical appliances—fires, kettles, irons, cookers, &c.

MESSRS. J. BERG & Co., 169, City Road, E.C.1.—An illustrated sheet giving prices of bell pushes and burglar alarms.

MESSRS. SIMPSON, BAKER & Co., 4, St. Augustine's Place, Tramway Centre, Bristol.—A net price list of electrical accessories and materials, including switches, wires and cables, insulating material, &c.

MESSRS. ASHWORTH & SMITH, 60, Whitworth Street, Manchester.—Bulletin No. 628, illustrating and describing the "Homecharger," a small transformer and rectifier for charging small batteries from a.c. circuits.

STERLING TELEPHONE AND ELECTRIC Co., LTD., 210-212, Tottenham Court Road, W.1.—Publication No. 303, giving illustrated details of automatic interphone systems. Priced.

DICTOGRAPH PHONES, LTD., Aurelia Road, Mitcham Road, Croydon.—The "Buzzer"—the firm's house organ, containing interesting and amusing notes, and a number of appreciative letters from "Dictograph" users.

MESSRS. C. A. VANDERVELL & Co., LTD., Acton, W.3.—Folder "M" giving numerous illustrations of electric lighting components for motor-cycles and side-cars. Fully priced.

AUTOMATIC AND ELECTRIC FURNACES, LTD., 251-253, Gray's Inn Road, W.C.1.—A pamphlet explaining "Why Germany

buys British Furnaces" and illustrating a typical "Wild Barfield" electric furnace.

THE CAMBRIDGE & PAUL INSTRUMENT Co., LTD., 45, Grosvenor Place, S.W.1.—A card giving an illustration of a "Cambridge" draught gauge and prices of draught and pressure gauges.

BRITISH INSULATED & HELSBY CABLES, LTD., Prescott, Lancs.—Publication No. 1,171, giving details, and illustrations of aluminum matting, and aluminum of various sections.

ECONOMIC ELECTRIC, LTD., 10, Fitzroy Square, W.1.—A well-illustrated catalogue giving prices and descriptions of all kinds of wireless apparatus.

MESSRS. STICLIFFE BROS., 90 & 91, Queen Street, Cheapside, E.C.4.—List No. 1221C, giving sizes and prices of cables, conduits, bell wires, &c.

MESSRS. R. A. EVANS, LTD., Prospect Road, Leicester.—A series of illustrated leaflets (bound), giving particulars and prices of lift accessories, including terminal boxes, limit switches, interlocks, &c.

MESSRS. NEWTON & WRIGHT, LTD., 471-473, Hornsey Road, N.19.—An illustrated detailed description of the "Snook" X-ray apparatus for the purpose of rapid radiography.

MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, S.E.7.—"Transformer Abstracts," No. 2. "Inquiries and Tenders." This is the second of a series of booklets designed to aid both salesmen and buyers in the proper understanding of transformers and their working.

Catalogues Wanted.—MESSRS. FITZGERALD BROS., electrical engineers and contractors, of 18, East Beach, Cove, co. Cork, desire to receive catalogues of electrical goods.

H.M. Trade Commissioner's Office at Trinidad reports that a British West Indian firm wishes to receive catalogues and current price lists from British manufacturers of electric motors. The name and address is obtainable at the Department of Overseas Trade in London.

Calendars and Almanacs.—THE HART ACCUMULATOR Co., LTD., of Marts-gate Lane, Stratford, London, E.15, has sent us one of its desk blotting pads as in previous years. On each of the blotting sheets a calendar for 1922 is printed in small type.

FROM MESSRS. FREDK. HODGSON & Co., LTD., of 24, Queen Victoria Street, London, E.C.4, we have received a wall calendar with small monthly slips for 1922 pasted beneath a reproduction in colour of H.M.S. *Renown* "in the teeth of a gale" (Montague Dawson).

THE WESTINGHOUSE ELECTRIC INTERNATIONAL Co. has prepared a pocket diary for 1922 containing particulars of the company's industries and a series of maps of different world markets.

MESSRS. JOHN ARMSTRONG & Co., Lancaster Buildings, Barton Square, St. Ann's Street, Manchester, have issued a wall calendar with a daily date pad for 1922.

A striking souvenir has reached us from Mr. GEORGE ELLISON, of Birmingham. A good deal might be written about it after contemplative and imaginative study. Men engaged in industry can learn important lessons from it if they will. We are all learning nowadays, perhaps by bitter experience, that it is sometimes necessary to compel ourselves to leave our work entirely alone, so as to recover from the effects of wear and tear. Life may become too monotonous and fatiguing if we are not careful. The dull, smoky life of the factory is used as a background in this picture, and upon it there is laid in colour the human interest side of life in the form of a beautiful girl. It is a study in contrasts—the unattractiveness of incessant work placed against one who may represent the softening and sweetening influences of life. Of course, other constructions are possible, and we may be wrong in our conception of the meaning of the design, but we like this version best because we think it the loftiest.

MESSRS. SIMPLEX CONDUITS, LTD., have sent us the 1922 edition of their handy pocket book and diary, with revised technical tables and data of use to the electrical engineer—a very well-planned book, and a friend of long standing.

From the KEIGHLEY GAS & OIL ENGINE Co., LTD., of Imperial Works, Keighley, we have received a calendar with a block of daily date slips for 1922 on a cardboard base cut to Imperial engine shape.

THE DEARBORN CHEMICAL Co., of Chicago, has issued a wall calendar for 1922 in the form of large monthly sheets.

THE PARK ROYAL ENGINEERING WORKS, LTD., of Cumberland Avenue, Park Royal, London, N.W.10.—A pocket diary and memorandum book with calendars, useful tables, and insurance policy. A most acceptable souvenir.

THE KEY ENGINEERING Co., LTD., of Trafford Park, has issued its usual celluloid pocket slip with calendar for the new year.

West of England District Board.—A satisfactory report was presented at the annual meeting of the District Joint Board for the West of England Area (Employers and Staff Members, Electricity Supply Industry). Ald. A. A. Senington (employers) was elected chairman for the ensuing year, and Mr. A. J. Ostler (staff members) vice-chairman.

Holidays.—The Times says that shipyards and engineering establishments on the Clyde will close down for ten days at the year end.

The works of Messrs. Bruce Peebles & Co., Ltd., will be closed from Friday, December 30th, until Monday, January 9th.

The Electrical Industry in Saxony.—According to an article in the *Leipziger Tageblatt* of December 2nd, the receipt of orders in Saxony is at the present time brisk. As a result of the fall in the mark, prices have been materially increased (approximately 50 per cent.) since October 1st. This is due to the fact that the electrical engineering industry is dependent on foreign countries for about 60 per cent. of its supply of raw material, particularly copper, manila-rubber, and cotton. The price increase which has taken place since the last fall of the mark does not at present correspond to the fall in value of the mark. There has been a passing decrease in the number of orders received since the latest increase in prices, but there are at the present time so many projects in course of completion that it is expected that a still more considerable number of orders will be received unless prices again rise materially. The article, a copy of which was forwarded to the Department of Overseas Trade by the Acting British Consul in Leipzig, says:—"With regard to orders received, our great electrical enterprises have made one remarkable observation. Previous to the war, approximately 40 per cent. of our total production was exported. This 40 per cent. has at the present time gone back to 15 per cent. Nevertheless, the total machine power represented by the orders received during the last two months has been as great as that received during six months of the pre-war year. This is mainly due to the fact that the whole of German industry is modernising itself more and more, in order to free itself as far as possible from the use of man-power. Further, the loss of the Saar district and of Upper Silesia has necessitated increased production on the part of our brown coal industry, as well as what remains of our pit coal industry. Consequently, all big machine factories, and some engine and boiler factories, are correspondingly busy, and in their turn are in a position to give orders to modernise their equipment. Further, as a result of the present brisk state of business in the textile and paper industry, considerable orders have been received by the electrical industry in respect of the modernisation of these works. It is difficult to state the prospects for the further development of the electrical engineering industry, since everything at the present time depends upon the exchange question. At the moment, thanks to the low value of the mark, our prices are still below world market prices, but a further increase in price will soon eliminate the now existing difference. In any case, the present demands for supply concentrated on a few months are unfavourable for the factories, and the recent disposition of the Government authorities is worthy of imitation, viz., that orders which are not absolutely urgent should not be given until the present boom is seen to slacken, in order that a more regular supply of work may be insured for the factories. The Saxon electrical engineering industry, which is represented by large firms such as the Sachsenwerk and Pöge-Gesellschaft, and by various electrochemical machine factories in Leipzig and numerous special factories which construct electrical apparatus, is doing equally brisk business as a result of the generally favourable boom. The profits of certain enterprises are unfavourably influenced by difficulties in the supply of raw material, concentration of orders on short terms, and on the other hand by continual demands for wage increases on the part of the workers, so that the difference between the cost of production and the sale price is constantly decreasing."

Italian Lamp Tax.—The *Gazette Ufficiale* (Rome) for November 23rd contains a Royal Decree-Law, dated November 16th, which prescribes Regulations regarding the taxation of electric light bulbs. The Decree provides that the manufacturing tax on electric light bulbs is fixed as follows for each bulb:—

(a) Incandescent electric light bulbs of any system:—

	With carbon filaments.		Other.
	Lire cts.	Lire cts.	
1. Up to 10 watts	0 25	0 50	
2. From 11 to 50 watts	0 75	1 50	
3. From 51 to 200 watts	1 50	3 00	
4. From 201 upwards	3 00	6 00	

(b) Arc lamps, excluding the carbons—3 lire.

(c) Carbons, pure or metallised, or of any other system, for arc lamps—2 lire per kg.

A surtax at the same rate is levied on such goods when imported from foreign countries. Goods manufactured for export are exempt from the tax. The date of enforcement of this manufacturing tax (and import surtax) is to be fixed by the Minister of Finance.—*Board of Trade Journal*.

We understand that this tax replaces the monopoly tax on electric lamps.

Chinese Notes.—Chen Pei-jen, Chu Chen-mu, Kiang Yün-shih and Shen Wei-kun have organised the Tsung Sing Electric Company at Sin Chen, Kiangsu, with a capital of \$25,000. Machines and plant are now being installed.

Chu Chien-chien is promoting a company to be known as the Paitaho Hydraulic Electric Power Co., Ltd., at Paitaho. Regulations have been drawn up and sanctioned by the Ministry of Agriculture and Commerce.

An electric company is being organised by some merchants in Tai Hsin, Kiangsu.

The Chusan Electric Light Company, at Chusan, Chekiang, has been registered by the Ministry of Agriculture and Commerce.

The Paoing Electric Company at Paoing, Chihli, has been registered by the Ministry of Agriculture and Commerce. A license of trade has also been given.

A proposal has been made by merchants to organise an electrical company in Shih Er-yu on the other side of the Yangtze River, opposite Chinking.

The Tsinan Telephone Company has increased its capital, and requested the Ministry of Agriculture and Commerce for registration.

Yih Tien-tuen, an American returned student, has been appointed by the Ministry of Communications to install a long-distance telephone system between Nanking and Shanghai.

Price Fluctuations During 1921.—In their annual trade review for 1921 Messrs. Bolling & Lowe give tables showing the price fluctuations of materials which have been without parallel in the history of the trade. We extract the following figures:—

	Dec. 14th, 1920.	July 1st, 1921.	Dec. 14th, 1921.
	per ton.	per ton.	per ton.
PIG IRON—			
Hemafire (East Coast)	13 5 0	8 0 0	5 2 6
Foundry (East Coast)	11 5 0	6 0 0	5 0 0
COPPER	75 15 0	71 5 0	67 0 0
TIN	212 10 0	167 0 0	171 10 0
LEAD	24 0 0	23 7 6	25 10 0
STEEL—			
Ship Plates	26 0 0	15 0 0	10 10 0
Angles	24 0 0	14 0 0	9 10 0
Bars	25 0 0	14 10 0	10 0 0
Joists	23 0 0	14 0 0	9 10 0
Heavy Rails	22 0 0	13 0 0	8 10 0

The above prices are for iron and steel of British manufacture, but all include delivery to L.O.B.

Messrs. Bolling & Lowe say:—"We feel that an Irish settlement having been reached, the question of Germany's reparation payments receiving serious consideration, the Conference with regard to Universal Disarmament making progress, and also that prices of British iron and steel are likely to find a level at which competition from without need not be so greatly feared, the prospects for 1922, at any rate for the last six months of next year, are brighter than they have been of late, and we look forward with confidence to the future. The all-important necessities for national and personal economy and Government cessation from interference with trade still exist, if the country is to make the progress as foreshadowed."

Social Events.—The members of the Elliott Cricket Club held their annual dinner on the 10th inst. at the Sydney Arms, Lewisham. In the absence, through sickness, of the president (Mr. L. W. Smith), the chair was occupied by Mr. R. O. Smith, a vice-president of the club. Mr. E. J. Griffin, the chairman of the club, proposed the toast of "The Firm" (Messrs. Elliott Brothers (London), Ltd.), and in the course of his remarks he expressed regret that the wishes that he voiced last year for the continued prosperity of the company had not materialised; in fact, in all probability the year just past had been the worst in the whole history of the firm. The only consolation, if one could call it such, was that other firms engaged in the same industry were in a similar, or even worse, plight. In wishing for the future success of "The Firm" the members were wishing themselves success, because happier times for the directors meant happier times for employés. The cricket club had shown what could be achieved by hard work. If the *esprit-de-corps* displayed on the cricket field was carried inside the works it would assure the success of his toast—"The Firm." Mr. R. O. Smith, who responded in the absence of the president, said he felt sure that if any of the directors had been present they would have said the same as he was going to say. They were glad to see such gatherings in connection with the social activities at the works, and the cricket club had achieved the greatest success. Everyone of them would regret the bad time through which the industrial world was passing, but one could perceive a ray of hope for the future. Success was bound to come if they stuck together, for the best means to success was co-operation—the co-operation so well used on the cricket field. Mr. R. O. Smith proposed the toast of "The Club"; Mr. E. A. Wisdom replied, and, in doing so, referred to the successes achieved by the club.

During the evening the Friendly Team prizes were presented by Mr. R. O. Smith. The batting prize, presented by Mr. L. W. Smith, had been won by Mr. H. Mitchell, while the bowling prize, presented by Mr. R. Lawler, had been won by Mr. D. S. Greig. Mr. W. J. Coppin was at the piano, and the musical programme was well supported by Messrs. W. J. Woodman, Wal Curran, G. A. Money, Fred Rampling, E. J. Griffin, B. Macnamara, W. Nicolle, and C. A. Smith.

The staff of Clyde Valley Electrical Power Co. held their annual dance on December 16th in the Grosvenor Restaurant, Glasgow. About 250 couples attended, and an enjoyable evening was spent.

The Belgian Electrical Market.—During the past twelve months business in Belgium in electrical machinery and appliances has been below normal, whilst German competition has also checked the sale of other imported as well as Belgian products. Dynamos and generators of German origin, reports the United States Commercial Attaché at Brussels, sell at prices 30 per cent. under American and 20 per cent. under Belgian quotations. Insulated wire and cable is made by a Charleroi concern at prices considerably under American quotations. The same is true of interior wiring supplies, and in this line German competition is active.

The use of arc lamps for illuminating purposes is comparatively small in Belgium, and the mercury vapour lamp is rarely seen. The Commercial Attaché adds that as no incandescent lamps are produced in Belgium, a large business in lamps with metallic filaments is done by Dutch companies, but local manufacturers affiliated with American interests are organising a local factory, and an extensive advertising campaign is being carried on to introduce a well-known American trademark. German incandescents are widely sold in Belgium. Meters and other measuring instruments of American manufacture are also subject to severe Belgian and German competition, the price ratios being practically the same as on machines. German bidders on a contract let by one of the larger communes of Brussels quoted prices 50 per cent. under those offered by American firms, while local manufacturers bid about two-thirds of the American prices. In motors the largest American concerns are having types up to 15 h.p. built by Belgian firms affiliated with them, and the same is true of small transformers. A good business is being done in switch-board apparatus, which, together with high-pressure switches, is the most active line in this industry. It is generally found that Belgian users of electrical machinery demand a higher external finish than American buyers, and are not so particular regarding internal construction.

An increased demand is noted for vacuum cleaners and electric flatirons, the majority of the former being of American manufacture, although some French models imitated from American types are seen in local shops. While numerous French, Italian, and Swiss manufacturers of small electrical cooking apparatus have agents in the larger Belgian cities, articles of this nature, owing to inferior merchandising and advertising, have never come into any considerable vogue. Small electric tea kettles sell for 110 to 130 fr. retail. Hot plates large enough to hold two or three dishes are priced at 275 fr. A considerable market has been created for small electric heaters suitable for use with ordinary household voltages. The favourite heater seems to be the radiant or head-light type, usually of French, Italian, or local construction, selling for 125 fr. and up, according to size. There is practically no demand for electric wringers and washing machines in Belgium nor for electric fans.

In Brussels, as the communes have separate lighting systems, there is no universal voltage. The commune of Brussels proper uses 110-volt current, and the immediate adjacent commune of Ixelles uses 220.

Protection for the Dutch Electrical Industry.—Electrical manufacturers in Holland have long been complaining of the effects of foreign competition emanating from countries having a depreciated currency. It is, however, only now that the Dutch Association of Electrical Manufacturers (Vereniging van Fabrieken op Electrotechnisch Gebied) has ventured to approach the Minister of Trade and Industry on the question. In the course of a communication addressed to the Minister, the Council of the Association states that the prevailing abnormal circumstances render it necessary firmly to adhere to the legally fixed protection—which is very low and in general 5 per cent.—and not make it illusory in connection with the disastrous fall in exchange. For this purpose the Council submits that it is essential that the 5 per cent. import duty should be levied on an invoice amount calculated, not according to the daily quotations, but according to the intrinsic value of the money in the country of origin, particularly Germany. Moreover, in special cases which may appear to the Minister to be necessary, the Council urges that the Minister should be armed with a general authority to impose a provisional import veto, as it is in the general interest of the country that the Dutch electrical industry should not be ruined.

E.P.D. Arrears.—In a speech at Newcastle on December 10th the Chancellor of the Exchequer (Sir Robert Horne), said he intended to propose to the House of Commons that outstanding arrears of Excess Profits Duty should, in cases which were found to merit the concession, be paid in quarterly instalments spread over a period of five years, the first instalment being payable before March, 1922. Another proposal was that interest payable in cash, at the net rate of 5 per cent. per annum, without allowance for income tax, shall be charged as from a fixed date on all outstanding arrears of E.P.D. as assessed, whether such arrears fall within the instalments scheme or not. Pending the assent of Parliament, the Chancellor had instructed the Commissioners of Inland Revenue to give effect as far as possible to his scheme, which was designed to assist industry in its present difficulties. Sir Robert said that the arrears had in many cases arisen out of no fault of the particular tax-payer who had burdened himself with larger factories or increased

equipment, which, owing to depreciation in trade, he found it impossible to finance.

The Times, in referring to the subject on December 13th, said that the scheme outlined by the Chancellor had had a lukewarm reception in certain business circles. The scheme was criticised on the ground that the concession which was to be made had not been asked for, except by a small group, and would really be a greater convenience to the Chancellor than to the industry of the country.

A great many firms had already paid the duty, so the concession, it was claimed, was unfair as between firm and firm. Those who had paid had done so with money which was urgently required for business purposes. Many of the firms which had not paid could not pay without becoming bankrupt, and this concession was therefore more apparent than real; for the Chancellor, if he had tried to obtain their money more quickly, might lose it altogether.

The real apprehension was, however, that this concession, which by many firms was regarded as no concession at all, would be used to choke off other demands which were now becoming insistent. It was regarded as not without significance that the Chancellor should have made his announcement of the new scheme immediately after the statement had been made that the Federation of British Industries intended to press for the removal of the Corporation Tax and for the reduction of the Income Tax.

The president of the National Union of Manufacturers, Mr. George Terrell, M.P., said the relief which the Chancellor had granted would be welcomed with delight by many, and would be quite an aid in the revival of trade.

Trade Depression and Income Tax Relief.—Mr. W. R. Fairbrother, of 67 and 68, Cheapside, London, E.C., writes: "From the many accounts appearing in the Press it is obviously hoped that the Chancellor of the Exchequer will endeavour to lighten the burden of taxation in the near future. May I, therefore, suggest what, in my opinion, would prove beneficial in furthering the efforts to revive the nation's trade? The repeal of the well-known and helpful Sections 43 and 44 (which gave relief when profits or income had diminished in any year of assessment) as and from the year 1920-21, is now clearly seen to have been a mistaken policy. Had such relief been continued over the period of the war's "aftermath" the present acute depression might have been to some extent averted, and trade in the reconstruction period would not have been so injuriously and adversely hit by such high taxation. I would, therefore, urge that these two sections be re-enacted and made retro-active as and from the year 1920-21, which would have the effect of (1) allowing firms and companies an amended assessment based on the lower profits, and (2) giving an individual the basis of actual income instead of the higher statutory assessment."

An Australian Inquiry.—H.M. Senior Trade Commissioner in Australia reports that an important local departmental store is sending a representative to the United Kingdom, the Continent, and the United States with a view to purchasing a large variety of domestic, medical, and other electrical fittings and appliances suitable for a retail store. United Kingdom firms may obtain the name of the representative and the address in London to which communications should be sent against his arrival, on application to the Department of Overseas Trade.

Electric Heating Apparatus in Germany.—The Electro-Heating Co. has been formed at Nuremberg to combine the electric heating apparatus manufacturing departments of the A.E.G. and the Bing Works.

The A.E.G. in Austria.—It is announced from Vienna that the A.E.G., of Berlin, and the A.E.G.-Union Electricity Co., of Vienna, have entered into a closer community of interests for 30 years. For this purpose a new concern has been formed in Vienna under the title of the A.E.G.-Union Works, which will take over and considerably extend the existing Stadlau manufacturing works of the Vienna company in question. The share capital has been fixed at 500,000,000 kronen, of which the Berlin company and the Vienna company each will subscribe one half.

Unemployment.—The "live" registers of the employment exchanges in the United Kingdom showed a decrease, for the week ending December 9th, of 209, the total unemployed being 1,833,800. The Morning Post states that relief schemes submitted by local authorities to the Unemployment Grants Committee are being sanctioned so rapidly that there is a danger of the sum allocated for this purpose being exhausted soon. The 660 schemes sanctioned up to the end of last week represented an expenditure of £7,600,000. If all the schemes submitted are approved, an expenditure of £14,886,675 will be incurred.

British Empire Exhibition.—Lord Morris, Chairman of the Executive Council of the British Empire Exhibition, discussing the question of the guarantee in connection with the exhibition, said he was more than sanguine that by Christmas Day they would be within sight of the £1,000,000 guarantee. Only £125,000 was required. The completion of the guarantee fund would aid the Labour situation considerably. Thousands would be employed directly on the exhibition grounds and others elsewhere.—Morning Post.

Book Notices.—*A Catalogue of British Scientific and Technical Books.*—Pp. xviii+376. London: British Science Guild, 6, John Street, W.C.2. Price 10s. net.—This catalogue, "covering every branch of science and technology, carefully classified and indexed," has been prepared by a committee of the British Science Guild, of which Sir Richard Gregory is chairman; Mr. J. S. Highfield, Mr. A. A. Campbell Swinton and Lt.-Col. W. A. J. O'Meara (hon. secretary of the Guild) are also members of the committee. The catalogue arises out of the collections of books shown at the British Scientific Products Exhibitions which the Guild organised in 1918 and 1919. It contains over 6,000 titles, classified under 50 main groups and nearly 500 sub-classes, each item including the author's name, title of book, size of page, number of pages, date of last edition, name of publisher, and the price. Following the main catalogue are a list of publishers, index of authors, and index of subjects. To this comprehensive and scientifically-compiled catalogue we offer the most cordial welcome; the want of it has long been felt—we are constantly receiving requests for advice regarding the choice of books, and shall find this volume, if only as a reminder, of great assistance. But it has other uses also, and we feel that the Guild by providing so excellent a guide to the rich store of British scientific literature has rendered most valuable service to science and industry alike.

The *Journal of the South African Institution of Engineers*. Vol. XX., No. 4, November, 1921.—This issue contains a paper describing the hydro-electric plant at Howick Falls, together with a discussion on the paper.

"Science Abstracts." Section A, Physics; and Section B, Electrical Engineering. Vol. XXIV, Part II. London. E. and F. N. Spon. Price 2s. 6d. net per section.

A G.E.C. Window Display.—An ingenious Christmas shop-window display has been arranged at Magnet House by the GENERAL ELECTRIC CO., LTD. Santa Claus is seen pouring gifts into a chimney mounted on a snow-covered roof, and by means of hidden mechanism and flashing lights an illusion is presented which gives the impression of a constant stream of articles descending the chimney. Falling "snow" is kept in motion by hidden fans.

For Sale.—By direction of the Disposal Board, Messrs. J. Hindle & Son will sell by auction at Liverpool, Birkenhead, and Ellesmere Port, on January 10th and following days, plant, machinery, electrical equipment, office furniture, &c. For particulars see our advertisement pages to-day.

An Overcrowded Profession.—MESSRS. JOHNSON AND PHILLIPS, LTD., advertised recently for a boy for their Liverpool store-rooms, and met with a response from about 1,500 youths of various ages. Does this indicate the intensity of the present rush to enter the electrical profession?

The Burden of Taxation.—The Chancellor of the Exchequer is to receive a deputation from the Federation of British Industries early in the New Year, when the heavy burden of taxation on industry will be the subject under consideration. The Federation is calling for a reduction in the Income Tax and the removal of the Corporation Profits Tax.

The Cost of Living.—According to the *Labour Gazette*, the cost of living as at December 1st was 99 per cent. above the figure for July, 1914; a year ago the cost was 169 per cent. above. This is the lowest price level since May, 1918.

Local Electrical Exhibition.—An interesting exhibition is being held by the Burnley Electrical Maintenance Co. described as the "Hot-Point" appliance show; there are on view all manner of things for labour saving in the home.

Factory Premises for Disposal.—Messrs. Hillier, Parker, May & Rowden will sell by auction at the Grand Hotel, Bristol, on January 12th, factory premises, with possession, situated at Eastville, Bristol, with a floor area of 42,000 sq. ft., garage, loading dock, &c. (See our advertisement pages to-day.)

Copper and Lead Prices.—MESSRS. F. SMITH & CO. report December 20th:—Copper (electrolytic) bars, sheets, wire rods, and etc. wire, no change.

MESSRS. JAMES & SHAKESPEARE report, December 20th:—Copper bars (best selected), sheet, and rod, £98; £3 dec. English pig lead, no change.

LIGHTING AND POWER NOTES.

Australia.—THE MORWELL SCHEME.—The Victorian Legislative Assembly passed a Bill on December 15th authorising the Electricity Commission to raise a loan of £2,000,000 in connection with the Morwell Brown Coal Scheme.—*Reuter* (Melbourne).

Aylesbury.—LOAN.—The Town Council is applying for a loan of £2,000 for meters.

Ayr.—REDUCED CHARGES.—The Corporation has decided to reduce the charge for electricity by 25 per cent.

Bangor.—BULK SUPPLY.—The City Council has decided to obtain a bulk supply of electricity from the North Wales Power Co., and application has been made to the Electricity Commissioners for sanction to borrow £9,000 to cover the estimated capital expenditure on installing the necessary plant, mains, &c.

Barry.—GAS *v.* ELECTRICITY.—Owing to the opposition aroused by its suggestion to spend £125,000 in improving the local gasworks, the Council has referred the proposal back to committee with instructions for the carrying out of further investigations regarding the cost of an electricity supply.

Bexley (Kent).—REVISED CHARGES.—The Urban Council has discontinued the rateable value tariff for electricity, and in substitution has decided to charge 8d. per unit.

Brentwood.—EXTENSION OF SUPPLY.—The Brentwood District Electric Co., Ltd., is applying for an order authorising it to supply electricity in the Brentwood urban district and in parts of Hutton, Ingrave, Shenfield, South Weald, and Great Warley.

Continental.—ITALY (SICILY).—A number of schemes have been drawn up for the utilisation of the island's water power for generating electricity. As the largest rivers are greatly reduced during summer, every scheme involves the construction of large reservoirs. The following are among the projected schemes:—Upper Belice River, 4,000 h.p.; Tusa River, 1,700 h.p.; Imera River, 18,415 and 15,020 h.p.; S. Leonardo River, 5,215 h.p.; Belice River, 6,413 h.p.; Vedura River, 10,736 h.p.; Platani River, 3,500 and 10,960 h.p.; Naro river, 2,370 h.p. These are but a few of the many applications for concessions which have been put forward.

AUSTRIA.—The Wasserkraft-Aktiengesellschaft has been formed, with capital wholly subscribed in Austria, to carry out extensive works for the utilisation of water resources for the generation and distribution of electricity mainly for the benefit of Vienna. The capital is fixed at 500 million kroner, half of which is subscribed by the Vienna Municipality and half by leading banking firms. For the first portion of the programme 100 million kroner has been subscribed by the two groups named, and it is expected to be completed by the end of June, 1925. It comprises water-power stations on the Ybbs and along the watercourses stretching from Lunz and Kienberg-Gaming, and also long-distance mains and accessory installations. The second part of the programme will call for 6,400 million kroner, to cover which sum bonds will be issued. Work on the first part of the programme was to have been begun at the beginning of last month. As is usual in foreign concern of this kind, the concession is only a lease, in this case for 30 years, at the end of which period all the installations revert to the municipality.

POLAND.—We learn from the *Elektrische Kraftbetrieb und Bahnen* that a group of the largest petroleum companies of Bryslav intend to set up a big electric power station conjointly, in order to carry out the boring and working of the petroleum fields. The Polish Ministry of Trade has promised its co-operation to carry out the work.

CZECHO-SLOVAKIA.—It is reported from Prague that the schemes of electrification prepared for the Ministry of Public Works have now assumed a definite form. They have originated from the consideration that, as submitted by experts, the coal resources of North-West Bohemia will be exhausted in from 70 to 80 years from the present time. It is therefore proposed to constitute a company at Prague under the title of the United Electricity Works for the construction and working of the following:—(1) A steam generating station in the district of the State mines near Hernewitz of a capacity of 45,000 kW, with a transmission line to Prague 63 miles long and a pressure of 100,000 volts, the expenditure being estimated at 300,000,000 crowns. (2) A hydro-electric works at Stjechowitz by the erection of a dam in the Moldau and capable of supplying 350,000,000 kWh per annum to Prague, the expenditure being computed at 450,000,000 crowns. (3) A hydro-electric works near Brama at a cost of 80,000,000 crowns and an annual output of 41,000,000 kWh. The scheme provides for the first-mentioned works being completed in two years and the second and third in 1927.

BELGIUM.—Since the termination of the war there has been a marked increase in the demand for electrical energy for lighting and power purposes in the Brussels district. Thus, whereas in 1913 the output of the generating plants of the Société Bruxelloise d'Electricité only amounted to 9,500,000 kWh, it is expected this year to reach a total of no less than 20,000,000 kWh. In view of the additional contracts already entered into for supplies in 1922, the company is now taking the necessary steps to enlarge the capacity of its generating stations.

SWEDEN.—As there appears to be a scarcity of power in the South of Sweden, the Government auditors have brought forward a scheme for the utilisation of the surplus energy at the hydro-electric works at Trollhattan in conjunction with the South Swedish Power Co. Negotiations have been proceeding between the State Hydro-Electric Department and the company with a view to co-operation in the matter. It is suggested that the former should erect a high-pressure transmission line between Trollhattan and a place to be selected in the South of Sweden. The line is conceived

as an extension of the main line Alvikareby-Trollhattan, which will soon be completed, and it would also come into consideration on a possible future transmission of power between the Scandinavian countries. It is estimated that the expenditure on the new line would amount to 7,000,000 kr.

Chester.—**LOAN.**—The Town Council has decided to apply to the Electricity Commissioners for sanction to borrow £12,000 for electricity purposes.

Fife.—**LOAN.**—The Kirkcaldy Tramways and Electric Lighting Committee has decided to apply to the Electricity Commissioners for sanction to borrow £80,000 for the installation of two 2,500 kW turbo-alternators and the necessary mains and plant.

Glasgow.—**LOAN.** The Corporation is seeking power to borrow £110,000 for the extension of high-pressure feeder cables in connection with the transmission of electrical energy from the Dalmarrock power station.

Hereford.—**LOAN SANCTIONED.**—The Town Council has received sanction to a loan of £8,000 for mains and services.

India.—**SHILLONG.**—A scheme is under consideration to utilise the waters of two rivers in the neighbourhood of Shillong, Assam, for generating electricity for lighting and industrial purposes.

Cossipore.—There will shortly be an addition to the generating plant at the Cossipore power station of the Calcutta Electric Supply Co. in the form of one Curtis 15,000 kW turbo-alternator and another of 6,000 kW similar to the one already in operation there. The British Thomson-Houston Co. has supplied these machines, and erection will be commenced early in January.

Isle of Wight.—**PROPOSED INCREASE OF CHARGES OPPOSED.**—The local bodies in the Island are taking joint action to oppose the application of the Isle of Wight Electric Light Co. for a Special Order, which seeks to increase the price of electricity.

London.—**STEPNEY.**—Upon the recommendation of the Electrical Engineer (Mr. W. C. P. Tapper), the Finance Committee has approved the extension of the Limehouse generating station, subject to the payment by the Unemployment Grants Committee of half the interest charges for the first five years; to the Electricity Commissioners' sanction to a five-years' suspension of repayment; and to the same applying to sanctions already received but not exercised.

Fulham.—The Electricity Committee reports the receipt of the Electricity Commissioners' sanction to borrow £11,124 for the purpose of mains extensions. As the Unemployment Grants Committee required the Council to undertake that no more than 75 per cent. of the standard rates should be paid to unemployed men engaged for this purpose, the Council has decided to proceed with the work at once without further regard to assistance from the Grants Committee.

L.C.C. and SMOKE NUISANCE.—The Public Control Committee of the L.C.C. states that in spite of warnings the nuisance of smoke from the generating stations of the Hammersmith and Islington Borough Councils continues. It accordingly recommends that, subject to the consent of the Ministry of Health, legal proceedings be instituted against the two Councils.

Nelson.—**LOAN.**—In order to provide work for the unemployed, the Town Council has decided to apply to the Electricity Commissioners for sanction to the borrowing of £8,458 for mains and services.

New Zealand.—**LOAN.**—A Bill authorising a new loan of £5,000,000, to be borrowed in London, was introduced in the House of Representatives on December 10th. Mr. Massey, the Prime Minister, explained that the money was required for development works, such as hydro-electricity, railways, roads, and the opening up of new lands. It is not proposed to raise the loan until the next financial year.—*Reuter* (Wellington).

Northallerton.—**REDUCED CHARGES.**—The Electric Light Co. has reduced the charges for public lighting from 7s. 6d. to 7s. 4d. per amp per 100 hours.

Northampton.—**REDUCED CHARGES.**—The Electric Light and Power Co., Ltd., has reduced the initial price of electricity for lighting purposes by 4d. per unit; the rent of hired motors by 10 per cent.; and for heating the charges will be reduced by the introduction of the following scale of discounts: 100 units per quarter, 5 per cent.; 200, 10 per cent.; 300, 15 per cent.; 400, 20 per cent.; 500, 25 per cent.

Paisley.—**NEW POWER STATION.**—Messrs. J. & P. Gault, Ltd., thread manufacturers, Paisley, are to erect at their Ferguie Mills a large electric power station, which is to cover a considerable area. The station will consist of a power house 150 ft. by 65 ft., a boiler house 100 ft. by 55 ft., and a pump house 52 ft. by 35 ft.

Leam.—Application is being made by the Town Council to the Electricity Commissioners for sanction to borrow £20,000 for the installation of new plant and mains.

Runcorn.—**ORDER REVOKED.**—The Minister of Transport has revoked, as from December 10th, the Runcorn Urban and Runcorn Rural Electric Lighting Order, 1910, as to so much of the amount supplied as is included in the parishes of Appleton, Crapenhall, Latchford Without, Stockton Heath, Higher Walton, Lower Walton and Thelwall.

Rushden.—**REDUCED CHARGES.**—The Electric Supply Co., Ltd., has reduced the charges for electricity for power and heating by 4d. per unit.

Scarborough.—**PRICE INCREASE.**—The Scarborough Electric Supply Co., Ltd., is applying to the Electricity Commissioners for authority to increase the maximum charges.

Sevenoaks.—**NEW PLANT.**—The Sevenoaks and District Electricity Co., Ltd., is installing a 200-kW alternator in its works. The engine, which is being supplied by Messrs. Mirreles, Bickerton & Day, is of the six-cylinder Diesel type.

Sherborne.—**ORDER REVOKED.**—The Minister of Transport has revoked the Sherborne Electric Lighting Order, 1912, as to the whole of the area of supply as from December 10th.

Shrewsbury.—**LOAN.**—The Town Council has decided to apply to the Electricity Commissioners for sanction to borrow £2,650 for electricity purposes.

Spalding (Lincs.).—The Urban Council has refused to grant permission to the South Lincs Agricultural Co. to supply electricity to the residents close to the works.

Torquay.—**PURCHASE OF UNDERTAKING.**—The Town Council has ratified the negotiations with Newton Abbot Urban Council in connection with an electricity scheme, under which the undertaking at Newton is to be acquired either by the Urban Council or jointly with Torquay, and Newton will be supplied with electricity at 10d. per unit instead of 1s. as at present. The cost of the electricity works at Newton is £65,000.

Walton-on-Thames.—**ELECTRICITY EXTENSIONS.**—It was reported at a recent meeting of the Urban Council that the Electricity Company, having obtained an order increasing the price of energy, intended to proceed at once with improvements for the supply of electricity at an estimated cost of £15,000.

Waterford.—**PROPOSED ELECTRICITY SCHEME.**—The Electric Lighting Committee has instructed an engineer to prepare a new scheme of public and private electric lighting for the city.

Weybridge.—**PROTEST AGAINST INCREASED CHARGES.**—The Urban Council has decided to send a protest to the Ministry of Transport against the granting of an Order to the Electricity Co. increasing the price of electricity to 1s. per unit, with a minimum charge of 15s. for each winter quarter and 10s. for each summer quarter. A protest has also been lodged by the Walton-on-Thames Urban Council.

Whitehaven.—**LOAN.**—The Town Council has applied for a loan of £8,500 for boilers, super-heaters, stokers, pipework, feed pump, and extensions to the economiser. There is to be a small reduction in the charges for energy as from the New Year.

Wicklow.—**ELECTRICITY SUPPLY.**—Owing to the cost of gas, the Council has under consideration a proposal for the supply of electricity to the district.

Worthing.—**EXTENSIONS.**—Extension of plant at an estimated cost of about £17,000 has been decided upon by the Town Council on the advice of the resident electrical engineer (Mr. Geoffrey Porter). The latter considers it essential that this extension should be taken in hand without delay in order to safeguard the supply during the winter of 1922-23, and he proposes the provision of a further 500-h.p. Diesel engine with a 350-kW generator. This will increase the total capacity of the undertaking to 1,460 kW.

TRAMWAY AND RAILWAY NOTES.

Australia.—**MELBOURNE.**—The Legislative Assembly has passed a Bill authorising the inauguration of electric railless trolley systems in the outer suburbs of Melbourne.—*Reuter's Trade Service* (Melbourne).

SYDNEY RAILWAY EXTENSIONS.—City railway extensions, estimated to cost £4,500,000, are to be proceeded with in Sydney, New South Wales, in order to relieve the existing rail and tramway services. In 1905 the tramways on the southern shore of Sydney Harbour carried 120,973,934 persons; in 1920 the number had risen to 269,255,033. Directly and indirectly the extensions authorised should provide employment for 5,000 men.

Bradford.—**APPLICATION FOR PROVISIONAL ORDER.**—The Parliamentary Sub-Committee of the Finance Committee has recommended that application be made to the Ministry of Transport for a Provisional Order authorising the Corporation to use railless trolley vehicles on any route within or outside the city, and for power to remove the existing limit of five tons, imposed by the Bradford Corporation Act, 1910, on trolley vehicles used on the routes already adapted to these cars and on the new routes proposed.

Leam.—The Tramways Committee has decided to apply for sanction to the borrowing of £150,000 for track renewals, &c.

Brazil.—RAILWAY ELECTRIFICATION.—The freight locomotives recently shipped by the Westinghouse Electric & Manufacturing Co. to the Paulista Railways of Brazil, are now in service in that country between Jundiahy and Louveira. These are the first electric locomotives to be used in Brazil. The new locomotives haul trains of from 13 to 15 "units" over grades up to 1.5 per cent. The so-called "unit car" is of 10 tons gross weight, and the term refers to the old wooden car of 30 years ago. Modern cars are said to be two, three, or four units, according to their size and load. Thus a train of 45 units represents 450 tons weight, and is approximately 675 ft. in length. Under former steam operation such trains could not be hauled over a 1.5 per cent. grade at a speed greater than 15 kilometres per hour. The Westinghouse locomotives ascend such grades at 45 kilometres per hour, which means trebling the capacity of the track and greatly increasing the speed of handling freight shipments.

London.—COMPENSATION FOR UNDERGROUND RAILWAYS.—Under the scheme of compensation for the retention of railways by the Ministry of Transport during the war period, the Metropolitan Railway receives £211,950 and the Metropolitan District Railway £197,597. The awards are based on the net receipts in 1913.

EFFECT OF REDUCED FARES.—The report of the L.C.C. Highways Committee upon the first week's working since the introduction of lower fares, shows that, while the number of passengers carried rose from 12,037,284 to 13,266,976, the revenue fell from £91,712 to £89,814. The question of further fare reductions is to be postponed until the end of the financial year.

Scarborough.—CLOSING OF TRAMWAYS.—A conference of representatives of the Corporation, the Tramway Company, and the Ministry of Transport has recently been held to discuss the tramway undertaking, and it has been decided to cease running the cars at the end of this year.

The Tramwaymen's Agreement.—SUB-COMMITTEE APPOINTED.—In accordance with a recommendation from the Municipal Tramways Association, the National Joint Industrial Council for the Tramway Industry on December 15th appointed a sub-committee to review the terms of the agreement arranged in March, 1919. Mr. J. Beckett states in this connection:—"The Council have not committed themselves to retain in the agreement the guaranteed 48-hour week over which the whole of the trouble has arisen. The guaranteed week will be reviewed by the sub-committee in common with the other clauses in the agreement. The committee will meet at once and report to a special meeting of the Industrial Council in February."

Wigan.—MAILS ON TRAMWAYS.—The Wigan Tramways Committee is to receive the sum of £500 per annum for the carriage of mails and postmen on the electric tramcars.

Wolverhampton.—FARES.—At a meeting of the Town Council on December 12th an alteration of the 2d. minimum fare, for short distances, was advocated. The Tramways Committee considered this impossible, as the revenue was at present just about equal to the expenditure.

York.—NEW DEPOT.—The new tramway depot is expected to be open for use before Christmas.

TELEGRAPH AND TELEPHONE NOTES.

Czecho-Slovakia.—SERVICE EXTENSIONS.—At a conference dealing with the proposed increase in the telegraph and telephone tariffs the representatives of the Czecho-Slovak Ministry of Posts stated that during the last three years 8,417 kilometres of telegraph lines and over 1,300 kilometres of telephone lines had been installed in Czecho-Slovakia. Preparations are being made for the construction at Prague next year of automatic telephone exchanges.—*Reuter's Trade Service* (Prague).

China.—WIRELESS TELEGRAPHY.—Introducing a resolution at the December 12th meeting of the Committee on Pacific and Far Eastern questions at Washington, Mr. Viviani, the principal French delegate, emphasised the necessity of superseding competition by co-operation in the establishment of wireless communications between China and other countries. He urged the appointment of a committee composed of representatives of the Powers interested, and of China, which would act on the following principles: The better utilisation of capital, personnel, material, and wave-lengths. China shall possess as soon as possible her own wireless plant equipped with all the latest technical improvements available. The internal wireless communications of China shall be operated in accordance with Chinese law, whilst her foreign communications shall be dealt with by an International Convention. The Governments interested shall in no way support companies or persons who do not comply with the principles and regulations based upon the recommendations of the above-mentioned committee. Government and Press messages shall be granted a reduction of at least 50 per cent.—*Daily Telegraph*.

Germany.—WIRELESS TELEPHONY. Experiments are being made with a newly-invented apparatus, fixed on the express trains running between Berlin and Hamburg, by means of

which, it is claimed, wireless telephone messages can be dispatched and received while the train is in motion. It is stated that the experiments have been successful, and that as soon as apparatus can be made and installed, it will be possible for travellers on the expresses to speak with any subscriber on the telephone system of Hamburg or Berlin. Should this venture prove remunerative similar arrangements will be made for travellers on other long-distance trains.—*Morning Post*.

The Pacific Cable.—DUPLICATION APPROVED.—The Australian Federal Government has approved the duplication of the Pacific telegraph cable. As it is understood that the other governments concerned have assented to the scheme, and as funds to cover the cost are available from the Pacific Cable Board's reserves (as we recently announced), there seems to be nothing to prevent the immediate initiation of the work. The proposed route of the duplicate cable will be a considerable modification of the existing one; the line is to go via Auckland (N.Z.) and Suva (Fiji Islands) instead of Norfolk Island, and will proceed to Fanning Island and Honolulu instead of to Bamfield, which will result in a shorter route. It is proposed to connect Samoa to the new cable.

Telephone Service.—CORRUPT PRACTICES.—At the Guildhall on December 16th, F. A. Oppenheim, managing director of the Trade & Finance Syndicate, was summoned under the Corrupt Practices Act for giving £3 to H. W. Camp, assistant traffic superintendent, as an inducement to show him favour in obtaining better telephone service. Ald. Sir Vansittart Bowater took a serious view of the case and imposed a £20 fine.

Wireless Telegraphy.—PROPOSED STATION AT BARRY.—The Cardiff Chamber of Commerce is to send a deputation in company with representatives of the Newport Chamber of Commerce to the Postmaster-General to urge the establishment of a wireless station at Barry. Mr. R. O. Sanderson, the president, who introduced the subject, mentioned that pleasure steamer companies had been compelled by legislation to install wireless apparatus on their vessels, and they felt that if their steamers were dependent upon assistance reaching them from the present stations (the nearest one of which was Poldhu, Cornwall) the result might be disastrous. The necessity for a wireless station in the vicinity was emphasised by a mishap which occurred during the summer on the Welsh grounds, and assistance could have been on the way in a few minutes if there had been a wireless station at Barry.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Australia.—MELBOURNE.—February 1st. Victorian Government Railways. Four motor-driven grinding machines, with accessories.

February 15th. Postmaster-General's Department. Telephone apparatus and parts (Schedule 544). (December 9th.)

Belgium.—December 28th. Belgian Ministry of National Defence, 10, Rue de Meriden, Brussels. Miscellaneous materials, including 14 tons of bronze wire, 13,000 double-bell insulators, and 272 head fittings with two ear-pieces for listening to and receiving wireless telegraph messages. Particulars (3 francs) from 15, Rue des Augustins, Brussels.

GOVERNMENT.—December 29th. According to the British Chamber of Commerce in Belgium, there is to be a public adjudication for an electric light installation at the Military Depot of St. Bernard (Hemixem), and the matter is open to competition from both Belgian and foreign firms. Amount of contract: Fr. 127,615. Deposit: Fr. 12,800. Specification (4 fr.) and plans (2 fr.) can be obtained at the Musée Commercial, 15, Rue des Augustins, Brussels.

Bulgaria.—February 10th. Bulgarian Post and Telegraph authorities in Sofia. Two thousand sets of telephone receivers and transmitters with accessories.

Bradford.—December 24th. Electricity Department. Rotary converting plant (Cont. E.207.) (December 9th.)

Chile.—February 4th. State Railways. Twelve windmills, complete; one electric compressor; one air-storage drum and d.c. motor; 1,300 metal filament lamps for lighting locomotives; 38 wall telephones.*

East Ham.—January 12th. Electricity Department. One 1,500-kW converter, either rotary or motor type; e.h.p. and l.p. switchgear and connectors. (See this issue.)

France.—January 16th. The French Post, Telegraph, and Telephone Authorities at Rabat. Eighty tons of copper wire, 3 mm. dia.

December 29th. French Ministry of the Colonies, 27, Rue Oudinot, Paris. Fifteen tons of copper wire.

"Beama" Scholarships.—The British Electrical and Allied Manufacturers' Association has, on the recommendation of its Education Committee, recently granted the following scholarships, each tenable for one year and each carrying a maintenance allowance of £100 and the payment of college fees:—

In *Electrical Engineering (Steam Turbo-generators)*.—L. H. L. Badham (tenable at the City and Guilds [Eng.] College, South Kensington); J. H. Butcher (tenable at the City and Guilds [Eng.] College, South Kensington); J. E. Macfarlane (tenable at Brighton Technical College).

In *Mechanical Engineering (Steam Turbines)*.—W. S. Bowers (tenable at Finsbury Technical College); J. A. Snape (tenable at Manchester College of Technology); M. L. Yates (tenable at Manchester College of Technology).

Lighting Large London Stores.—That the proportions and architectural embellishments of buildings need not be hidden as soon as evening sets in is demonstrated by the first section of the new Selfridge Building, where a complete system of



EXTERIOR LIGHTING.

"flood-lighting" has been recently installed. We are able to reproduce a view of the building taken at night, and the way in which the details of the columns and cornices are thrown into relief is particularly striking. The "flood-lights" are of a standard design, and consist of a solid copper body lined with sectional parabolic reflectors of mirror glass. They are equipped with 400-watt Osram gasfilled projection-type lamps, with specially concentrated filaments. The installation was designed by the General Electric Co., Ltd., and is the first example of "flood-lighting" as applied to large London stores.

Pacific Cables.—Reuter's Agency is informed (December 14th, 1921) that the negotiations between the United States and Japan have led to an agreement being reached between them with respect to the Island of Yap and other mandated islands in the Pacific Ocean north of the Equator. The points of the agreement are as follows:—

1. The United States shall have free access to the Island of Yap on a footing of entire equality with Japan, or any other nation, in all that relates to the landing and the operation of the existing Yap-Guan cable or of any cable which may hereafter be laid by the United States or its nationals.

2. The United States and its nationals are to be accorded the same rights and privileges with respect to the radio-telegraphic service as with regard to cables. So long as the Japanese Government shall maintain on the Island of Yap an adequate radio-telegraphic station, co-operating effectively with cables and with other radio stations on ships and shore, without discriminatory exactions or preferences, the exercise of the right to establish radio-telegraphic stations at Yap by the United States or its nationals shall be suspended.

3. The United States shall enjoy on the Island of Yap the following rights, privileges, and exemptions in relation to electrical communications: (a) Rights of residence without restriction and of acquisition and enjoyment and undisturbed possession upon a footing of entire equality with Japan or any other nation of all property and interests, both personal and real, including lands, buildings, residences, offices, works and appurtenances. (b) No permit or licence to be required

for the enjoyment of any of these rights and privileges. (c) Each country to be free to operate both ends of its cables, either directly or through its nationals, including corporations and associations. (d) No cable censorship or supervision of operations or messages. (e) Free entry and exit for persons and property. (f) No taxes, port, harbour, or landing charges or exactions, either with respect to the operation of cables or to property, persons or vessels. (g) No discriminatory police regulations.

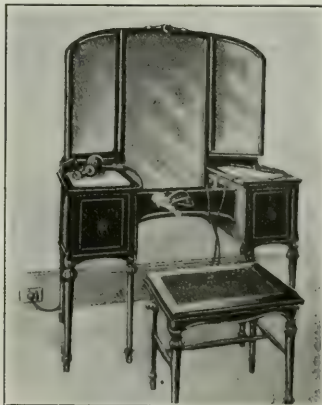
4. Japan agrees that she will use her power of expropriation to secure to the United States the needed property and facilities for the purpose of electrical communication in the island, if such property or facilities cannot otherwise be obtained. American property and facilities for the purpose of electrical communication in the island are to be exempt from process of expropriation.

A formal convention will be drawn up for signature and will be subject to ratification by the Senate.

The *Times* says that by the agreement the U.S.A. obtains the right to use the Yap-Shanghai cable for messages to Japan and also the use of the cable to the Dutch Indies.

An "Underground" "Speeding-up" System.—The Underground railway authorities have installed a system at their Kilburn Park station, calculated to expedite the passage of travellers past the booking office. The "passimeter" system, as it is called, involves the use of three separate cyclometers, two automatic and one non-automatic. The first registers, dates, and cancels each ticket, and the passenger passes through an ordinary turnstile adapted to operate the second meter. A third cyclometer is used by the booking clerk to record the number of season-ticket holders passing the barrier. The system permits the traveller to pass straight through to the platform, thus saving a great deal of time during the "rush" periods. The "passimeter" system is used in conjunction with the automatic ticket-issuing device mentioned in our columns a short time ago. This is operated by the booking clerk pressing buttons, thus releasing any number of tickets at once, up to five. Five magazines, containing tickets of different prices, are provided. The pressing of a button starts up a small electric motor, which revolves drums upon which are projections that pick up the number of tickets required in a strip. The strip is then brought up through a slot near the pigeon hole and a knife attachment cuts them off. The number of tickets issued through each slot is automatically registered, and later designs of the machine will have a dating attachment.

Electrically-equipped Furniture.—The November issue of the National Electric Light Association *Bulletin* contained a well-illustrated article on the practicability of electrically-equipped furniture. Mention is made of exhibits of this nature at the recent New York Electrical Show, and the illustrations show a number of examples. Amongst these is a table, intended for a breakfast or dining room, equipped with two "outlets" neatly fixed to the edge of the table-top, from which short lengths of "flex" are taken to a toaster and grill or other appliances. Connection to the house wiring is made by means of a floor outlet. The overhanging table-cover common in this country is of course done away with



AN ELECTRICALLY-EQUIPPED DRESSING TABLE.

and a smaller one substituted. A dressing table, shown in the article, and which we reproduce, is provided with wiring and outlets for curling tongs, hair dryer, and vibrator. The electrical fittings do not detract from the appearance of the table. A picture of a bed appears; this has a light fixed on either side of the head, as well as a heating-pad connection. There is apparently a great deal to be done in this direction. In this country the tendency has been to build special furniture for electrical equipment.

Newcastle Housing Exhibition.—The recent Housing and Home Life Economy Exhibition that was held at Newcastle-upon-Tyne from November 18th to December 1st, 1921, proved a great success, the central feature being the stand of the Newcastle-upon-Tyne Electric Supply Co., Ltd., and associated companies.

An attempt to get away from the usual type of exhibition stand was made by dividing the stand into three portions, one of which was erected to a half-timbered model house.

On the first, containing a dining room and bedroom furnished and decorated to illustrate the artistic effect of electric lighting, and containing electrical heating and lamp-holder apparatus; the second portion was used for showing fittings, heaters, and small cooking apparatus, the third portion being fitted up as an electric kitchen.

The dining room, with latticed windows and stained oak beam ceiling, was furnished in Jacobean style, the fireplace being tiled and containing a "Magical" fire. The lighting was by an Italian mosaic bowl fitting and a handsome ebony standard lamp. On the table were shown an electric toaster, coffee percolator, and kettle, and on the mantelsheff was an oak-cased electric clock. The bedroom was decorated in white and blue with oxy-silver electric light fittings and heater. Two types of bedwarmer were shown on the bed, over which was a pendant light with a push-button switch.

In the central portion of the stand various two-light wall bracket fittings were shown on the dividing wall, and bowl fittings suspended from the ceiling. Here were also immersion heaters, grinders, kettles, irons, hair-driers, massage sets, a sewing machine with motor, and electric heaters, and electric clocks with electric control. A wireless telephone receiving set was installed in one corner and proved a great attraction, music and speech being transmitted from another part of the hall.

The remaining portion of the stand was fitted as a kitchen complete with a sink, water supply, electric wash-boiler, and electric hot-water supply, and contained electric washers, dish washers, and electric cookers. Continuous demonstrations were given with all the apparatus. The cooking always drew a crowd, and on one side of the stand clothes were washed in an electric washer, dried and ironed, and on the other side electric dish washers were shown in use. The hot-water circulator and wash-boiler were supplied by Messrs. Watson Norris, Ltd., of Wallsend; the cooking was carried out on a Jackson No. 20 Cooker; the washing machine used was a "Universal"; and the dish washers shown were of the "Western Electric" and the "Whirlpool" types.

The whole of the stand was wired with "Stannos" wiring and a considerable amount of business was done at the exhibition. A great advantage of the stand was that the domestic uses of electricity were demonstrated to many who could not be reached by any other method of advertising.

The Newcastle-upon-Tyne Electric Supply Co., Ltd., also furnished the full electrical equipment for the caterers of the restaurant that was attached to the exhibition, which gave entire satisfaction. The plant consisted of one large double oven, two oval fish fryers, two grinders and toasters, and two water urns, all of which were made by the Jackson Electric Stove Co., Ltd.

An Electrically-driven Ship.—Considerable interest was taken at Liverpool recently in the new electrically-driven Swedish vessel *Mod*, which, whilst in port loading up with cargo, was inspected by Prof. Abell, Dr. Marchant, Prof. Watkinson, and the staff of the Faculty of Engineering, Liverpool University. The installation consisted of two boilers, burning coal under a forced draught, and supplying steam at 200 lb. pressure to two Ljungstrom turbo-alternators, which occupy positions that would have been filled, in the case of a twin screw steamer, by the port and starboard turbine sets. A condenser is fixed under each turbine, and also electrically-driven wet and dry air pumps and a feed-water heater. Running at 4,200 r.p.m., each main generator is calculated to develop 1,000 kW at 900 volts, 50 cycles, 3-phase. The 3-phase slip-ring propelling motors, when running at 750 r.p.m., give a propeller speed of 75 r.p.m., and the speed of the *Mod* is nearly 12 knots. As to the controls of the vessel, a hand wheel operates the main switchgear, whilst two field-regulating switches vary the voltage of the generators. A steam-driven set generates direct current at 110 volts for lighting purposes. With the exception of the bilge pump all the engine-room auxiliaries are electrically driven by power taken from the main generators. It was demonstrated that the movements and operations of the propeller, starting, stopping, slowing, &c., can be controlled in less time than is possible with a steam engine. A hand-wheel on the controlling switch gear is the propeller control.

The Stephan Burglar and Fire Alarm.—This novel protective system, which was demonstrated recently in the presence of representatives of the Scottish Yard, the London Fire Brigade and Salvage Corps, insurance companies, &c., is based upon the fact that resistance and capacity which are connected with a circuit can be a person coming within the circle of a fire alarm. It is pointed out that the demonstration device was caused to function as a fire alarm by an increase in the temperature of the air adjacent to the protected object. As a burglar alarm it functioned on the approach of the

demonstrator to within a few inches of the protected object and before he had time to actually touch it. The sensitivity of the system is apparently, augmented by the use of a Siemens thermionic valve amplifier, and its operation is not interfered with in any way should the burglar attempt to insulate himself; the alarm is not actuated by vibration, and it is hardly necessary to mention that the new system reacts also on any attempt to destroy wiring, apparatus, or the case containing the latter.

The apparatus is held compactly in a case approximately 2 ft. 3 in. high, 10 in. wide, and 5 in. deep, and can be placed either in the room itself which is to be protected, or at any distance from the rooms or objects to be protected. If larger areas are to be protected, the contrivance can be centralised and the endangered locality reported to a central station by acoustic and optical signals. If the case is placed in the room which is to be protected, an intercom or time switch permits the person occupying the room to leave it without releasing the alarm.

The connection between the apparatus and the rooms or objects to be protected consists of a thin lead-covered cable, which can easily be attached to or embedded in the wall and whose intentional or accidental destruction releases the alarm at once. It is possible to protect easily accessible and isolated objects of any kind, no matter whether they are made of metal, china, wood, fabric, or other material. The device is in the hands of Messrs. J. G. and R. B. Wainwright, Ltd., of London.

Service Note. The introduction into the Navy of "director firing," of which Sir Percy Scott was the inventor, has given birth to a new training course. In order that "director layers" shall be conversant with the electrical aspects of the instruments they are required to use and to help maintain, and appreciate more thoroughly the necessity for careful handling, they are to undergo a five-days' course in low-power electricity in the torpedo schoolship *Vernon* on completing the existing qualifying course for director layers, says *The Times*.

The Old Brigade.—It is proposed to hold a dinner at the Hotel Cecil on January 20th for "Municipal Electrical Old Stagers," i.e., those who served as chief engineers, or as assistants, subsequently becoming "chiefs," of municipal undertakings before December 31st, 1900. A number of distinguished "electrical" gentlemen have been invited. Tickets, 25s. each, inclusive of wine, may be obtained from the Secretary to the Committee which has been formed—Mr. C. H. Wordingham, C.B.E.

"Trade Follows the Telegraph."—The fact that news of the Irish settlement reached Australia within 14 minutes of its dispatch from London was related by Mr. John Lee, controller of the London Central Telegraph Office, in an address to the Birmingham Business Club recently, entitled "International Telegraphy in its Relation to Commerce." One million communications a month, he stated, passed to and from England over Government-owned lines and cables, of which 525,000 represented the incoming traffic. It might be taken that it was the purchaser or the intending purchaser who sent the telegrams, and as the incoming traffic increased, sooner or later, it would mean trade would increase also. "There is a popular superstition," said Mr. Lee, "that trade follows the flag. Don't you believe it! Trade follows the telegraph."—*Birmingham Post and Telegraph*.

Engineering in France in the Vacation.—We are informed that certain French engineering firms of the Lorraine district (rolling stock, railway material, &c.) have kindly consented to accept for periods of two or three months a few British engineering students during their summer holidays; applications, in writing, stating age and qualifications, and giving references, will be received (until further notice) by the Hon. Sec., British Section of Société des Ingénieurs Civils de France, 45, Great Marlborough Street, London, W.1.

The students will not receive any salary, and will make their own arrangements for the journey, board and lodgings. Local members of the Société will give advice in these matters if desired. The students, in their own interest, will undertake to submit to the same discipline and working hours as their French colleagues on the works' staff. Some knowledge of the French language is advisable.

Electrolytic Zinc Co. of Australasia.—An official cable states that the first unit of the main plant at Risdon, Tasmania, of the Electrolytic Zinc Co. of Australasia, which will absorb 15,000 h.p., started running on November 22nd. "Everything is running satisfactorily and in a few weeks it is expected the full output of this unit will be reached." It is added that "the complete plant, absorbing 30,000 h.p., will, it is expected, be running well before the end of 1922 with an output of from 40,000 to 45,000 tons of refined zinc per annum." The Electrolytic Zinc Co. of Australasia was formed in October, 1920, with a capital of £3,000,000, half in cumulative preference and half in ordinary shares, to acquire and extend a zinc ore treatment works at Risdon, Tasmania. Large participations were taken by the Amalgamated Zinc, North and South Broken Hill Companies and the Zinc Corporation; the shareholders in these and other Australian mining enterprises were invited to subscribe for shares.—*Financial Times*.

The Electro-Harmonic Society.—The veto placed on the too-early booking of seats seems to have had little or no effect upon members' attendance; the Great Hall of the Cannon Street Hotel was crowded on Friday evening last. Sir James Devonshire, K.B.E., occupied the chair, and a very good programme was "put on." Every item was well received, the programme including pianoforte *solo* by Mr. Bernard Flanders, A.R.A.M.; songs by Miss Winifred Kennard and Messrs. Barrington Hooper and Harry Dearth, and humorous and other items by Messrs. W. V. Robinson, Bernard Turner, Wilson James, and Harry Davison.

It does not appear that the attendance at the concerts during the first half of the session has been affected by the alteration which the committee recently found it necessary to make in the subscription. As we stated a month or two ago, resignations were foreseen as a result of the increase, but we understand that in actual fact they have been very few in comparison with the number expected, while the number of new members elected has been very gratifying. We think it only right to state the real position, because those who are under a misapprehension themselves and are not disinclined to circulate their wrong impressions among other people, may be brought to see that the change which the committee regarded as essential in the best interests of the whole society has been fully justified. That the audience on Friday last found the programme prepared for them very much to their taste was evidenced by the fact that every item from beginning to end was enthusiastically enjoyed.

The Batti-Wallahs.—The efforts made to get members of the Batti-Wallahs' Society to take a greater interest in that body would seem to have failed, for a circular announces that owing to the small attendances at recent functions the committee on the 2nd inst. decided to abandon all meetings fixed for the future, excepting the annual dinner and the summer meeting. Mr. F. Pooley, the hon. sec., and Mr. A. J. Greenly, the hon. entertainment secretary, are resigning at the next annual meeting.

INSTITUTION NOTES.

Institution of Electrical Engineers.—An extraordinary meeting of the Institution will be held on January 12th, 1922, when three sets of cinematograph pictures will be exhibited on the screen, accompanied by explanatory notes.

LIVERPOOL SUB-CENTRE.—Mr. J. S. Highfield, the president, addressed the members of the Sub-Centre on December 12th. He outlined the advantages gained by the Institution for its members by the grant of the Royal Charter, and pointed out the great use that Centres and Sub-Centres could be in guiding the Council. Dr. S. P. Smith followed the president, and gave his lecture on "Single- and Three-phase Commutator Motors with Shunt and Series Characteristics." The lecture was well illustrated by lantern slides. Mr. Teago opened the discussion and dwelt on the main points brought out by the lecturer, and added a few remarks outlining some research work carried out by him under the direction of Dr. Vauchant at the Laboratories of Applied Electricity, The University, Liverpool, on a motor of similar characteristics. Messrs. Peck, Dawbarn, Young, Malpas, Rettie, Clothier, Abernethy, and Ashby also took part in the discussion. After the meeting experiments were carried out in the laboratories on the motor referred to.

SCOTTISH CENTRE.—Mr. H. Martin delivered an abstract of the paper on "Cyc-Arc" automatic welding before the Scottish Centre at Glasgow on December 13th. The lecture was fully illustrated by lantern slides. Many examples of welded specimens were exhibited, and a demonstration of welding was given which showed the various operations, but the results obtained were not satisfactory because the supply voltage was rather low. It is interesting to note that the supply was taken from the battery of an electric vehicle.

Physical Society of London.—The twelfth annual exhibition of electrical, optical, and other physical apparatus will be held as usual on January 5th and 6th, 1922, at the Imperial College of Science, South Kensington. Tickets of admission are obtainable from the secretaries of the Physical and Optical Societies and the Institution of Electrical Engineers.

Institution of Production Engineers.—A general meeting of the Institution will be held on December 30th at the Institution of Mechanical Engineers. Mr. G. H. Hales (member of Council), works manager of Messrs. Drummond Bros., Ltd., Guildford, will deliver a paper, to be illustrated by lantern slides, dealing with "The Costing System and its Relation to Production." Advance copies of the paper will be available a few days before the meeting, and may be obtained on application to the hon. secretary.

Cheilmford Engineering Society.—On December 8th Mr. D. Spencer, of Messrs. Armstrong, Whitworth & Co., Ltd., read a paper on "Hydro-electric Opportunities." Mr. G. F. Barrett, O.B.E., the president, being in the chair. The lecturer explained that although only a small amount of water power had been developed in the British Isles, there was a large quantity, estimated at 900,000 h.p., available. An abundant and cheap supply of electric power might easily

be provided in countries such as India and Australia with hydro-electric equipment. The lecturer held the view that in a few years' time India and Australia would become great manufacturing countries, and that the latter would manufacture wooden goods instead of sending the raw wood to this country. Invariably hydro-electric schemes necessitated a long transmission line, but the present tendency was to use much higher pressures than hitherto. Mr. Batalliard described the Francis turbine and the Pelton wheel. He dealt with various points in the design and construction of turbines and their application.

Faraday Society.—At the annual general meeting of the society held on December 13th the following officers were elected:—President, Professor Alfred W. Porter, F.R.S.; Vice-presidents, Mr. W. E. Cooper, Dr. J. A. Harker, F.R.S., Prof. C. H. Desch, Mr. E. H. Hartschek, Prof. F. G. Donnan, C.B.E., F.R.S., Prof. T. M. Lowry, C.B.E., F.R.S., and Dr. G. Senter; Treasurer, Mr. Robert L. Mond. The annual report stated that the work of the society had greatly expanded, and an appeal was made for an increased membership without which it would be difficult for the society to keep pace with its increasing activities without a higher subscription.

Glasgow and District Radio Club.—At a meeting of the club that was held on October 12th the president gave Part I of his lecture on "The Theory of the Thermionic Valve." Mr. Snodgrass dealt with the emission of electrons from heated bodies and, with the aid of diagrams on the blackboard, explained the working of a valve up to the point where it begins to oscillate. At the meeting on October 25th Mr. Snodgrass favoured the members with Part 2 of his lecture. November 9th was an "open" night, and after the conclusion of routine business the secretary read a letter from the Wireless Society of London with reference to arrangements which are being made between the Marconi Co. and the G.P.O. authorities regarding proposed special weekly transmissions for the benefit of amateurs. Mr. Wm. R. Clark discoursed on the "Electronic Theory of Electricity" on November 23rd. Some receiving apparatus is being rejuvenated by a sub-committee, and will be in use shortly. In this connection the club is highly indebted to the following members for gifts of accessories:—Messrs. W. Yuill, W. K. Dewar, D. C. Wright, D. B. McQuistan, A. Pick, J. T. McDade, and E. Snodgrass. "Buzzer" practice is now available each meeting night between 7.30 and 8 p.m. for members.

Institute of Transport.—Mr. James Paterson, a director of Messrs. Carter, Paterson & Co., Ltd., lectured, under the auspices of the above-named Institute, at the Royal Society of Arts, on December 16th, on "The Operation of a Road Distributing Agency," remarking that the field for the electric vehicle was widening rapidly both at the expense of horse-drawn and the petrol-driven vehicle. In his opinion, the field of usefulness of that type of car would eventually be very much greater, especially for door-to-door delivery purposes.—*Financial News.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

The Times reports that Sir James KEMMEL was received on Tuesday last week by the King of Spain, who complimented him on the rapid completion of the Spanish Babcock & Wilcox works at Bilbao.

Councillor W. CHILTON has been appointed chairman of the St. Pancras Borough Council Electricity and Public Lighting Committee for the ensuing year.

Mr. GEORGE STEPHEN HERSCHELL, senior superintendent of the Edinburgh Telegraph Department, has retired after serving in the Post Office for 47 years. At a meeting presided over by Major Jayne, Controller of Telegraphs, Mr. and Mrs. Herschell were presented with gifts from the staff.

Mr. Alderman ATLEE has been appointed chairman and Mr. Councillor LAZARUS vice-chairman of the Stepney Borough Council Electricity Committee.

NEW COMPANIES REGISTERED.

Blockley Electrical Engineering Co., Ltd. (178,315).—Private company. Registered December 10th. Capital, £1,000 in £1 shares. To carry on the business indicated by the title. The first directors are: A. E. Beck, Dovedale, Blockley, Wares; L. A. Bask, Dovedale, Blockley, Wares. Qualification, Ten shares. Registered office, The Electricity Works, Blockley, Wares.

Lawford Ross, Ltd. (11,968).—Private company. Registered in Edinburgh December 10th. Capital, £2,000 in £1 shares. To carry on the business of electrical and mechanical engineers, &c. The first directors are: A. D. O'Hara, 45, Woodlands Road, Glasgow, residence merchant; W. G. Williams, 3, India Street, Charing Cross, Glasgow, manufacturer; W. Kerr, Grand Hotel, Charing Cross, Glasgow, restaurateur; P. J. Neeson, 39, Campbell Avenue, Langside, Glasgow, wire and spirit merchant; R. L. Ross, 35, Lawrence Street, Dovanhill, Glasgow, electrical engineer. Qualification, £20. Secretary, R. M. Broadbent. Registered offices, 170, Hope Street, Glasgow.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Oriental Telephone & Electric Co., Ltd.—Satisfaction for the year ended December 31st, 1931, of trust deed dated June 28th, 1903, of Rs. 5,000 of a loan agreement dated June 12th, 1907, securing £200,000.

Isle of Thanet Electric Tramways & Lighting Co., Ltd.—Preference of £14,500 prior-charge debentures announced December 6th, 1921. When announced. Charged on company's undertaking and property, present and future.

Chipperfield, Ltd.—Second mortgage debenture, dated December 1st, 1921, to secure £30. Charged on certain premises in Bridge Road, Oulton Broad, Suffolk. Holder: S. Bailey, 150, London Road North, Llewiston.

Saitax Manufacturing Co., Ltd.—Debenture, dated November 30th, 1921, to secure £2,535. Charged on the company's undertaking and property, present and future, including uncalled capital. Holders: J. H. Palmer, "Wilton Arms," High Street, Thornton Heath.

City of Oxford Motor Services, Ltd. (formerly City of Oxford Electric Tramways, Ltd.)—Satisfaction to the extent of £1,500 on November 24th, 1921, of charge dated February 19th, 1914, securing £46,000.

Electric Welding Co., Ltd. (31,364).—Return dated November 30th, 1921. Capital, £460,000 in £10 shares, 45,000 ordinary and 1,000 founders'. 22,417 ordinary and 917 founders' shares taken up, £10 per share called up on 14,084 ordinary and 917 founders'. £143,665 7s. 6d. paid, including £6,835 4s. 11d. paid on 2,583 ordinary and 36 founders' shares tendered. Calls in arrears amount to £13,179 17s. 5d. £83,330 is considered as paid on 8,333 ordinary shares. Mortgages and charges, £22,400.

Pacific & European Telegraph Co., Ltd. (36,683).—Return dated November 10th, 1921. Capital, £100,000 in £10 shares. All shares taken up. £40,000 paid, being 44 per cent. Mortgages and charges, £68,800.

United Electric Tramways Co. of Caracas, Ltd. (89,642).—Return dated November 29th, 1921. Capital, £260,000 in £1 shares. 170,000 shares taken up. £7 paid. £163,993 considered as paid. Mortgages and charges, £145,900.

Thos. W. Ward, Ltd. (31,020).—Return dated October 13th, 1921. Capital, £1,100,000 in £1 shares (150,000 first preference, 250,000 second preference, 600,000 ordinary, and 100,000 employees). All the first and second preference and ordinary and 25,491 employees' shares taken up. £621,626 paid. £403,963 considered as paid. Mortgages and charges, nil.

Electric Supply Corporation, Ltd. (52,036).—Capital, £250,000 in 45 shares. Return dated July 28th, 1921. 42,000 shares taken up. £175,000 paid on 35,000. £35,000 considered as paid on 7,000. Mortgages and charges, £154,914.

Fors Accumulator Foreign Patents, Ltd. (108,151).—Capital, £3,660. Return dated December 2, 1921. 2,048 ordinary shares of £1 each. Return dated January 11th, 1921 (mid July 22nd). 584 preference and 2,048 ordinary shares taken up. £132 paid on 132 preference. £2,500 considered as paid on 452 preference and 2,048 ordinary. Mortgage and charges, £125.

CITY NOTES.

The Tata Companies.

Andhra Valley Power Supply Co., Ltd., were held in Bombay on November 25th.

The report of the first-named company for the year ended June 30th last stated that the Government's consent had been obtained to the acquisition of lands and to the supply of electricity. Demands for power aggregating 60,000 h.p. had been received from factories, mills, &c., and Mr. F. W. Willis, the general manager of the other two companies, had been appointed to a similar position in the Tata Power Co. The route of the Roha-Bhira Railway has been constructed, and it was expected to have the 23 miles of track laid by the end of the present year. The laying of the lines between Chinchwad and Mulshi was practically completed before the monsoon, the heavy rains had necessitated a great deal of repair work on both railways. As a result of native agitation against the flooding of the site of the dam, the company agreed not to commence this before November, but the erection of staff quarters had been proceeded with in the meantime. A great deal of survey work had been selected. During the year all the transmission line towers between Panvel and Bhira were erected, with a few exceptions, and the telephone line connecting Roha with Kolad was completed. A sub-station was erected at Panvel to tap the Hydro-Electric Co.'s main, from which power would be taken to the sites of the tunnel and dam. Copper cable and insulators had been received for the single circuit between Panvel and Bhira, and orders for the second circuit had also been placed on favourable terms. The chairman, in moving the adoption of the report, said that the taking of power from the Hydro-Electric Co. for the constructional work at the dam, tunnel, and power house sites would obviate the costly transport of fuel, and the line being used for the purpose would form part of the main transmission line to Bombay. Upon the whole the year's progress had been satisfactory, with the exception of work on the Mulshi hydraulic division, which had been retarded by the action of native agitators, who had circulated false statements regarding the intention of landowners from the area, which was to form the dam. The company had decided to stop work on the hydraulic part of the scheme in the hope

that the owners would realise what was in their true interests. They had, however, successfully excavated the whole of the foundations of the dam and had found rock of good quality upon which the dam could safely be raised. A resolution was passed sanctioning the payment of interest out of capital on ordinary and preference shares for the year ended June 30th at the rate of 4 per cent. The retiring directors were re-elected. During the meeting a statement was distributed by the organisers of the agitation against eviction, announcing their intention of continuing their "satyagraha" or campaign, from the terms of which it appeared that the principal objection was to the influx of foreign, i.e., British, capital and "Western industrialism."

The report of the directors of the Tata Hydro-Electric Supply Co., Ltd., recorded a total income of Rs. 36,15,110. Deducting working expenses, Rs. 16,96,131, and depreciation, Rs. 3,00,000, the gross balance was Rs. 16,18,979. The addition of Rs. 87,956 brought forward brought the total disposable profits to Rs. 17,06,935. An interim dividend at the rate of 7 per cent. per annum for the half-year ended December 31st, 1920, absorbed Rs. 8,33,990. The directors recommended the payment of a final dividend at the rate of 7 per cent. per annum, less income tax, on preference shares and 7 per cent. on ordinary shares. This would absorb Rs. 8,57,570, leaving a balance of Rs. 15,49,365 to carry forward to the next account. Although working hours had been reduced from 12 to 10 per day, revenue had increased owing to some mills working extra hours and also to the completion of the second installation. Forty-six consumers were now taking power aggregating 45,000 h.p. Owing to the joint agency and management of the Hydro-Electric Co. and the Andhra Valley Co., arrangements had been made to inter-connect the systems to ensure a more certain continuity of supply. This linking-up had been achieved by aerial tie lines between the respective generating stations at Khopoli and Bhivpuri and the receiving stations at Parel and Dharavi. The extensions necessitated by the inter-connection were practically completed by the end of the year. The working of the power station and cables had been satisfactory. The total rainfall during the season amounted to 139 in., and the amount of water stored in the lakes was sufficient to meet the company's requirements up to the end of the next monsoon. In presenting this report, the Chairman (Mr. R. D. Tata) said that the company had hopes of an increased load in the near future; the local Tramways Company had been negotiating to take the whole of its power requirements from the Hydro-Electric Co. and its sister companies as early as possible. The dividend of 7 per cent. was approved and the report and accounts adopted.

The directors of the Andhra Valley Power Supply Co. reported that landowners whose land had been acquired up to date had been satisfied with the compensation paid them. The whole of the company's available power had been disposed of. About 80 consumers, chiefly textile mill owners, had contracted to take power from the company for a period of ten years at the rate of 725 anna per kWh, the consumers installing their own electrical equipment. The general manager reported that progress in the construction works had been good. Out of a total of seven million cu. ft. of masonry, 5.7 million cu. ft. had now been laid. The dam was now 138 ft. high; its finished height would be 190 ft. The masonry work on the auxiliary dam and the excavation of the tunnel had been completed, as had also practically all the important building work. All the generators had been erected, and two of these would be ready for service early in the New Year. Nearly all the transmission-line towers were in position, and the erection of one line was practically finished. Other plant installed included three banks of transformers and two 12,000-kW synchronous condensers. Good progress had been made in the installation of switchgear at mills and distributors had been laid to the supply points. In his speech the Chairman said that the first part of the system was complete and two pipe lines had been laid. It was expected that in 1923 all six pipe lines would have been installed and the whole of the Andhra system would be in commission. The connecting-up of all their consumers would occupy about two years, at the end of which the company would be in a position to commence the payment of dividends. The payment of interest out of capital during construction, at the rate of 4 per cent. per annum on preference and ordinary shares, was sanctioned.

The directors, in reporting for the year ending December 31st, 1920, state that the discussions with Government Departments concerning the prices of certain contracts

executed during the war, and concerning taxation, have caused delay in the presentation of the accounts, and are still continuing. In order to present the accounts for the annual meeting, it has been necessary to make estimates where no definite results have been achieved, and these estimates have been formed on conservative lines. All the company's works in the year 1920 were very seriously affected by labour disturbances inside and outside, and particularly by the prolonged maulers' strike, which threw all engineering and shipbuilding production out of balance. The company's electrical interests were fortunately less affected than the other branches. High prices of coal and of raw material, heavy taxation, and the disordered condition of foreign exchanges accentuated the un-

favourable circumstances, and the company, in common with others, suffered much from these adverse influences. Customers, under such conditions and in the hope of a future fall in prices, would naturally only effect purchases when forced by the necessity of their own requirements to do so, and trade was thus reduced to very narrow limits. Moreover, the large proportion of the company's works, kept at the disposal of the Government for the production of armaments, was practically empty of work, a fact which necessarily added to the difficulties which the company has had to face. The fall in value of all stocks and materials towards the end of the year caused losses which have been provided for in the accounts. In order to provide, without encroaching too much upon the company's cash resources, the requisite means for the change over from war to peace work, and for the extension of the company's electrical interests, the board authorised the creation of £4,000,000 7 per cent. seven-year notes. Of these £1,500,000 were issued in July, 1920. The issue expenses have been written off from the "premiums on shares reserve account." The profit as shown by the accounts is £541,261, out of which preference dividends have been paid for 1920 amounting to £395,985, leaving a balance of £145,275, which has been added to the "carry forward" from December 31st, 1919, of £846,364, leaving at credit of "profit and loss account" £991,639. In view of the necessity of conserving the company's resources in the present state of trade, the directors do not recommend the declaration of any dividend for the year 1920 on the ordinary shares.

C. A. Vandervell and Co., Ltd.

In their report for the year ending March 31st, 1921, to which we made brief reference last week, the directors express their regret that the result of the year's trading has shown a very considerable loss. This was caused by the sudden national trade depression which affected every industry in the country during the latter part of 1920 and at a time when the company had large contracts on hand for electrical equipment (the majority of which had to be cancelled), and had correspondingly placed large orders for material to meet customers' requirements. Thus heavy stocks were acquired at prices which had depreciated enormously by March, 1921, and which have been valued in the balance sheet now presented at the prices prevailing on March 31st, 1921. The programme of the company's works' production being at this period organised for an exceedingly large output, it was impossible immediately the cessation of orders occurred to retrench sufficiently at once to save the inevitable disproportion between establishment charges and productive labour, which has so militated against the company's trading during the year under review. Steps, however, were taken as soon as possible which have rectified this situation. The questions of the Excess Profits Tax, and allowances by the Government on the war plant and buildings, are not yet settled, but it is anticipated they will be cleared up satisfactorily to the company at an early date. In dealing with the accounts, the directors have withdrawn the £75,000 which was placed to reserve last year, and have also absorbed the £140,499 brought forward from the previous year, to meet the deficiency in this year's accounts.

The loss as per balance sheet is £251,472. The amount brought forward was £140,499, less dividends paid, £22,500, making £117,999, so that the balance of loss is £133,282, which will be reduced by £75,000 transferred from reserve account, after confirmation by the shareholders, leaving £58,282 to be carried forward.

Cape Electric Tramways, Ltd.

The annual meeting of shareholders was held in London on December 14th. Mr. Ludwig Breitmeyer (chairman), presiding, said the introduction of new rolling stock during the year had resulted in the more advantageous dealing with the heavy traffic in Cape Town, while ensuring more comfort for the passengers. On both the Cape Town and Port Elizabeth systems there had been an increase in the number of passengers carried, the total increase being 3,851,958. The previous year's figures were, however, low on account of the strike, and the true increase was about 1,800,000. The ratio of working expenses to income was only about 1½ per cent. higher than in the preceding year and, having regard to the downward trend of material and labour costs, the position was bound to improve as time went on. Both systems had been carried on without interruption during the year under review. The Cape Town municipality had decided not to exercise its option of purchase, but although the company was now secure until 1925, it could not undertake any extensive additions to the system owing to the feeling of uncertainty as to the municipality's decision when the question of acquisition again arose, unless an adequate return was assured and the recoupment of the expenditure was guaranteed.

French Companies.

The *Compagnie Industrielle des Téléphones* has declared a dividend at the rate of 40 francs per share for 1920-21, or 5 francs more than in the preceding year. The *Société d'Electro-Metallurgie de Dives* reports net profits and balance forward amounting to 6,676,000 francs for 1920-21, permitting of the payment of a dividend at the gross rate of 60 francs per share.

The *Société des Porcelaines et Appareillages Electriques Grammont*, owing to the growth in general expenses and the

depreciation of stocks, reports a loss of 765,000 francs for 1920-21, which has been carried forward.

The gross profits of the *Compagnie Générale d'Electricité*, of Paris, in 1920-21, are reported at 12,021,000 francs, as compared with 11,263,000 francs in the previous year, the net profits being 7,223,000 francs and 7,379,000 francs in the two years respectively. The dividend is at the rate of 60 francs per share as in 1919-20.

Société Paris-Rhône. The meeting of this company on November 3th passed the accounts of the preceding year. The profits amounted to 876,679 francs after payment of the statutory dividend of 6 per cent. on the capital, which absorbed 360,000 francs. The balance was allotted to the sinking funds of works under way and stocks in store, the Council having been led to take this step by the reductions which had occurred in the cost of prime materials during the financial year. Issue had been made during the course of this year of the 1,200 500-franc bonds authorised by the last meeting.

The following French electrical companies have increased or propose to increase their capital:—The *Compagnie Electrique de la Grosse (Chalmers-sur-Saône)* up to 1,500,000 fr.; *Tramways Electrique de Belfort*, issue of 2,000,000 fr.; *Société Electrique de Samois-sur-Seine*, issue of 200,000 100-fr. 6 per cent. shares; and *Société de Purification Industrielle des Gaz (electric precipitation)*, from 220,000 to 440,000 fr.

Claud Hamilton, Ltd.—At the annual meeting on December 12th Mr. A. J. Fergusson, who presided, said that the directors did not recommend the payment of a dividend this year, although the result of the trading for the year was one of the best in the history of the undertaking. They did this in order to consolidate the financial position, as there was a considerable bank overdraft to reduce. They were capitalising a portion of the general reserve fund and distributing an amount among the ordinary shareholders as fully-paid bonus shares in the proportion of one for every ten shares held. At an extraordinary general meeting which followed, the increase of capital by 10,000 ordinary shares of £1 each was agreed to, and the Articles were altered to permit of the payment of bonus shares.

Power-Gas Corporation, Ltd.—At the annual meeting, held on December 13th, the chairman (Mr. E. Lloyd Pease) said that the dearth of capital, high costs, and uncertainty as to the future were detrimental to the investment of money in industrial plant and machinery, but nevertheless the year's result was comparatively favourable. He protested against the excessive cost of the carriage of goods and the burden of municipal rates. During the year the company had purchased the patent rights of Continental water-gas plant and was now ready to commence manufacture.

Stock Exchange Notices.—Dealings in the following Securities have been specially allowed by the Stock Exchange Committee under Rule 148a:—

Llanelli and District Electric Lighting and Traction,—£125,000 seven-and-a-half per cent. debenture stock, issued at 94 per cent., partly and fully paid.

Reading Electric Supply,—£100,000 seven-and-a-half per cent. first mortgage debenture stock, issued at 95 per cent., partly and fully paid.

Newcastle-upon-Tyne Electric Supply, Ltd.—£750,000 6 per cent. second mortgage debenture stock, issued at 85½ per cent., partly and fully paid.

German Companies.—The Brown, Boveri Co., of Mannheim, is increasing its capital to 175,000,000 marks by the issue of 60,000,000 marks in new ordinary shares.

The Berliner Telefonfabrik Gesellschaft, of Hanover, is declaring a dividend of 20 per cent. for the last financial year, as compared with only 15 per cent. in the preceding twelve months.

Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less income tax on the preference stock, for the quarter ending December 31st, 1921, and the third quarterly interim dividend of 2½ per cent. on the ordinary stock free of income tax in respect of profits for the year ending December 31st, 1921, are announced.

Marconi's Wireless Telegraph Co., Ltd.—Dividend of 7 per cent., less income tax, upon the 250,000 7 per cent. cumulative participating preference shares; interim dividend of 5 per cent., less income tax, upon the 2,636,906 ordinary shares.

Victoria Falls & Transvaal Power Co., Ltd.—Dividend at the rate of 6 per cent. per annum less tax on the preference shares for the past half-year.

Manila Electric Corporation.—A dividend of 1½ per cent. for the past quarter on the common stock is to be paid. The company has changed its name from the Manila Electric Railroad and Lighting Corporation to the above.

Automatic Telephone Manufacturing Co., Ltd.—Dividend on the 6 per cent. preference shares for the half-year ending December.

Chile Telephone Co., Ltd.—Interim dividend of 3s. per share, free of tax, for the half year ended September.

Burmah Electric Tramways & Lighting Co.—There is put to general reserve and depreciation £5,000; £1,900 is required for Corporation tax, and a dividend of 8 per cent. is paid on the preference shares for the period ended September, 1915, leaving, says the *Financial Times*, £545 to carry forward.

STOCKS AND SHARES.

MONDAY EVENING.

The imminence of the Christmas holiday season has made no difference to the strength shown by the investment markets of the Stock Exchange. Nor has the great shopping carnival put any noticeable check upon the spending power of the investor, so far as Stock Exchange securities are concerned. One after another, new issues are snapped up avidly. The Llanelly & District 7½ per cent. debenture stock, offered at 94, is about ¼ discount; the Reading 7½ per cent. debenture stock which came out at 95, commands a small premium. The Newcastle Electric 6 per cent. second debenture stock offered at 85½ stands at ¼ premium above the issue price. British Thomson-Houston debenture has come up from 92½ to nearly a couple of points higher. The same tendency is making itself felt in practically every sound security, and, by way of illustration, it may be mentioned that dealers in the market for Home Railway prior-charge stocks complain that they have no longer any decent-sized lines to offer, whereas a month ago their books were heavy with stock.

District 4½ per cent. first preference has risen to 60, and the Assented first preference (interest 3½ per cent.) guaranteed by the Underground Electric Railways Co., of London, advanced to 47½. Even East London debentures are moving, the second-charge "A" stock rising to 59, the "B" to 30½, and the third debenture to 15½. Business has also been, marked in the company's fourth debenture at 9. Central London Assented stocks, of all three classes, have risen to the common level of 51½, while the non-assented stand at 35½, 40½, and 32½ for ordinary, preferred, and deferred stocks respectively. Districts have lost a point of their previous, and rapid, rise.

The feature of the week, however, amongst Undergrounds, is the way in which the Income Bonds of the holding company have been run up, the price mounting to 77½, showing a gain of 4 following a rise of 6 which took place last week. The company's £10 shares, however, have lost an eighth. It is interesting to set out the companies controlled and operated by the combine, and we take the following figures from a private brochure issued by a firm of Stock Exchange brokers to their clients. This gives, in short compass, an excellent idea of the way in which the interests are held and spread:—

Company.	Total capital.	Underground Electric Co. holding.	Revenue for year ending Dec. 31, 1920.
Metropolitan District ..	£14,687,821	£3,341,500	£17,250
London Electric ..	17,597,610	10,204,900	154,118
City and South London ..	3,423,829	1,872,630	38,385
Central London ..	4,556,000	Nil	Nil
London General Omnibuses ..	3,487,357	1,600,480	114,320
London and Suburban Traction ..	3,903,374	896,310	Nil
Associated Equipment ..	1,600,000	1,100,000	208,571
Miscellaneous holdings ..	6,798,395	287,707	4,000

£55,054,680 £19,393,347 £506,644

The Buenos Ayres Western Co., of the Argentine Republic, is raising fresh capital in the shape of 4 per cent. debenture stock in order to complete electrification work on the line at Buenos Ayres commenced some years ago. It was thought that this offer might prove the prelude of similar issues from the other Argentine Railway companies, but nothing further has been heard on this point. Meantime, the case for further extension of electrification by the steam companies is being strongly urged by those who look to a great revival of railway enterprise now that the companies have got back to something like their own footing of control, though it has to be remembered that, in certain respects, the Government retains a grip upon the railways.

The market for home electricity shares is very steady, showing, however, no particular feature on the week. It is by no means easy to buy shares in this department, and those which come in are rapidly absorbed by the regular investor. Prompts are ½ higher. The new issues are decidedly firm. Lancashire Electric Light & Power 7½ per cent. debentures, which came out at 95, have gone up to 102. County of London Electric 7 per cent. debenture is 10½ premium. In some of the stocks the dealers will quote only prices at which they are prepared to buy. Electric manufacturing shares are quiet. Siemens have been a good market at 21s. 6d. General Electric hardened to 18s. 6d.

The interim dividend on Marconis has just been declared and is 5 per cent., the same as that of a year ago. In consequence, the price hardened a little to 14½, while Marconis remain firm at a guinea. Anglo-American Telegraph deferred has risen to 18½, owing to the fact of the dividend impending. In the Eastern group, nothing of fresh consequence has developed. Prices maintain the slightly better tendency discernible last week. Westerns and both kinds of Globe shares are ex-dividend, recording most of the deduction in each case. Great Northern at 25½ are the fraction higher.

Conditions in Brazil are declared to be getting into a more cheerful state, and many of the railway and traction stocks have advanced during the past few days. Brazilian Traction common gained a couple of dollars. On the other hand, Rio Tramways and other bonds, which are affected by the rise or fall in the dollar, have come down substantially as the result, of course, of the manner in which the £ sterling has gone up in relation to the dollar. This does not touch Mexicans in any way, but the market in these is quiet again, interest having dwindled to a minimum.

Rubber shares remain out of the picture as regards public interest. The price of the produce scarcely moves from day to day. By the time these notes are published, it may be that further testimony will have been provided of the difficulties that beset the rubber-producing industry in any attempt to get varying interests to work co-operatively. Vickers went up on the issue of what can only be described as a poor report to the end of 1920, although the company, like all others of its kind, has naturally been faced with peculiar obstacles in changing-over from war to peace work. Nevertheless, the general markets of the Stock Exchange show sufficient strength to warrant the assumption, as well as the wish, that the recent recovery will help not a little in assisting the pleasures of a Merry Christmas.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.						
	Dividend.	Price Dec. 19, 1921.	Rise or fall.	Yield p.c.		
	1919, 1920.	1921.				
Brompton Ordinary ..	12 12	6½	—	29 4 8		
Charing Cross Ordinary ..	7 8	4½	—	8 17 10		
do. do. 4½ Pref. ..	4½	3½	—	7 4 4		
Chelsea ..	13 14	3½	—	9 8 2		
City of London ..	6 6	15½	—	6 13 4		
County of London ..	8 8	8½	—	9 2 10		
do. do. 5 per cent. Pref. ..	6 6	7½	—	7 10 0		
Kensington Ordinary ..	7 8	9	—	8 0 0		
London Electric ..	2½	2½	1	7 10 0		
do. do. 6 per cent. Pref. ..	6 6	8½	+ ½	9 12 0		
Metropolitan ..	6 7	8½	—	9 8 8		
do. do. 4½ per cent. Pref. ..	4½	2½	—	7 13 2		
St. James' and Pall Mall ..	13 13	6½	—	8 17 10		
South London ..	6 7	2½	—	10 13 2		
West Metropolitan Pref. ..	7 7	17½	—	8 0 0		
Westminster Ordinary ..	10 10	5½	—	8 10 2		
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref. ..	6 6	84	+ 1	7 2 10		
do. Def. ..	1½	13½	+ ½	8 2 2		
Chile Tele. ..	6 6	6	—	5 17 8		
Cuba Sub. Ord. ..	10 10	15½	—	10 0 0		
Eastern Extension ..	10 10	16½	—	6 2 2		
Eastern Tel. Ord. ..	10 10	16½	—	6 2 4		
Globe Tel. and T. Ord. ..	10 10	16½	+ ½	6 8 1		
do. do. Pref. ..	6 6	34½	+ ½	6 9 9		
Great Northern Tel. ..	24 24	24½	+ ½	9 8 2		
Indo-European ..	10 10	27½	—	9 2 0		
Marconi ..	25 15	1½	+ ½	8 11 6		
Oriental Telephone Ord. ..	12 12	2	—	* 6 0 0		
United R. Plate Tel. ..	8 8	13½	—	* 6 2 8		
West India and Panama ..	Nil	Nil	—	Nil		
Western Telegraph ..	10 10	16½	+ ½	* 6 8 1		
HOME RAILS.						
Central London Ord. Assented ..	4 4	51½	+ 2	7 15 4		
Metropolitan ..	1½	25½	—	5 17 8		
do. District ..	Nil	Nil	—	Nil		
Underground Electric Ordinary ..	Nil	Nil	—	Nil		
do. do. "A" ..	Nil	6½	—	Nil		
do. do. Income ..	4 2	77½	+ 4	* 8 18 0		
FOREIGN TRAMS, &c.						
Anglo-Arg. Trams, First Pref. ..	5½	12½	—	10 9 6		
do. do. 2nd Pref. ..	Nil	5½	—	8 0 0		
do. do. 8 per cent. Deb. ..	5 5	68½	—	7 17 8		
Brazil Tractions ..	Nil	Nil	+ 2	Nil		
British Columbia Elec. Ry. Pice. ..	5 5	68	—	8 12 4		
do. do. Pref. ..	5 5	92½	—	* 9 5 0		
do. do. Deb. ..	12½	67½	—	* 10 17 0		
do. do. Deb. ..	42 42	61½	—	6 18 3		
Mexico Trams, 5 per cent. Bonds ..	Nil	Nil	—	Nil		
do. do. 6 per cent. Bonds ..	Nil	27½	—	Nil		
Mexican Light Common ..	Nil	Nil	—	Nil		
do. Pref. ..	Nil	27	—	Nil		
do. 1st Bonds ..	Nil	5	—	8 2 8		
MANUFACTURING COMPANIES.						
Babcock & Wilcox ..	15 16	22	—	6 14 9		
British Aluminium Ord. ..	10 10	14½	—	8 0 0		
British Insulated Ord. ..	15 15	1½	—	10 0 0		
Callenders ..	15 15	18	—	10 18 2		
do. 6½ Pref. ..	6½	6½	—	8 18 8		
Crompton Ord. ..	10 10	13½	—	14 11 0		
Edison-Swan ..	10 10	—	—	—		
do. 5 per cent. Deb. ..	5 5	64	—	7 16 3		
Electric Construction ..	8 8	18½	+ 9d.	10 19 2		
Electric Electric ..	8 8	10½	—	15 0 0		
do. Pref. ..	6 6	12½	—	9 12 0		
Gen. Elec. Pref. ..	6½	17½	—	7 13 0		
do. Ord. ..	10 10	18½	+ 9d.	10 19 2		
Henley ..	15 15	20½	—	15 6 7		
do. 4½ Pref. ..	4½	38	—	6 2 2		
India Rubber ..	10 10	—	—	—		
Met. Vickers Pref. ..	8 8	12	—	9 2 10		
Siemens Ord. ..	10 10	10	—	* 6 7 7		
Telegraph Con. ..	20 20	21½	—	* 6 11 9		

* Dividends paid free of Income Tax.

SHIP LIGHTING—IN RELATION TO SAFETY, COMFORT AND EFFICIENCY.

By W. J. JONES.

(Abstract of paper read before the ILLUMINATING ENGINEERS' SOCIETY.)

CERTAIN general considerations with regard to ship-lighting are evident. Of paramount importance is reliability in the lighting, on which the safety of the ship depends. Again, there are special requirements in the form of weather proof wiring and fittings; the arrangement of lights is limited by restricted overhead space and the fact that fixtures must be rigid and unaffected by the motion of the ship. Lighting problems naturally depend on the purpose served by the ship, e.g., whether a warship, a liner, or a cargo vessel, but in all cases lighting under the deck is important by reason of the fact that the admission of daylight is restricted.

The question of providing artificial light on the deck itself is a more debatable one. To the landsman it would seem that work on the deck of a ship at night would be assisted by judicious lighting; shipmasters and officers, however, seem disinclined to use lights on decks of sailing ships, presumably on the ground that glare would prove distracting and even dangerous, and that the contrast between the lighted deck and the surrounding darkness would interfere with the look-out.

The wiring of ships is a matter of special importance in view of the fact that it is essential that the risk from fire from electrical defects be reduced to a minimum. The rules issued by the Institution of Electrical Engineers on ship lighting embody the most recent information and modern practice to ensure safety. One of the most important matters is to ensure that in passenger vessels there are spare generators to serve in case of breakdown. It may seem extravagant to split the generating plant up into a number of units, but the thermal efficiency of the small engines at full load is much greater than that of large ones that are under-run.

The main generators are usually capable of supplying the full normal requirements of the ship with one out of commission. This arrangement allows repairs or adjustments to be made and still preserve the continuity of the supply. It is usual to have an emergency plant, sometimes driven with an oil engine, placed well above the water line, for use in the event of the boiler room being flooded, or accumulators are installed on one of the upper decks to serve the same purpose.

Of the methods of distribution of electrical energy in the ship the ring method is coming more and more in favour, and in a modern liner the number of lamps called for often exceeds 10,000 or 12,000.

The electric lighting fittings must be of a strong and substantial design, and sufficiently rigid to withstand the motion of the vessel. On account, however, of the low head room that is available, they must necessarily be short. Fittings may be classified into three distinct types:—

1. Special ornamental or decorative fittings for first-class state rooms and saloons. These majestic fittings consist chiefly of a shell of cream porcelain which covers the lampholder. Frosted lamps are most frequently used in conjunction with these fittings. For state rooms berthlights are provided with Holophane bowls which focus the light to the position required (eliminating the possibility of disturbing the occupants of other berths with stray light).

2. Plain brackets and pendants for the passage ways and third-class rooms, in which utility is required rather than ornate appearance.

3. Watertight fittings, such as well-glass and bulkhead fittings, for the engine room, decks, and other exposed parts of the vessel.

For the purpose of steering, the Board of Trade specifies that there shall be navigation lights, and the visibility of such lights when seen at a distance is naturally of very great importance, and has been the subject of research at the National Physical Laboratory during recent years. The lamps for the masthead, stern light, and side lanterns are specified to consist of 32 c.p. carbon-filament lamps, having two filaments each of 16 c.p. operating in parallel; the reason being that should one filament fail it is a very remote chance that the other will go out of commission at the same time. It is important that the failure of any one of the lights should be immediately known, and some form of indicator is therefore necessary which will show by means of luminous indications when the lamps are burning satisfactorily, and also give an audible signal when they fail and a visual warning when one of the filaments of double-filament lamps breaks.

On the front of such an indicator is shown a deck plan of the ship in white enamel and having small circular windows in positions corresponding to those of the navigation lights. The glasses of the windows indicating the side lights are coloured red and green respectively, the windows indicating the masthead and stern lights being of white glass. The case contains switches which control the navigation lights. As long as the navigation lights are burning satisfactorily the windows of the indicator are illuminated from the inside by small indicating lamps, each window having its own lamp. The indicating lamps are not directly in series with the navigation lamps, but are connected in parallel with coils which are in circuit with the navigation lights; and failure

of the indicating lamp, therefore, does not interrupt the circuit of the navigation lamps. The coils act as switches and control the current to a superluminous lamp mounted on the top of the case.

In the event of any of the navigation lights failing, the indicating lamp corresponding to that particular light is extinguished immediately. At the same time the armature of the series coil falls away and, in doing so, completes the circuit of the bell. In the case of navigation lamps having double filaments, when one filament breaks the indicating lamp continues to burn, but with diminished brightness, and the bell does not ring. If the second filament should then break the indicating lamp is extinguished immediately and the bell will ring.

The decorative element of lighting is predominant in saloons and the fixtures may be of almost any design, usually in keeping with the design of the compartment. It is, however, necessary to particularly avoid glare and hard shadows. An intensity of 2 to 3 foot-candles is suggested as being adequate for this purpose. It is, however, almost impossible to employ high candle-power units because of the small head room, and this almost invariably means the use of a number of small units to obtain an even illumination.

There are apparently two general ways of illuminating a writing room or library: (1) By a general illumination of 1 to 2 foot-candle intensity, supplemented by table lamps or sconces; (2) by a much higher general illumination so designed as to be thoroughly diffused, having a value of 4 foot-candles.

In dining rooms, again, there are two methods of lighting: (1) By means of a general illumination, supplemented by table lamps; (2) by a higher general illumination. A foot-candle intensity of 2 to 3 is suggested.

It is usually somewhat difficult to illuminate engine rooms adequately on account of the multiplicity of overhead pipes, girders, ladders, &c., but, by making the surroundings light and, if at all possible, white, a vast improvement is obtained. It is usual to install well-glass fittings with 30-watt lamps, but, if these are used in very dark surroundings, the effect of glare is apparent. It is accordingly suggested that the engine rooms be lighted as far as possible with fittings provided with some means of obscuring the source of the light, and this may be done by shades or opalescent globes. It is important that all gauges and indicators be provided with local lights which have the source of light obscured from the eyes. Provision of good lighting, and by that is implied that it be sufficient in intensity and properly screened, is necessary, as machinery has to be handled while it is in motion.

Boiler rooms are probably the most difficult parts to illuminate of all, in view of the lack of reflecting and diffusing surfaces. Consequently, when a bare lamp is used, a distinct degree of discomfort is experienced from glare which results in a diminution of acuity of vision. Local lights must again be provided over the gauges and indicators.

In the smoking room decorative effect is the chief thing to be considered, but adequate illumination must be provided in order that card games may be played without eye strain. Two to three foot-candles should be sufficient.

Where the decorations of state rooms and berths demand it, the electric lighting fittings should be so designed as to be in harmony. Such apartments are essentially bedrooms, but at the same time must be the lady's boudoir, the gentleman's dressing room, and they are not uncommonly called upon to take the place of the hospital ward. It is here that the lack of comfort is most noticeable. A warm and cosy effect is required, but at the same time sufficient illumination is necessary for the dressing table. A general illumination of 1 to 2 foot-candles seems necessary, supplemented by local lights.

The lighting of decks offers several interesting problems. On sailing vessels an engine of relatively small dimensions driving a dynamo might deserve consideration simply for the purpose of providing artificial illumination unaffected by the wind, apart from its possible utility as a subsidiary means of driving the ship against adverse tides, &c. Unduly powerful deck lighting might be objected to on the ground of its interfering with a look-out into the darkness; this condition implies care in avoiding exposure of sources to the eye. Lamps should be shaded and the order of illumination on the deck-surface need not exceed that customary for safety in factories and yards on land.

The lowering of boats is always a matter of some difficulty and lighting for such a purpose should be of considerable help. In some vessels lights are suspended between the davits and are available for use both for lowering and loading the boats. A sufficiency of light for taking on and storing cargo is necessary, going far in the prevention of accidents. In practice it is usual to have lighting units suspended over the coal and cargo hatches, not shining in people's faces to facilitate the handling of material. Searchlights are lamps, but more recently the gas-filled lamp in focus type reflectors has been used with success.

When a ship is loading or unloading at the port, supplementary illumination from the supply on land may be pro-

vided, and there are important possibilities in this direction. Portable units of the "floodlight" type can be effectively used to and in the handling of goods by night and also to facilitate ship inspection and repair. In view of the frequently congested state of traffic at docks the use of artificial light to assist night working and shorten the period during which the ship remains in port is obviously important.

The lighting of ports and dockyards forms in itself a large subject, and presents difficulties by reason of the very extensive area that requires illumination. In these circumstances the order of illumination available is necessarily low, and it is all the more important to ensure that this light is distributed as efficiently as possible and to avoid glare from unshielded lamps within the range of vision, such as is liable to cause accidents.

Even in modern vessels the lamps still experience a considerable amount of vibration of high frequency. Helical traction lamps bid fair to entirely replace the old carbon lamps.

Of recent years the introduction of gasfilled lamps on board ship has made considerable headway, particularly in the large sizes for the purpose of illuminating the decks and for the facilitation of handling goods, and they appear to be quite satisfactory and are giving good life.

The economic feature of distribution does not call for a high voltage system on board ship because of the comparatively small area which has to be supplied with electricity compared with the amount of energy developed. In view of this fact 110-volt circuits are predominant, although some of the latest vessels which have been constructed have been provided with 220-volt circuits, but lamps operating on the higher voltage are not quite so robust in view of the fact that the filament is small in cross sectional area. There is a further point to be noted. In the case of gasfilled lamps the efficiency of the lamps of lower voltage is 10 or 15 per cent. greater than that of those operating at higher voltage, i.e., for the same wattage 10 or 15 per cent. more light is obtained.

A standard voltage should be introduced on board ships of the Navy and Mercantile Marine. At the present time the various voltages and types of lamps which are asked for, even in different vessels in the same service, increase the expense of manufacturing lamps in bulk, and make it more difficult to produce lamps of good uniform characteristics. A further fact to be borne in mind is that boats are often in port only two or three days, and supplies of lamps consequently have to be despatched at very short notice. It would greatly facilitate matters if lamps for only one, or at the most two, voltages had to be stocked for marine work in order to deal with these rush orders.

DISCUSSION.

Mr. F. PURSER FLETCHER (Admiralty) said there was probably nothing in common between the lighting of merchant ships and men-of-war. On some merchant ships they had 10,000 lights, whereas in the largest ship in the Navy there were not many more than 3,000, and the lighting was simply required to be sufficient to allow instruments to be read and to provide a reasonable degree of comfort in the mess rooms, cabins, and compartments of the ship. In battleships the low head-room made it impossible to use reflected lighting with any great degree of success. He had tried to illuminate the different spaces of ships so as to avoid eye-strain, but with the poorest degree of success. With regard to the lighting of boiler glasses at sea, one could have a high candle-power on the boiler fitting, but unless it were directed on to the level at the right angle the results were very unsatisfactory. The illumination given by 32 c.p. at a distance of 4 ft. and projected on to the boiler glass at an angle of about 10 deg. below the water level gave by far the best indication of the water level. In merchant ships the dynamics were near the upper deck, but it was the reverse in the Navy, and there was likely to be trouble with water in the event of the compartment being flooded. The same condition occurred with the wiring. It was difficult to arrange water-tight fittings to be satisfactory in the event of flooding of the compartment.

The American Navy's figures specifying the different degrees of illumination required were useless unless it were specified at what plane the intensity of illumination was to be given. In the merchant service one could use high candle-power search lamps with considerable satisfaction, but in the Navy it was not at present possible to use them in view of their frailty and inability to withstand the shock effects of sea service. Helical traction lamps appeared to be the most suitable for use in the Navy under conditions of gun-fire and shock.

In the electrical engineering department of the Navy attempts were being made to get artificial light similar to daylight. Sheringham shades and various types of daylight glass had been tried in order to get conditions that would not produce eye-strain. With all such systems the nearer one got to daylight the more one got the eye-strain. In some cases one could get 20 per cent. and in some less.

Mr. P. J. WALDRAM said that in a chart-room amply lit the reading of the charts would not be so easy as it would in a chart-room somewhat badly lit generally, but with the charts themselves well illuminated from below, which he

believed was the custom in the Navy. It would be impossible under sea conditions to light the deck with constant efficiency, and it was better under those conditions not to light it at all. On a ship failure of the electric lighting system generally synchronised with other emergencies which rendered it vital that men should be able to get to their stations at once. It was obviously highly dangerous to cause them to do so with their sense of feel, direction, and touch partially atrophied by having been able to go about their work at night under conditions of ideal safety.

The CHAIRMAN (Mr. C. H. WORDINGHAM) said the rules issued by the Institution of Electrical Engineers went much further than lighting, and referred to the whole of the electrical equipment of ships. The Institution rules as adopted by Lloyd's were now in a fair way of becoming universally recognised all over the world. A complete series of interchangeable weather-proof fittings was provided, and standard pressures had also been set up in those rules, and were likely to be worked to. On the smaller ships 110 volts was sufficient, but on the larger ones 220 volts had such great advantages that it would be very largely adopted. He did not think it was necessary to go so high as 440 volts, but the tendency was in the direction of higher pressures. A question that had a bearing on illumination was the enormous diversity in the load on a ship. There were many motors that were only used when the ship was at sea and others that could only be used in harbour. Having provided the generating capacity for those motors, a large part of the cost of providing for ample lighting—i.e., the part which was involved in standing charges—was already incurred, and therefore one could afford to light liberally. It had not the same effect on the fuel, but the amount of fuel used in producing light was negligible in comparison with the fuel required for propelling the ship. This diversity came in again in connection with the ring-main system, which he (the chairman) used in the Navy. He introduced it and defended it against all comers, because it largely reduced the amount of copper necessary for the main distributing conductors. At the same time, every point had a duplicate means of supply.

LONDON AND HOME COUNTIES ELECTRICITY DISTRICT.

THE ELECTRICITY COMMISSIONERS' DECISIONS.

The Electricity Commissioners have considered the evidence given at the inquiry held by them at the Institution of Electrical Engineers (from June 14th to July 29th, 1921) into the schemes submitted respectively by the (a) London County Council, the Conference of Local Authorities in Greater London, and the London Joint Committee (1920), Ltd. (hereinafter referred to as the Associated Companies); (b) Poplar Borough Council for a part of the area; and (c) the proposals made by the Great Eastern Railway Co. and the London, Brighton & South Coast Railway Co. respectively, all of which have been outlined in this journal.

The Commissioners' reasoned statement of their decisions records, *inter alia*, their gratification at finding a large measure of agreement between the promoters of the three principal schemes submitted, who all agree that an improvement in the present position is urgently needed, and that a Joint Electricity Authority, representative of all interests, should be established without delay to carry out the necessary reorganisation. There is general agreement as to the functions of such a Joint Authority and considerable approximation of view regarding its constitution.

An agreed technical scheme was presented by the principal promoters. The Associated Companies agree to vest their generating stations forthwith in a Joint Authority upon certain conditions; the London County Council agrees to transfer to a Joint Authority its rights of purchase of the company undertakings and, in consideration of the immediate transfer by the companies of their generating stations to the Joint Authority on certain terms, agrees to a postponement of the purchase of their distribution systems; the Conference of Local Authorities agrees generally to the control by, or transfer to, a Joint Authority of the local authority generating stations, and to a settlement with the companies on the lines indicated.

The Commissioners are of the opinion that the district cannot be adequately dealt with if the areas over which the rights of the North Metropolitan Electric Power Supply Co. and the Metropolitan Electric Supply Co., Ltd. (so far as its bulk supply area is concerned) extend are excluded, but they consider that these companies require special treatment, as indicated later. They therefore confirm the provisionally-determined district, subject to the following minor fringe amendments, namely:—The inclusion of the whole of the rural districts of Billericay, Epping, and Ongar, in the county of Essex; the detached part (lying between the rural districts of Ware and Epping) of the parish of High Wych, in the rural district of Hadham, in the county of Hertford; the parishes of Penn, Coleshill, and Amersham, in the rural district of Amersham, in the county of Buckingham; the parishes of

Shalford and St. Martha, in the rural district of Hambledon, and the parish of Artington and part of the parish of Compton, in the rural district of Guildford, in the county of Surrey, and the exclusion of the parishes of Sunninghill and Sunningdale, in the rural district of Windsor, in the county of Berks.

The Commissioners are unable to accept the scheme of the Poplar Borough Council, but a Joint Electricity Authority will be established for the district on the lines proposed in the schemes promoted by the London County Council and the Conference of Local Authorities, and a body constituted as follows would meet the requirements of the district.—Local authorities, 8; companies (London 6, outside London 1, power 1), 8; London County Council, 6; other county councils on their own behalf and on behalf of the urban and rural districts not owing undertakings (Middlesex and Bucks, 1; Hertfordshire and Essex, 1; Surrey and Kent, 1), 3; railway companies, 1; and the chairman, if elected from outside, 1; or a total of 27 representatives.

The estimates submitted in the joint technical scheme for the first and second stages of development indicate that for the year 1919-20 the total demand in the district was 360,600 kW, and that 608,000 kWh were sold, the average annual load factor being 21.6 per cent. The three principal promoters agree on the estimate of growth during the next ten years; about 1925-6 the demand will be 465,000 kW, and the kWh delivered to authorised distributors will be 1,067,000,000, at an average annual load factor of 25.9 per cent.; also about 1930-31 the actual demand will be 660,200 kW, and the kWh delivered to authorised distributors will be 1,520,000,000, at an average annual load factor of 26.3 per cent. These estimates do not include supplies to railways for traction purposes; they were not challenged at the inquiry, and the Commissioners accept them as reasonably accurate forecasts of the future requirements, excluding special railway supplies.

The Commissioners concur generally in the technical proposals for dealing with the requirements during the first stage, terminating about 1925-6, for which they have already authorised the necessary generating plant. The additional capital required beyond that involved in providing this plant, will be practically limited to that needed for inter-connecting mains between grouped stations, thereby enabling the fullest use to be made of existing and authorised extensions of generating plant amounting to 638,000 kW in all, and setting free otherwise reserve plant for revenue-producing purposes.

Regarding the proposals for dealing with the second stage, the Commissioners differ from the promoters, who proposed to continue the development of certain existing "group" stations and to install in them a further 199,000 kW of generating plant, thus bringing the plant installed in "group" and other stations about 1930 to a total of 832,000 kW and involving new capital amounting to £9,750,000.

The alternative proposal provided for the installation of 645,000 kW of generating plant in capital stations, and the reduction of the 557,000 kW of plant installed in the "group" stations to 252,600 kW, thus involving the throwing aside of 324,400 kW of plant long before the end of its economic life. This alternative involved new capital expenditure amounting to £23,855,000.

The Commissioners' conclusion is that a better way is to install the 199,000 kW of generating plant in a capital station or stations while retaining the "group" stations as developed during the first stage. As compared with the estimated annual cost of electricity supplied to the busbars of authorised distributors—namely, £7,262,700, or 1.147d. per kWh under the technical scheme, the Commissioners' proposals should enable electricity to be delivered at a cost of £6,190,700, or 0.978d. per kWh (an annual saving of upwards of £1,000,000, or 15 per cent.), with all the advantages derivable from a capital station, such as availability for large railway or other supplies in bulk at favourable rates.

For proper evolution beyond the first stage ("group" station proposal), the further plant required during the second stage should be accommodated in a well-placed riverside station or stations which would generate on a large scale at a high load factor, the local stations meeting the remaining low load-factor demands and the peak loads. Such a modified combination would minimise the outlay upon and the costs of transmission from the capital station, and would make the fullest use of the capital invested in existing stations. It would lessen the estimated coal consumption by 10 per cent. and reduce the average cost of electricity delivered to authorised distributors by 15 per cent., as compared with the proposals submitted to the Commissioners. These savings would be additional to the substantial savings outlined in the technical scheme, as compared with existing conditions.

The Barking site should be utilised for the construction of the first capital station on which the County of London Electric Supply Co., Ltd. is prepared to begin immediately the construction of a 100,000-kW station. The company, by virtue of its Act of last session, can be called upon at any time before August, 1926, to sell this station to a Joint Electricity Authority upon terms to be prescribed by the Commissioners, who are of the opinion that the station will be needed to reinforce existing sources of supply before 1926, and are prepared forthwith to give their consent to its establishment.

The Commissioners are not in accord with the views that a Joint Authority would be unable to generate more cheaply than a railway company possessing its own generating station,

and they are of the opinion that a combined supply from a common source will be advantageous to both parties. They fully anticipate that co-operation will be forthcoming in the practical working out of the technical scheme under the aegis of the Joint Authority, and that, excluding stations owned by the power companies, only six or seven of the principal company stations and a like number of the local authority stations will ultimately survive as generating stations; it is more particularly these stations which should vest in the Joint Authority. The remainder, of which about 50 will be gradually closed down, can be incorporated in the scheme of reorganisation under the control of the Joint Authority.

There is a far-reaching measured agreement on this matter between the Associated Companies, the L.C.C. and the Conference of Local Authorities, and it appears that it should be possible by agreement to settle terms of transfer of the selected stations on an equitable basis. Negotiations on these matters are still proceeding.

Regarding the extension of the tenure of the distribution powers of the supply companies in London, which may be terminated by purchase in 1931, the Commissioners conclude that a substantial extension of tenure would be more conducive to the stability of these undertakings and to their efficient development than the existing short period with recurring rights of purchase at short intervals, but that any such extension should be coupled with a reasonable sliding scale of price and dividend. The Order establishing the Joint Authority will be so drafted as not to interfere with the rights of the North Metropolitan Electric Power Supply Co. or with the bulk supply rights of the Metropolitan Electric Supply Co., Ltd., will provide for the delegation to those companies of the supply powers of the Joint Authority in their respective areas, and for the submission by each of them (within a period of two years) of proposals for supplying undeveloped areas where there is a reasonable prospect of such a supply being remunerative. Arrangements for mutual assistance between these companies and their neighbours will be facilitated, and it is proposed that in the apportionment of the administrative expenses of the Joint Authority, the contributions of these companies shall be limited, having regard to their special positions and powers.

With regard to finance, the authorised undertakers should find the funds for all extensions of generating plant at their stations while such stations remain in their possession, and for any inter-connecting mains required before the Joint Authority is in a position to act. The capital moneys necessary for the construction of additional inter-connecting mains and for the erection of capital stations should be raised by the Joint Authority under powers of borrowing to be conferred by further legislation. The Associated Companies submitted definite proposals for financing the Joint Authority during the initial period up to a sum not exceeding £1,200,000, and the London County Council and the Conference of Local Authorities expressed their readiness to assist with municipal credit, if powers were obtained in that behalf, and the scheme as finally approved were satisfactory to them.

The observations of the parties represented at the inquiry will be invited on the clauses of the draft Order before the Commissioners hold the further inquiry required by Section 5 (4) of the Electricity (Supply) Act, 1919.

NEW ELECTRICAL PROPOSALS FOR THE CONSIDERATION OF PARLIAMENT.

We give below a list of proposals that will come before Parliament early in the new year. Readers who are desirous of obtaining further information will find the applications published in the *London Gazette* for November 22nd and 25th.

(a) Electric Light and Power.

Blackburn Corporation.—Extension of area of supply; construction and working of new tramways; power to run omnibuses; further powers with reference to tramway and electricity undertakings; financial provisions, &c.

London and Home Counties.—Powers to carry out schemes approved by the Electricity Commissioners under the Electricity (Supply) Act, 1919, constituting as a separate electricity district under or for the purposes of the Act of 1919 the whole or any part of the area comprised within and being the counties of London (including the City of London), Middlesex, Berks, Buckingham, Essex, Hertford, Kent and Surrey (including the county boroughs of East Ham, West Ham, and Croydon), or any scheme so approved or formulated.

Swansea Corporation.—Extension of limits for supply. Corporation to be the purchasing authority for tramways in the added area. Financial provisions, &c.

South Wales Electric Power Distribution Co.—Reduction of capital by cancelling capital unrepresented by assets; conversion of Ordinary and Preference shares into stock; provisions as to price of electricity and revision thereof; methods of charging; supply of electricity to parish of Bettws; agreements with local authorities to subscribe to

1920) and other securities of the company, and of the Traction Co., Ltd.

Yorkshire Electric Power Co.—Sub-division of ordinary and preference shares and provisions incidental thereto.

Worthing Corporation.—Supply of electricity in parish of Durrington, supply of fittings, electricity in bulk, and general provisions.

North Metropolitan Electric Power Supply Co.—Revision of distribution of prices and methods of charging by North Metropolitan Electric Power Supply Co. and North Metropolitan Electrical Power Distribution Co., Ltd. Transfer of undertakings and orders of said Distribution Co. to the Electricity and Distribution of Distribution Company. Increased borrowing powers and other financial provisions. Bulk supplies from Metropolitan Railway Co. and North-Western Railway Co. and disposal of existing limitations. Profit-sharing schemes, &c.

Neath Corporation. Extension of the borough boundaries; supply of electricity in added areas; transfer of electricity undertaking and rights of Neath R.D.C. to Corporation and repeal of Acts; supply to Corporation of electricity in bulk by South Wales Electrical Power Distribution Co.; power to enter contract of borrowing for electricity; financial provisions, &c.

(b) **Electric Tramway, Motor-bus, and Railless Trolley Vehicles.**

London County Council.—Construction of new and reconstruction of existing tramways, electrical traction; provision and working of trolley vehicles; financial provisions, &c.

Northampton Corporation.—Extension of time for construction of tramways, &c.; power to run motor omnibuses; financial provisions; further powers.

Birmingham Corporation.—Further provision as to trolley vehicles, tramways, and omnibuses; financial provisions.

Doncaster Corporation.—Power to provide and run motor omnibuses. Further powers in connection with light rail and omnibuses; increase of fares and charges on ditto; further powers with reference to the electricity undertaking; financial provisions, &c.

Nottingham and Derbyshire Tramways Co.—Power to construct additional tramways in the urban district of Heanor, the rural district of Basford, and the borough of Ilkeston. Increase of fares; further provision as to existing and proposed tramways; repeal or amendment of Tramways Act, 1870, with respect to acquisition of proposed tramways by local authorities; financial provisions, &c.

Black Country Tramways and Light Railways.—Postponement of dates for compulsory purchase of undertakings, tramways, or light railways of the Birmingham District Power and Traction Co., Ltd., the South Staffordshire Tramways Co., the South Staffordshire Tramways (Lessee) Co., Ltd., the Dudley, Stourbridge, and District Electric Traction Co., Ltd., the Wolverhampton District Electric Tramways, Ltd., and the British Electric Traction Co., Ltd. Extension of time for completion of certain of the companies' synchronisation of dates for compulsory purchases and extension of leases, &c.; prohibiting compulsory purchase of undertakings of all or any of the companies unless the undertakings of all or some of them are so purchased. Fares, rates, and other general and incidental provisions, &c.

Bristol Corporation.—Construction of tramways in City of Bristol; provision of trolley vehicles; powers to borrow for purposes of Acts, sections and incidental provisions.

Bristol Tramways and Carriage Co., Ltd.—Extension of time for completion of authorised tramways; acquisition of powers to enter contracts, &c.; transfer of powers and extension of time therefor; special provisions as to terms of purchase; repeal, extension, and amendment of Acts.

Jarrow Corporation.—Powers to run omnibuses within and without the borough.

Bolton Corporation.—Construction of tramways in Bolton and Westhoughton; use of trailer cars; fares and charges; powers as to running of omnibuses within and beyond Bolton; construction of electrical sub-station and further powers as regards electricity supply; provision of electricity show rooms; financial provisions.

(c) Railways, &c.

Thames Deep-water Wharf and Railways.—New company; powers to construct wharf, railway, and electricity generating stations; working of railway by steam or electricity; supply electrical energy; arrangements with the Midland and G.E.R. Co.'s; powers to run omnibuses, motors, coaches, &c.

London, Brighton & South Coast Railway.—Powers for the raising of additional money by borrowing or issue of Debentures or Debenture stock for the general purposes of their undertaking (including the equipment of the railways for electric traction) or for such special purposes (if any) as may be determined.

North-Western and Midland Group Railways.—Powers of the North-Western and Midland Group Railways Companies to provide and use road vehicles (omnibuses, motor-cars, &c.) for the conveyance of passengers and goods.

Metropolitan Railway Co.—Power to guarantee or subscribe towards any loss or deficiency which may result from

the preparation for or holding of an exhibition by the British Empire Exhibition (1923), Incorporated, &c.

Trafford Park Co.—Construction of railways; electrical power for working railways; provide trolley vehicles in Stretford Urban District and in Rural District of Barton-upon-Irwell and the Borough of Eccles, &c.; additional share and loan capital; power to obtain electrical energy from Manchester Corporation.

Post Office (Pneumatic Tubes) Acquisition.—Acquisition by Postmaster-General of underground works of Pneumatic Despatch Co., Ltd., and maintenance, reconstruction and user thereof for Post Office purposes.

BRITISH WATER-POWER RESOURCES.

THE final report of the Water Power Resources Committee, of which Sir John Snell is the chairman, was issued last week (H.M. Stationery Office, price 8s. net).

The Committee was appointed in June, 1918, by the President of the Board of Trade to examine the extent and the availability for industrial purposes of the water power resources of the United Kingdom; in October, 1919, it was enlarged and directed to consider also what steps should be taken to ensure that the water resources of the country were properly conserved and fully and systematically utilised for all purposes. So far as Ireland was concerned, both inquiries were carried out by a Sub-Committee appointed directly by the President of the Board of Trade. The report of this Sub-Committee has already been issued. The following is a summary of the chief findings of the Main Committee:—

Water Power.—From the outset the Committee realised that, with the limited financial means at its disposal, it would be impossible to undertake a complete survey of the water power resources of the country, and it concentrated upon obtaining particulars of as many schemes as possible for utilising particular sources which appeared likely to prove commercially practicable. Actual surveys were undertaken in a number of areas, and schemes from Government Departments and other sources were also examined. The report and evidence obtained, which do not purport to be exhaustive in any way, establish a *prima facie* presumption that some 210,000 kilowatts in the form of electric power can be developed continuously day and night throughout the year at an economic rate from those British schemes which were considered. Similarly, the Irish Sub-Committee considers that from a portion only of the water power resources of Ireland a continuous output of 413,000 kilowatts can be obtained. The Committee points out with regard to Great Britain that the potential electrical output of the commercially practicable schemes before it is equal to about 40 per cent. of the total output in the year 1919-1920 of the 410 British public electricity supply and electric railway and tramway undertakings operated by steam power; also, that the development of this amount of energy in steam stations would involve the consumption of nearly three million tons of coal per annum.

The bulk of the larger British water powers are found in the Scottish Highlands; although this district is situated at some distance from the present great industrial centres, no part of it is far from the sea or the Caledonian Canal. The Committee points out that the utilisation of the Scottish water powers might do much to assist the depopulation of the Highlands.

The larger water powers of Wales are situated in the North-Western part of the Principality. The proposals of the North Wales Power & Traction Co., Ltd., which involve the utilisation of several large water powers in this district for public electricity supply purposes, have already received the approval of the Electricity Commissioners.

In England the main sources of water power are the small falls on rivers; although the power available at any particular site is small, the aggregate output that might be obtained by improving these sites, by installing modern turbines in the place of inefficient plant at existing sites, and by general improvement of the water-courses, is considerable. As a typical case, the Wiltshire Avon may be cited. At present plant is installed or about to be installed to generate in the aggregate 650 kilowatts, but investigation showed that an additional output of 2,300 kilowatts could be obtained. An examination of the Lake District did not reveal any large water power capable of commercial development.

The Committee considers that every inducement should be given to persons interested in power production to utilise for their requirements a perennial source of energy like water power rather than a wasting asset like coal, and recommends that the collection and publication of information regarding potential water powers should continue, and that financial assistance might be afforded by the State to water-power undertakings during the difficult years of the constructional period.

A haphazard harnessing of the country's water power may, however, lead to partial developments which would prejudice the ultimate complete utilisation of the available resources,

and thus result in considerable waste. It is necessary, therefore, that some control over development should be exercised in the national interest. The Committee considers, further, that provision should be made for the ultimate acquisition by the State of all future water-power undertakings, and proposes a system of terminable licences, usually of long term, for limiting the tenure of the undertakers of water-power developments.

It is suggested that either the Board of Trade or the Electricity Commissioners should be specifically charged with the duty of studying, supervising and promoting the development of water power.

As regards tidal power, the Committee reiterates the recommendation made in its Third Interim Report, that this subject should be specially studied by a Technical Commission, with particular reference to the Severn Estuary, with regard to which a considerable amount of information has already been accumulated.

General Water Resources.—A great number of different interests are concerned in the available supplies of water. The predominant requirement is necessarily an adequate supply for domestic and sanitary purposes, but in any proposal involving the use or abstraction of water, the claims of steam and water-power plants, trade and industrial consumers, and canals and navigable waterways need to be considered, and the prevention of pollution, the protection of fisheries, and the needs of agriculture from the standpoints of land drainage, irrigation and watering of stock have to be borne in mind. In Scotland the water resources are, comparatively speaking, abundant, and the population over considerable areas is sparse, and in consequence the conciliation of opposing interests can be effected by the Government Departments concerned, most of which are responsible to one Parliamentary head, the Secretary for Scotland. In England and Wales, however, the increase of population and the growing requirements of industry are responsible for a steadily increasing demand for water, and the problem of meeting future needs is giving rise to considerable anxiety. The Committee recommends, therefore, that a Water Commission, having jurisdiction over England and Wales, should be appointed mainly for the following purposes:—

- (i.) Subject, in case of opposition, to Parliamentary sanction, to allocate the water resources of England and Wales in the general interests of the community, and to re-adjust existing allocations of water where hardship or anomalies are shown clearly to exist.
- (ii.) To adjust conflicting interests in connection with the use of water for a particular purpose.
- (iii.) To afford assistance to Parliamentary Committees before which Bills relating to water may be heard, and to Government Departments concerned in the use and control of water for specific purposes, and also to the various local authorities and water-supply undertakings.

It would be necessary for the Commission to collect and compile data relating to water resources in order to enable it to perform its function efficiently, and it is proposed that this information should be made available to the interested public through the medium of a special indexing system, which the Committee has worked out in some detail.

It is proposed that the expenses of the Water Commission should be defrayed in part by a levy on the water undertakings in England and Wales, and in part by the fees of applicants for powers to undertake works.

The Irish Sub-Committee recommends the constitution of an Authority to allocate water between the several interests in Ireland.

It is proposed that, with a view to eliminating waste of both time and expense, the departments concerned with the various water interests should be empowered to authorise promoters of unopposed schemes to carry out the proposed works; in the case of an opposed scheme, the Order of the Department should be Provisional, and require confirmation by Parliament.

LEGAL.

THE BIRKDALE ELECTRIC SUPPLY CO., LTD. v. THE SOUTHPORT CORPORATION.

THE action of the Attorney-General at the relation of the plaintiffs against the Southport Corporation, was again mentioned to Mr. Justice Peterson in the Chancery Division on December 16th.

Mr. TYLDESLEY JONES said that the case raised the question as to the right of supplying electricity in that part of the borough of Southport which was formerly known as Birkdale. The plaintiffs' case depended partly upon their rights and powers under a certain agreement, and partly on a question of *ultra vires*. It would be impossible to try such a case on a motion, and the parties had agreed, subject to his Lordship's

sanction, to allow the motion to stand until the trial of the action, and to ask leave to apply for an early hearing. It was important to both parties that the matter should be brought to as quickly as possible. The Corporation were as anxious as the plaintiffs in order that they might know what their rights were. The case would take at least two days, as there were agreements, provisional orders, and Acts of Parliament that would have to be carefully examined.

His Lordship said he would give liberty to the parties to apply to expedite the trial of the action when they were ready. There could be no order on the motion as to what the costs be costs of the action.

EDYE AND OTHERS v. SOUTH METROPOLITAN CO. (TRAMWAYS CO., LTD.)

IN the King's Bench Division, Mr. Justice S. M. L. on December 16th, concluded the hearing of an action brought under Lord Campbell's Act respecting the death of a man named Lord William Edey, in which his widow, infant children, and his mother claimed damages against the defendant company.

Mr. HOLLES WALKER, K.C., appearing for the plaintiffs, said that the deceased man died leaving a will, and under the circumstances the proceedings ought to have been in the name of the widow and the brother, who were co-executors. He asked, therefore, that the brother might be added as plaintiff.

No objection being raised by the defendants, Mr. Holles Walker, continuing, said that the deceased man was 39 years of age, and carried on business as a credit draper, and was in the habit of going round to his customers on a motor cycle. On June 16th of last year he was riding his cycle, with his assistant in the side car, along the road from Mitcham to Croydon, which had in the middle a double set of tram-lines. There was no footpath adjoining the road, and pedestrians had to walk on the common. Mr. Edey was proceeding in the direction of Croydon, and in front of him going in the same direction was a steam wagon, and behind that was a motor lorry, which was going faster than the steam wagon. The driver of the lorry endeavoured to pass the steam wagon, and in doing so came upon the tram-lines. He came to a spot where the sets were so worn down that the metal rail stood out about an inch above the road. The motor came against the obstruction, skidded, and came in contact with the motor cycle, knocking it over, and so injured the driver that he died shortly afterwards. The South Metropolitan Co. were the owners of the line, and plaintiffs contended that the accident was due to their neglect, as they were bound to keep the line in a safe and satisfactory condition.

Evidence was given as to the condition of the road and bearing out counsel's statement as to the manner in which the accident happened, but the driver of the lorry which ran into the cycle was not called.

Mr. MANLY, the Tramway Co.'s electrical engineer, who examined the line after the accident, said that an examination of the track disclosed no defect. His examination extended over a length of 80 yards, and he found the line to be in excellent condition with the exception of a depression in the clear way on the off side, and that depression was in the centre, three-quarters of an inch below the level of the stone sets.

The case for the defence, which was supported by a number of witnesses, was that the accident was caused, not by the condition of the line, but by the manner in which the lorry had been driven.

His Lordship, in giving judgment for the plaintiffs, said there was no evidence of negligence on the part of the driver of the lorry, and he was satisfied that the accident would not have happened had it not been for the depression in the road. He thought the accident was consequent upon the neglect of the defendants to repair the road, which was in a dangerous condition. In assessing the damages, he had to consider, not what was the particular loss to a particular member of the family, but what was the loss to the family as a whole, and after having done that he had to apportion the award. The deceased was carrying on a prosperous business, which was bringing in about £10 a week. Taking all the circumstances into account, he awarded to the family in all £2,000, of which the mother would receive £200, the widow £300, two children (8 and 9 years of age) £450 each, and the third child (which was 4 years of age) £600.

CHARGE OF STEALING LAMPS.

AT the Bow Street Police Court last week, E. A. Kann, of Barnes, was charged with stealing 3,600 electric lamps (value £360), the property of the General Electric Co., Ltd. He was remanded, bail being allowed. According to the *Evening Standard*, the solicitor for the prosecution said that accused had been in the employ of the company as assistant to the manager of a lamp department at a salary of £120 a year. It was alleged that he caused the 3,600 lamps to be sent out in the first instance to a customer who had not ordered them, and that he subsequently fetched them away from that customer and sold them, in the name of Lyons, to another firm at a price much below their value. The firm in question communicated with the prosecutors.

BRITISH THOMSON-HOUSTON CO., LTD., v. CORONA LAMP WORKS, LTD.

JUDGMENT was unanimously given for the appellants in the House of Lords on Monday by Lords Haldane, Finlay, Cave, Dunedin, and Shaw in the British Thomson-Houston and the Corona Lamp Works, Ltd., litigation over the alleged infringement by the latter of Letters Patent No. 10,948 of the year 1913, for an invention entitled "Improvements in Incandescent Electric Lamps." The British Thomson-Houston Co. brought an action for an injunction to restrain the Corona Co. from infringing the Letters Patent, but Mr. Justice Sargant held that they were invalid on the ground that the specification did not sufficiently define the ambit of the monopoly claimed. The Court of Appeal affirmed this decision, also on the ground of insufficiency, so the matter was taken to the House of Lords by the appellants, where judgment was reserved on the 22nd of last month, after a very long hearing.

LORD HALDANE, who first delivered judgment, said in the litigation out of which this appeal arose the appellants were plaintiffs, and they brought their action to restrain infringement of a patent, taken out in 1913, and an electric lamp in which the filament incandescens in an atmosphere of gas or vapour of low heat conductivity, instead of, as was still usual, in a vacuum. The respondents, who were defendants, denied infringement, but their substantial defence was, first, that the patent was invalid for want of subject-matter, having regard to the state of knowledge at its date, and, further, that the patent did not describe sufficiently the character of the alleged invention, with the result that its directions were ambiguous and misleading. Mr. Justice Sargant, who tried the action, held that there was valuable and good subject-matter disclosed in the patent, but that it was bad in that it failed sufficiently to define or limit the ambit of what it claimed. The Court of Appeal affirmed this conclusion.

In the Courts below the controversy turned mainly on the second defence, that of ambiguity in statement and insufficiency in directions. At the Bar of the House of Lords this question had, indeed, remained prominent, but its prominence had been less than that of the prior question of subject-matter, on which the Courts below were adverse to the respondents. The primary controversy in that House had been whether subject-matter had been sufficiently established, as consisting in an invention really new in point of principle, and if so, then whether the claiming clauses and directions in the patent were sufficient to inform people, assuming them to possess skill in the manufacture of electric lamps, how to apply the general principle in particular ways. As to the methods recommended, the question was whether those given were clearly enough described; for, if so, and if the fundamental principle had been explained, it did not matter, for the ambit or discovery claimed, if there were alternative methods of applying the principle which were not given exhaustively, provided these were no more than mechanical equivalents to the particular methods prescribed. Lord Haldane gave a lengthy history of the state of matters previous to the date of the present invention, and said the general situation prior to 1913 was as follows: tungsten had been substituted, with practical advantage, for other metals and for carbon. The tungsten filament was introduced into a carefully produced vacuum, and this vacuum rendered a substantial amount of vaporisation, with consequent blackening of the bulb, inevitable. It was known that inert gases could be employed, which would fill the vacuum and greatly diminish vaporisation, and among such known inert gases was argon; but, on the other hand, the introduction of any gas gave rise to conduction and convection to such an extent that the temperature of the filament became too low for incandescence to take place, unless a current were sent through in an amount such that the filament was soon destroyed. The dilemma had seemed insuperable, for between 1882 and 1913 nothing had been accomplished to get rid of it, and manufacturers had accepted a tungsten filament in a vacuum as the only practical method for commercial success.

In 1913 the patent of that year was taken out in this country, embodying an invention of Dr. Langmuir, an American physicist, whom Mr. Justice Sargant described as "a practical scientist of the highest qualifications." The idea underlying the invention was this. If the surface of the filament rendered incandescent by the current was increased, it had been found by experiment that the light resistance from the surface increased in volume in a proportion much greater than that of the increase of temperature required to provide loss due to conduction and convection to the filament having been placed in an atmosphere consisting of an inert gas. By the introduction of such a gas into the bulb of the lamp vaporisation could be much reduced and incandescence would be maintained if the current was made sufficient to replace the heat lost by conduction and convection. Under such a method the temperature could be preserved at a degree sufficient to render incandescence a larger surface than was possible in a vacuum where destructive vaporisation of surface was unavoidable. A larger surface than lamp makers had been accustomed to use could, therefore, be made to radiate light rays. It was shown that when this new principle was carried into effect about 10 per cent. increase of absolute temperature yielded proportionately

three times the light formerly obtained. The discovery was thus the obtaining of a yield of light in a proportion to temperature much greater than under former methods. Light could now win heavily in what one of the expert witnesses called the "race" of light increase against heat loss.

The application of this principle, as a mere principle, of course could not have been patented. But the inventor claimed in his patent to have shown practical methods which embodied and could put it into operation. If he actually did so his invention was a patentable one. There was also the question whether the directions given in the words of the patent itself were sufficient, and whether its claiming clauses defined the invention unambiguously.

His Lordship did not think that in the patent before them it was intended to define, or that it was possible or necessary to define, the expression "large" as referring to any definite limits. All that was necessary was for Langmuir to tell the lampmakers how to get as large an incandescent surface as they wanted for their practical purposes. He made plain to them in the specification that this was no longer impracticable, and that if they would adopt his new process of manufacture they would attain a valuable commercial result, the outcome of the scientific principle implied in the process. He showed them how, by coiling a small filament, to get the large incandescent surface notwithstanding that the diameter of the filament was narrow, and one, therefore, requiring only a small amount of current. In this way the "Half-watt" lamp became attainable.

In the light of the directions given in the body of the specification, his Lordship thought that in the words there was claimed what had been already adequately described. It was, in his opinion, no mere abstract principle, but a method or process of manufacture, capable of being at once put into operation by any experienced electric lamp maker, with such adaptations as his commercial requirements and standards suggested. To put it into operation required no new inventive capacity, and it would have been inconsistent with the generality and sweep of the explanation given to have inserted a definition of the word large, otherwise than relatively to current practice. Such a definition, if attempted, would have limited unnecessarily the ground over the whole of which the new method was to be made operative. The principle and its working in practice need not be distinguished in the fashion which was required when the discovery was of some merely particular and qualified kind.

Mr. Justice Sargant in his judgment recognised fully the value of the invention, but he thought that there was a direction that the diameter of the coil was to be "substantially of the order of 10 mills, a figure clearly indicated by the specification as constituting a thick filament." No doubt a filament of such a diameter would be thick or large, within the language of indication. But when he went on to suggest that the illustration did not suffice, inasmuch as the claim was not, so far as size was concerned, definable quantitatively, but only by reference to other variables, he (Lord Haldane) could not agree with him. For the reasons he had given he thought that the claim was not one merely for articles falling within particular limits of size in filament, but for a general process of manufacture applicable in all the cases which practical experience allowed. That was because of the character of the pioneer invention which the patent described.

It was, in truth, an invention of an ingenious and useful process of manufacture in which the integers, so far as old, were combined in accordance with a principle that was new, and embodied a fresh invention. For these reasons he submitted that the judgment in the Court of Appeal should be reversed, and the appeal allowed with costs.

Lords Cave, Finlay, Dunedin, and Shaw concurred, and so the appeal of the British Thomson-Houston Co. was unanimously allowed with costs.

New Russian Stations. It is stated that out of the comprehensive schemes for the "electrification of Russia," as projected by the Soviet Government, only four stations have so far been commenced, concerning one of which the Russian newspapers have published some information. This station is situated in the town of Kachivya, about 75 miles to the south of Moscow, and in the vicinity of the railway to Tula. The site has long been regarded as suitable for the purpose because two banks, one Russian and one German, sought several years ago, to obtain a concession for the establishment of supply works in the town. The fuel used is an inferior kind of pit coal which exists in the neighbourhood; it resembles German lignite, and is suitable for firing steam boilers. The latter are 10 in number, on the Garbe and Sterling system, there are two steam turbines of 12,000 h.p. supplied by the Swiss Brown-Boveri Co., and the pressure of the generators is 3,000 volts. There are two Swedish transformers of the Luth & Rosen make, which raise the pressure to 115,000 volts, at which pressure the current will be transmitted to Moscow. The other three stations will be of a similar size, and the transformers for these have also been supplied from Sweden.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Win-Sum" Radiator.

Messrs. TILD, SIDAY & Co., Ltd., 180, Prury Lane, W.C.2, have designed an apparatus for the provision of hot or cold air to rooms and buildings. This is the "Win-Sum" radiator, shown in figs. 1 and 2. It consists of a rectangular box 15 in. high, 20 in. long, and 13 in. wide, with a curved top. At one end of this is fitted a specially constructed motor-driven fan with speed regulating resistance. At the other end

set of spur gears, the spur wheel being mounted on the worm shaft of a worm-gear pulley block of ordinary design, specially strengthened for power drive. The unit is fitted by means of an electrically-welded chain and clevis block and hook, special care being taken in the manufacture of this to ensure the perfect fitting of the chain in the chain wheel. This equipment, which is made for 110 voltages up to 180 V., weighs only 2 cwt. and is 10 ft. long, 1 ft. 6 in. high at a speed

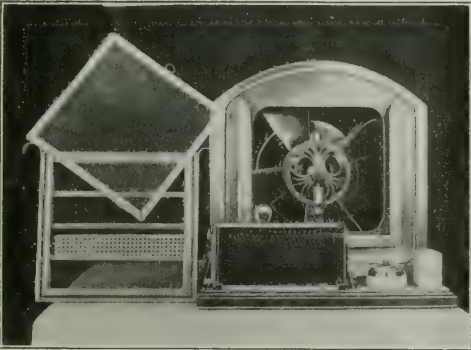


FIG. 1.—THE "WIN-SUM" RADIATOR—FAN END.

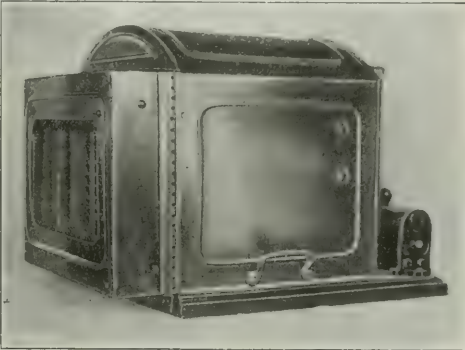


FIG. 2.—THE "WIN-SUM" RADIATOR—HEATER END.

four independent heating elements are fixed (fig. 2). A double screen covers the fan end, and between the two parts of this, porous perforated slabs, impregnated with a deodorising or disinfecting fluid, may be placed. A baffling disk placed behind the fan prevents reverse air currents. Provision is also made for an ice chamber if this is required.

A Witton-Kramer Electric Pulley Block.

In most warehouses, workshops, and factories there occur from time to time instances of lifting and goods-handling work which, though not of sufficiently frequent occurrence to justify the installation of expensive cranes or other transporting devices, render essential some form of power hoist. To meet the demand for this class of apparatus, the WITTON

of 10 ft. per minute. The standard equipment shown in the accompanying illustration (fig. 3) includes a chain for a 10-ft. lifting height.

The "Oliver" Mortising Machine.

The accompanying illustration (fig. 4) shows a vertical-spindle, hollow-chisel mortising machine recently placed on the market by the OLIVER MACHINERY Co., Grand Rapids, Mich., U.S.A. The principal feature of the device is the fact that the motor is mounted directly on the spindle of the machine, being enclosed in the same housing with the spindle and the mechanism of the head. The motor operates on either two- or three-phase, 60-cycle alternating current at a speed of 3,600 r.p.m. The rotor is mounted directly on the machine spindle, which runs in ball bearings. The position of the motor eliminates countershafting, pulleys and belts, and also saves floor space. Since it is self-contained the machine may be given any position in the shop desired, regardless of the position of the line shafting. The maker claims that the drive is very economical in the consumption of power. An enclosed starting switch with fuses is mounted on the machine and connected by a flexible conduit to the motor.



FIG. 3.—WITTON-KRAMER Electric Pulley Block.

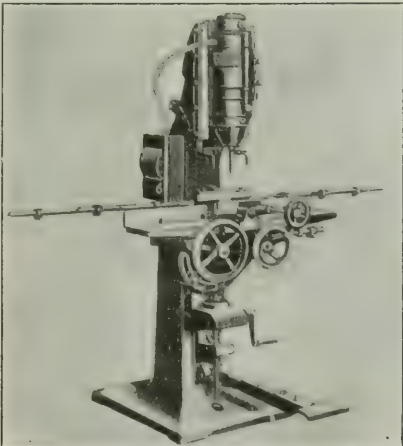


FIG. 4.—THE "OLIVER" MORTISING MACHINE.

KRAMER Electric Tool & Hoist Works (Proprietors: The GENERAL ELECTRIC Co., LTD.) has produced an electric pulley block, features of which are its compactness and lightness. The electrical unit consists of a totally-enclosed motor, with a reversing controller. The drive from the motor shaft is by a

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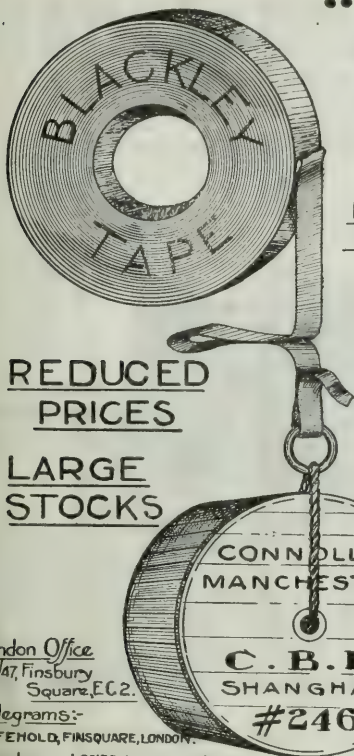
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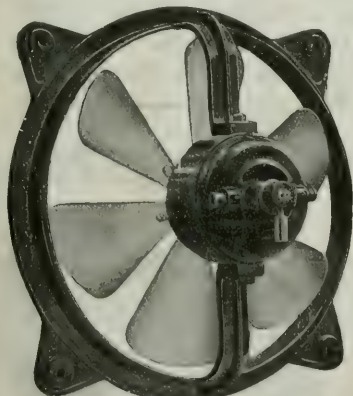
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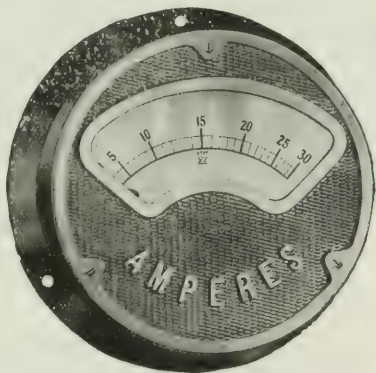
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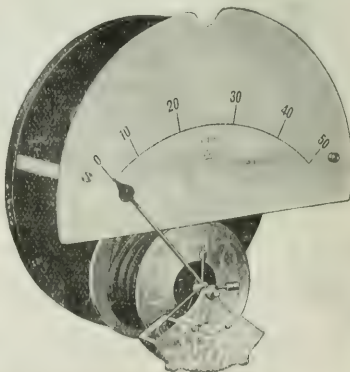
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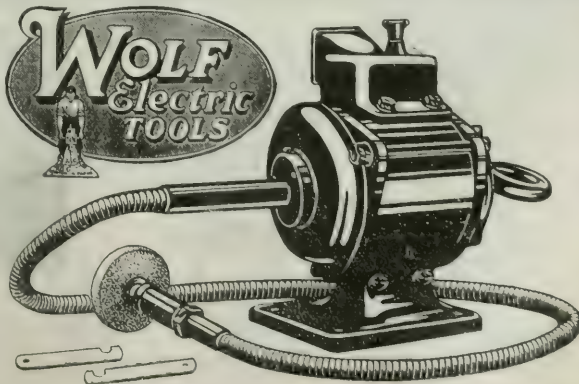
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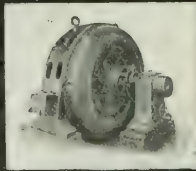
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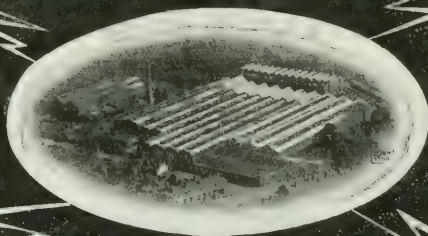




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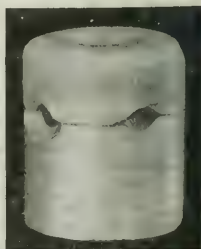
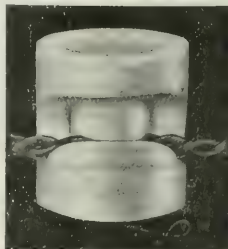
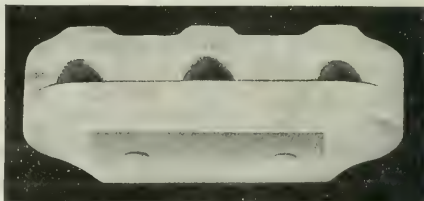
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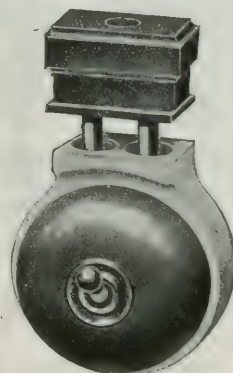
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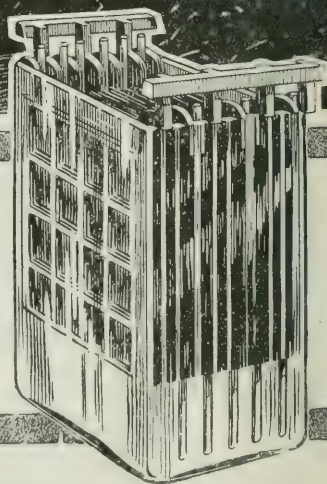
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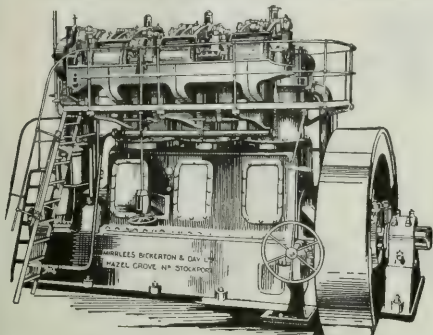


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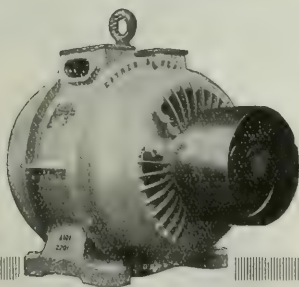
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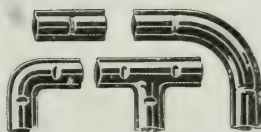
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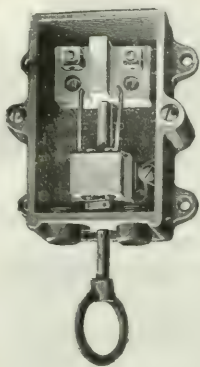
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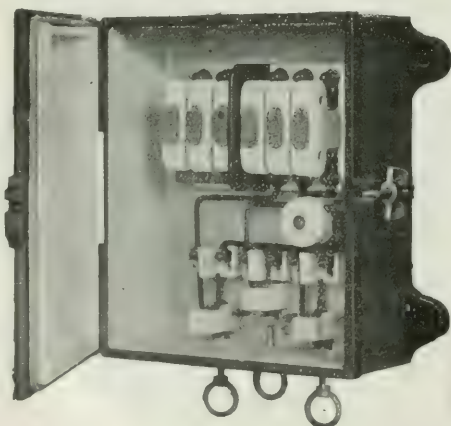


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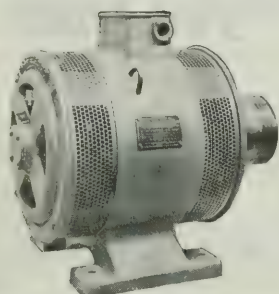


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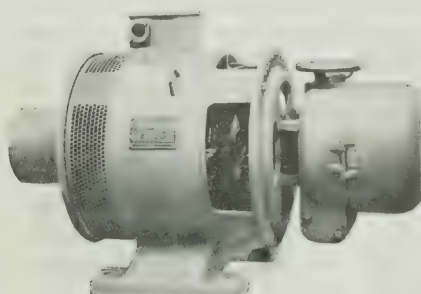
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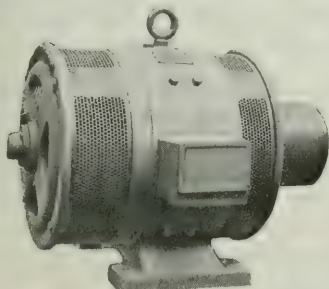
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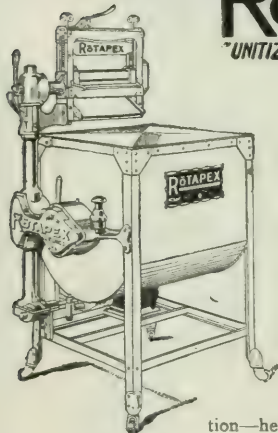
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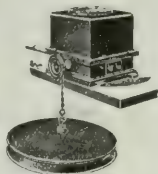
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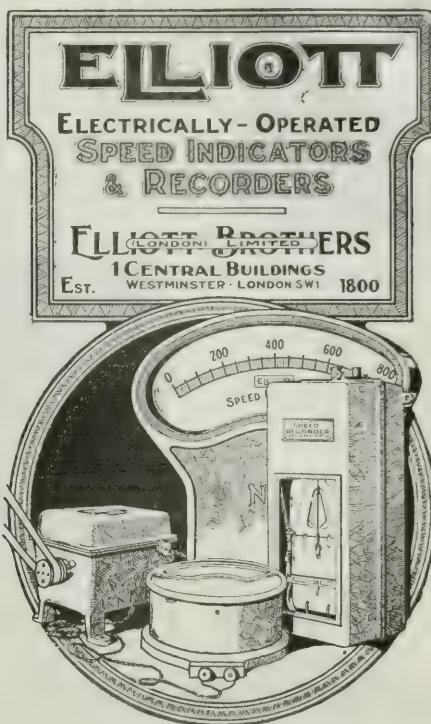
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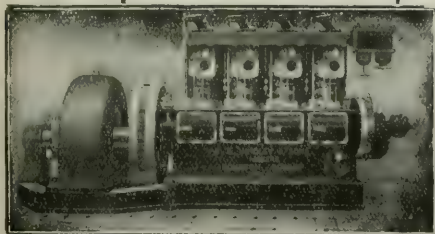
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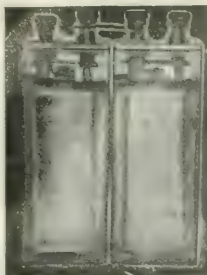
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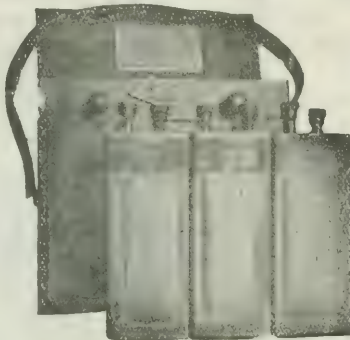
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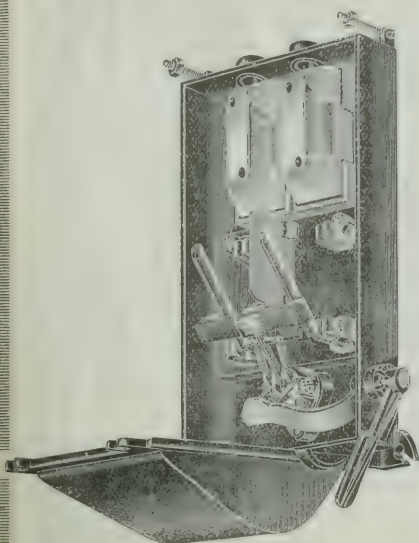
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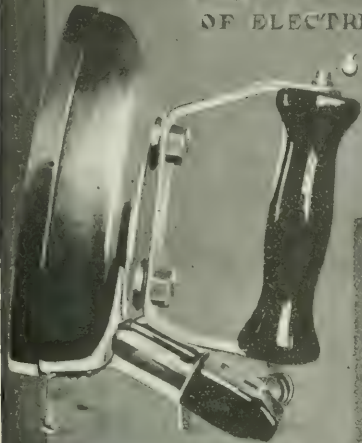
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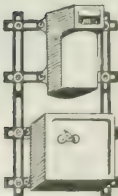
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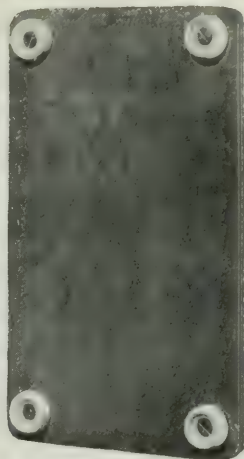
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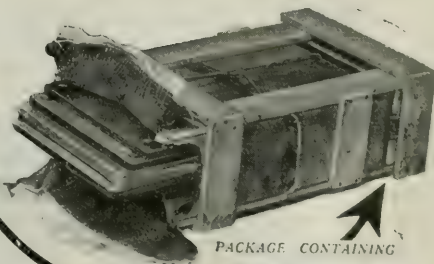
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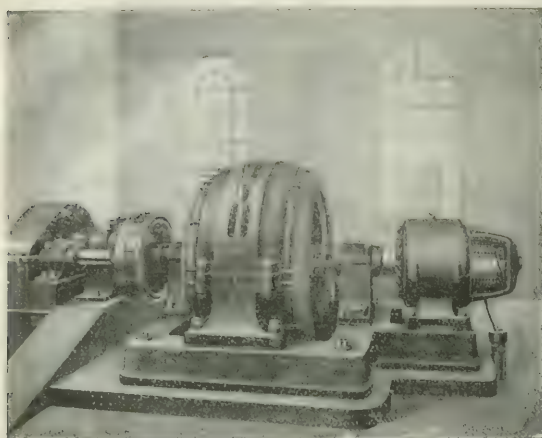
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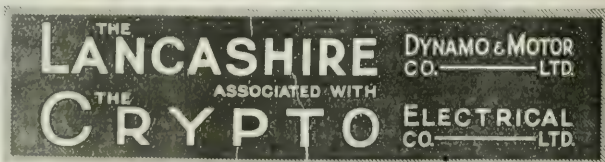
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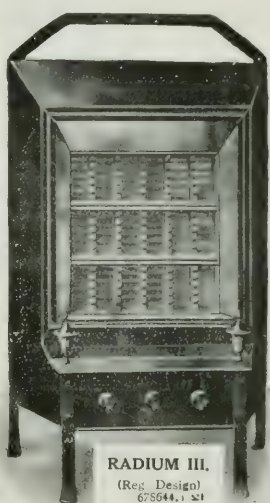


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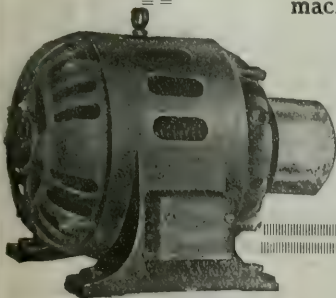
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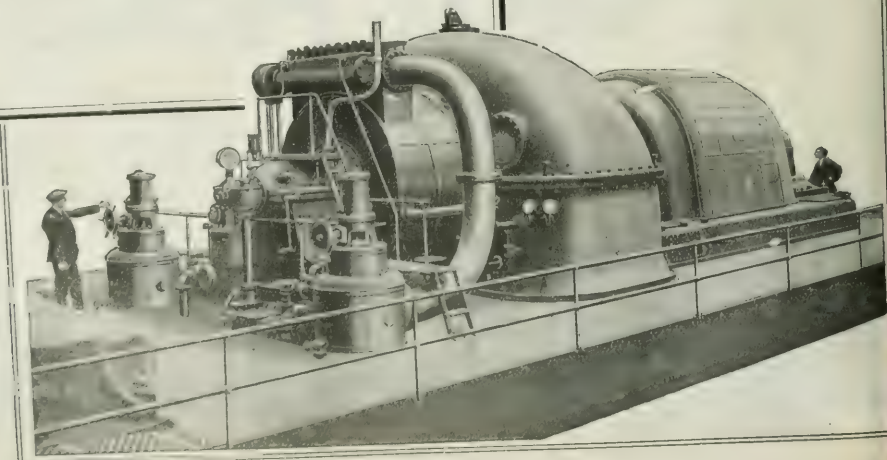
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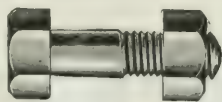
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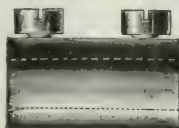
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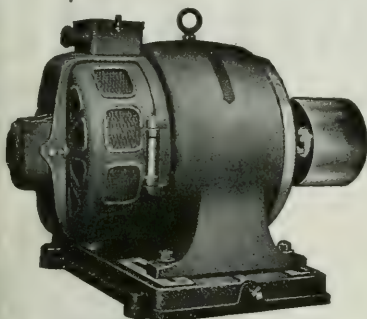
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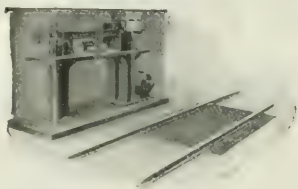
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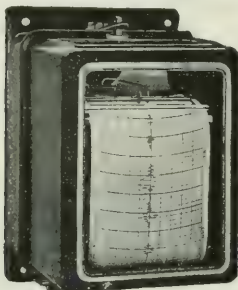
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THE ELECTRICAL REVIEW.

VOL. LXXXIX.

DECEMBER 30, 1921.

No. 2,301.

ELECTRICAL REVIEW.

BRITISH WATER POWER.

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THE final report of the Water Power Resources Committee, which was outlined in our last issue, does not depart greatly from the substance of the four interim reports, but it brings together a mass of information and comment which will render it of great value as a work of reference. The subject is immensely complicated in this country by the demands of our cities and towns for water supply, and for this reason the Committee strongly recommends the establishment of a central controlling body in the shape of a Water Commission for England and Wales; in Scotland the conditions are so far different, owing to the sparse population and the abundance of water, that such a body is considered unnecessary. Water commissions for 60 years past have recommended the establishment of controlling authorities, and the present Committee's conclusions were almost unanimous.

The functions of the authority would include the collection of information regarding our water-power resources and placing it at the disposal of undertakers, enabling them to select suitable sites for development, assistance in the prosecution of such schemes and in obtaining statutory powers, safeguarding the interests of the local population, and the collection of statistics of rainfall and flow over long periods, a service which can only be rendered by the State. A system of standardised data is put forward in the report, based upon the highly elaborated methods of the Canadian authorities, and it is proposed that maps and indexes of water resources for the whole of the Kingdom shall be available at a central office. In view of the assistance that the Commission would be able to render to water supply undertakings, the Committee thinks that a large share of the expenses of the Commission should be borne by them, thus reducing the cost to the ratepayer; but we fear this argument will not go far to mollify the intense opposition of the public to the establishment of a new authority at this time, when the severest retrenchment is the order of the day. Whether the cost is thus distributed, or is borne by the Treasury, the result is the same—the citizen has to dip into his pocket a little deeper—and whilst we admit the advantages of the proposal, we are bound to regard it from the standpoint of financial expediency.

On the other hand, with regard to water power in particular, the Committee would entrust either the Board of Trade or the Electricity Commissioners with the duty of supervising and promoting the development of the resources of Great Britain, and to this proposal we offer no objection. It is undoubtedly most desirable that this important question should be taken in hand as soon as possible, and if it can be dealt with by an existing Government department, the additional expense will be a minimum.

It is to be hoped that if and when Government action is taken, it will be taken with the express object of development. We have seen how, in the United States and Scandinavia, where water power is available in abundance, Government control has resulted in deplorable delays; with a view to securing the best terms for the State, impossible conditions have been prescribed. If the aims of the Committee are to be fulfilled, it is absolutely essential that private enterprise shall be given a free hand and an extended tenure—otherwise our last state will be worse than the first.

With regard to tidal power, it is felt that a *prima facie* case has been made out for its further investigation; the Severn scheme is admitted to be technically

feasible, and if it is proved to be commercially impracticable no other project of the kind has any chance of success. Attention should be given therefore, says the Report, to the possibilities of the Severn scheme in the first instance, and the experiments set on foot by the French Government, as well as Italian proposals, may be cited in support of this recommendation.

INDUSTRIAL AFFAIRS.

"THE leading strings, which preserve and uphold the infant, would impede the full-grown man. And so the very means by which the human mind is, in one stage of its progress, supported and propelled, may, in another stage, be mere hindrances."

When Macaulay wrote thus about the coming of the Reformation, trade unions were in their very early stages. The time has come to-day, however, when it is the duty of all who have the interests of the workers at heart, among whom the leaders and members of trade unions should be prominent, to take stock of the situation, to examine the machinery, and, in general, to ascertain whether the organisations as they exist are suited to the circumstances of the present time.

In the days when workers were ground down, when child labour was largely employed, when women worked under horrible conditions at unsuitable occupations, the combination of workers to improve their lot was just, necessary, and desirable. There were those who thought the abolition of child labour would spell the ruin of industry but they were mistaken. The improvement of the lot of the workers for which trade unionism has been mainly responsible has not only done no harm, but has done positive good, to industry. In like manner the leading strings of the infant, and the dogmatism of Rome, were necessary to the immature body of the child and the immature mind of mediæval humanity. They did good, and without them much could not have been done that was done.

Humanity, when mature, is impatient of restrictions. Trade unionists object to the limitation or obliteration of initiative following upon the widespread adoption of process specifications based upon motion study and so-called scientific management. To a great extent we are in sympathy with them, for a man or woman is not a machine, and ought not to be looked upon as one. Yet how far do trade unions leave the individuals who compose them any freedom of thought? A small group of extremists may seize the direction of a union, or of a branch, and may behave in a way absolutely opposed to the wishes of the majority of its members. We need not go outside London for an example of such a happening. It is not many weeks since the executive of the E.T.U. suspended the London District Committee on account of its extreme and unruly behaviour, examples of which will be within the memory of our readers.

Anything in the nature of tyranny will, in the long run, inevitably be resented, and that resentment will more readily come to light in bad times than in good. When, as was the case during the war and the post-armistice boom period, wages are increasing and employment is good, dissatisfaction is apt to fizzle out in a few scarcely-heard grumbles. But when men are standing about waiting for doles, when the wages of those who remain at work are falling, that dissatisfaction will be expressed both in a more audible and in a more practical fashion. The A.E.U. lost 10,000 members during the single month of October, 1921. Mr. Thomas spoke pessimistically a few weeks ago about the N.U.R. In some degree, and perhaps a substantial degree, the decrease in membership may be due to the slump in trade, the fall in wages, the general unemployment, in short, to the industrial situation at large; but it is impossible to ascribe to these causes, or to any of them, the widespread apathy that was revealed in, for instance, the engineering wages ballot.

Here was a case in which the question to be voted upon touched every member in the pocket. Would they, or would they not, strike to retain what they had gained? Yet a large proportion of the membership would not take the trouble to answer the question, and thereby tacitly declined to strike. Some of this apathy may have been due to a realisation of the futility of a strike at a time when most employers, or at least the smaller ones, as we commented at the time, would have been rather glad to shut down their works; but on many occasions, where the clear-sighted saw at the beginning that futility which the failure of the strike proved, the fact was not allowed to prevent the strike from taking place. But we believe that in general the man on the floor of the shop was, and is, tired to death of being driven, or led, or coerced into striking every little while, and losing several weeks' pay, about an issue which might concern him only remotely.

The time has gone by when a central executive can appreciate conditions all over the country, and can co-ordinate reports, and direct uniform action as a result of its information. Devolution is necessary. The workers must combine, just as employers must combine; and employers and workers must combine together. By the establishment of works committees (upon which the representatives of the workers ought to be trade unionists), to which the employers could furnish information as to the present state and future prospects of business, and by which the best methods for the advancement of the firm, and of the industry, could be discussed, much good would be done. The advancement of the nation's industries is the advancement of the nation. But employers and employed cannot get down to facts at a meeting hundreds of miles away from those facts. They must talk matters over and fight them out on the spot, at the works where the things that have to be discussed actually happen. Then they will be able to see what is the best course to pursue; whether, for instance, the adoption of the now famous and very successful Priestman scheme of profit-sharing can be beneficially adopted, or whether hours have to be extended in order to reduce costs of production. Men will interest themselves actively in matters which they can influence, and when they can see with their own eyes, in their own shops, the results of their activities. And if, as would be proper, membership of his trade union could be taken as a sign of a man's competence in his trade, then the unions themselves would benefit by the devolution of their responsibilities, and consequently the beneficial activities of the unions could be considerably extended.

Moreover, the existence of a works committee would come, in time, to be recognised as a symbol that the management was reasonable and progressive. The conservative, secretive, difficult kind of employer would find his business suffer, because the best workmen would prefer to work for his rivals. He would therefore find it imperatively necessary to advance with the times. Is it not abundantly clear that pressure of that sort would be better and more effective than the kind of general strike we have seen of late years? Why should a good employer be hampered and his workpeople impoverished because of the necessity of bringing a bad employer to his senses? He will be protected by the other employers, whereas if there were no question of his men downing tools as a body, but only going, individually, to a more agreeable concern, he would suffer alone, and would have to take the only means of improving matters, unless he were so stiff-necked as to prefer to go out of business.

There is still room for individuality. The strength of the British commonwealth of nations, as it seems we are now to call it, lies in the individual strength of the several nations composing it. Centralisation of Imperial affairs has been proved to be impracticable, and has been given up. Centralisation in industrial affairs, though not yet given up, is no less impracticable, and it will have to make way for methods more adapted to the needs of the times in which we live.

The Secrecy of the Ballot in Trade Disputes.

On several occasions during the last few years the public, who have been the innocent victims of disputes between Capital and Labour, have been astonished to find that a settlement has been arrived at within a very short time after the rejection of very similar terms "by an overwhelming majority of the men!" One reason for this apparent anomaly may be that the method of taking the opinion of the men is faulty in some material respect. Either the men have not understood the proposed terms or they have been prevented from expressing their real opinions by the fear of disclosure. A recent case before Mr. Justice Sargent makes it plain that where the rules of a trade union provide that a vote shall be recorded in a particular way—a way designed to ensure that the secrecy of the ballot shall be preserved and that rule is not observed, the ballot is vitiated and cannot, in the result, be enforced.

It appears that on May 30th, 1921, a ballot was taken of the members of the National Society of Operative Printers as to a proposed alteration of the rules. The ballot papers of about half the members were marked with the numbers of the men to whom they were issued so that these men could be identified. It was not suggested that the marking was done with any sinister object, but in the view of the learned Judge "the secrecy of the ballot was very considerably stultified." Having expressed the opinion that under the rules "ballot" involved a method of secret voting, he held that the resolutions which followed the ballot were not binding. Seeing that the rules which Mr. Justice Sargent had to consider are in all essentials common to a large number of trade unions, it is obvious that his decision is of considerable importance, and those who are responsible for the proper administration of the unions will do well to remember the decision at which he has arrived. They should follow a little more closely the procedure by which those who enjoy the franchise are able to record their votes at elections. Whatever else has been said against the system by which members of Parliament are elected, no one has ever impugned the secrecy of the ballot. We are convinced that a very large number of trade disputes could be avoided, or composed at a much earlier date, if every member were satisfied that he could record his vote on the matter without fear or favour.

The Art of Salesmanship.

The popularity of the E.D.A. salesmanship conferences is evidenced by the large attendance at the second meeting, held on Friday, December 16th. A great deal of enthusiasm was displayed by those present to join in the discussion, which dealt with the selling of electrical power-driven appliances in the home, but it would appear, from the remarks made, that this enthusiasm is not always reflected in the actual selling of the apparatus. As was pointed out, it is a great asset for a salesman to be able to tell a prospective customer that he is successfully using in his own home the particular appliance he is trying to sell. Here, however, we had the spectacle of an electrical contractor discussing ways and means of increasing his sales of electrical appliances, whilst himself admitting that he had discontinued the use of such an appliance in his own home because it made a noise. The same sort of thing has happened before with regard to electric cooking apparatus. This is surely not conducive to good business, and the point was pointed upon by subsequent speakers.

In discussions on salesmanship we have acquired the habit of looking for some information with regard to American methods, and we generally get it; on this occasion, too, we were not disappointed. Although electrical appliances are much more popular in America than here, the Americans have one advantage, and that is that there is a larger percentage of houses receiving a supply of electricity. At the same time, it was interesting to hear that owners of apartment houses there sometimes install electrical washing machines before

tenants move in, but there is reason to believe that the price of the apparatus is a big factor in this connection. An American speaker, in order to indicate new fields for the sale of washing machines, instanced the case of an American woman who installed one on the hire-purchase system and developed a clothes-washing business, which was sufficiently profitable to provide her with a motor-car. In this country, of course, there is a great deal in the fact that, comparatively, so few houses are connected with electricity mains, and but for the fact that the discussions are confined to selling methods, there is no doubt that much would have been said about the methods of supply authorities. It is of interest to note that whilst the big stores were derided on the last occasion on account of their "jerry" wiring, on this occasion the suggestion that they should help in popularising the apparatus met with a good deal of approval. A point much discussed was the necessity for the salesman to gain a thorough knowledge, not only of the appliances he is selling, but of their application, and Mr. Morton's remarks on the details of clothes-washing certainly point to the fact that he practises what he preaches.

Railway Electrification.

The paper read by Sir Vincent L. Raven, K.B.E., before the North-East Coast Institution of Engineers and Shipbuilders, of which an abstract is commenced elsewhere in this issue, is noteworthy on the following grounds, amongst others—namely, that it emanates from a leading steam railway engineer; and that it makes out an absolutely convincing case for the adoption of electric traction on railways. We cannot recollect any previous paper which so fully compares not only the relative merits of steam and electric locomotives, but also the extremely important accessory plant and equipment and the operating methods which are inherent respectively to the two systems of traction, and whilst we are unable to reproduce the long paper *in extenso*, we feel that it calls for an exceptionally full abstract.

From time to time revolutionary changes take place—not without difficulty and in the face of strenuous opposition—in thought and practice in various walks of life; such changes, for instance, as the substitution of iron for wood in shipbuilding, of steam for wind power in ship propulsion, and of turbines for reciprocating engines in numerous applications; such a change is in progress before our eyes in the methods of traction on railways, and it is exceedingly interesting to watch its development. Quite naturally and properly, engineers who have at command the vast experience that has been gained with steam have regarded the upstart electric locomotive with suspicion, and have been keenly critical of its possibilities and alleged advantages; as ever, "the old is good." But it is an essential characteristic of every engineer worthy of the name that he is open to the reception of new ideas and is willing to adopt new methods, when he is satisfied that the new are better than the old. How else could the turbine—the "steam-eater" of 1890—have established itself on board ship?

We see the same process at work on land, and we welcome the accession of so eminent an authority as Sir Vincent Raven to the ranks of the convinced supporters of electric traction. A fact which adds to the weight of his advocacy is that for many years the railway of which he is the chief mechanical engineer has carried on both passenger and goods haulage by electricity on a scale which has enabled him to judge at first hand between the merits of electricity and steam; he speaks of that which he doth know. Moreover, the North Eastern Railway Co. is about to electricity 250 miles of its main-line system. Granted that the advantages of railway electrification are now generally admitted, the fact remains that up to the present practically all our development in that direction has been associated with suburban railways; in this paper, heavy goods and passenger transportation are dealt with, and it is hoped to aid materially the adoption of the larger schemes.

BREAKDOWN TESTS ON INSULATING MATERIALS.

A Simple "Guard-Ring" Method.

By N. A. ALLEN, B.Sc.

The commercial method of testing samples of materials used for insulating purposes consists, in general, of placing a layer of the substance to be tested between two flat circular brass plates having rounded edges and applying a voltage until the dielectric breaks down. The size of the sample is chosen so that sufficient overlap is obtained to obviate flash over around the edge of the specimen from one plate to the other.

It is noticed that the material almost invariably fails near the edge rather than at the centre of the plates. This is due to the increased electrical stress at the edge of the plate, illustrated in fig. 1, causing

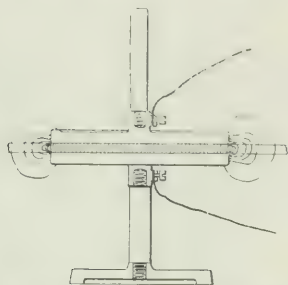


FIG. 1. LINES OF STRESS: PARALLEL PLATES.

breakdown there at a lower pressure than the voltage at which the failure would occur if the dielectric were stressed uniformly.

The use of some form of guard ring for tests of this nature is well known. If the guard-ring is badly arranged, however, the specimen will be found to fail at the edge of this ring instead of at the edge of the plate.

The method described below has been developed by the author, and has given complete satisfaction. The diagram in fig. 2 shows a section of the apparatus, which consists of a smooth base of cast iron supported on ebonite pillars. The sample to be tested is placed flat on this base, and a smooth circular brass plate placed upon it. The guard-ring, which is a heavy cast-iron ring, is laid down concentric with regard to the plate.

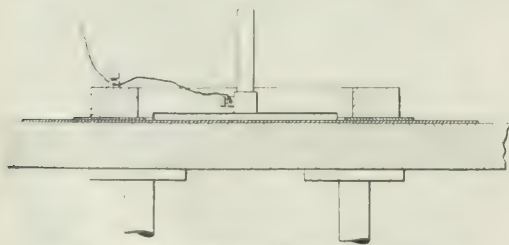


FIG. 2. SECTION OF APPARATUS (DIELECTRIC NOT TO SCALE).

but instead of resting upon the sample it is placed upon an annular ring of the insulating material, identical in all respects with the specimen under test, and protected by a stress oil film at the guard ring.

The insulator ring itself rests upon the specimen, and is pressed tightly down by the weight of the cast-iron, preventing outgassing air space as far as possible.

The distance between the inner edge of the guard ring and the outer edge of the plate is approximately $\frac{1}{4}$ in., the diameter of the plate 3 in., thickness $\frac{1}{8}$ in., while the inner diameter, outer diameter, and depth of the cast-iron ring are $3\frac{1}{2}$ in., 5 in., and $\frac{1}{2}$ in., respectively.

At this point it may be mentioned that too much stress cannot be laid upon the necessity of eliminating air spaces when conducting tests of this description. It was pointed out by Steinmetz that the introduction of a layer of insulating material of high dielectric constant (specific inductive capacity) into an air-gap which is in a state of electric stress approaching breakdown, is liable to cause a brush discharge across the gap. This is because the voltage drops on two condensers in series (*i.e.*, in this case a layer of insulator and an air-gap) having equal charges and dimensions, are inversely proportional to their dielectric constants. Thus the air takes more than its share of the voltage, the air is stressed at a higher value, and breakdown occurs. This phenomenon, which has only in recent times been admitted to its proper position of importance in the mind of the electrical engineer, has been the cause of many failures of insulators which are working at safe nominal stresses, whereas owing to the presence of air-pockets the actual stress is sufficient to cause a brush discharge across the air-gaps, with carbonisation and consequent breakdown of the insulation.

In fig. 3 is indicated the state of stress distribution in this apparatus. The presence of the outer conductor at the same potential as the testing plate causes the lines of force to be parallel not only in the centre, but also at the edges of the plate, while the insulating ring prevents breakdown at the edge of the guard-ring.

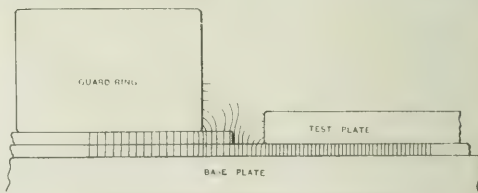


FIG. 3. LINES OF STRESS IN APPARATUS.

Thus a fair test of the dielectric strength of the material is ensured.

A series of tests was carried out with some $2\frac{1}{2}$ mil insulating paper, first without any guard-ring, secondly with the apparatus which has been described, and a table of comparative results is given, indicating the number of failures occurring at the edge and at the centre of the plate in the two methods, and also the respective breakdown voltages.

	I	II
Number of tests	51	85
Number of failures at edge	15	2
Percentage	82%	2%
Number of failures at centre	8	83
Percentage	18%	97%
Average breakdown voltage	1080	1190
Percentage	91%	100%

I.—Plate without guard ring.
II.—Plate with guard ring.

The advantage of this method is that it is just as convenient as the ordinary commercial method: the same annular ring of insulator can be used for a large number of tests, and the results obtained are more accurate with this than with the other method, providing a fairer test of the behaviour of the material under uniform electric stress.

THE FOUNDRY ELECTRIC FURNACE.

By JAMES EDGAR.

THE industrial uses of electric furnaces are very numerous, and one of the most satisfactory developments has been their invasion of the foundry. This department has long had the reputation of being extremely conservative, but innovations are accepted there as they are elsewhere with a good deal of suspicion. The number of electric furnaces in operation is small in comparison with the number of foundries. There are over 3,000 foundries in this country, and the great majority of them carry on with combustion furnaces.

The cupola requires a great deal of attention and considerable skill on the part of the men in charge to ensure satisfactory results. It has, however, important qualifications. Its efficiency is relatively high; it would appear to be about 40 per cent., and it is comparatively cheap; for instance, from 2 to 5 cwt. of coke will melt a ton of metal. It cannot, however, be called simple in operation, and the melting is done, as with all combustion furnaces, in the oxidising influence of the blast, which is harmful to some of the elements, notably manganese and silicon.

Notwithstanding the failings of the cupola, however, foundrymen are decidedly partial to it, and it is, as a combustion furnace, a good type. It is very improbable, indeed, that the electric furnace will oust it from the iron foundry, at any rate for a considerable time, although, if electrical engineers really concentrate on foundry requirements and electrical energy becomes cheaper, the number of electric furnace installations will grow rapidly. With steel, iron and brass alike there are two great points in favour of the electric furnace, the first being that the melting is done in a reducing atmosphere, and there is thus no oxidation, while the second is that a high degree of superheating is necessary to ensure good castings, whereas the superheating power of combustion furnaces is limited.

Messrs. T. Summerson & Sons, Ltd., one of the few British iron-foundries who use an electric furnace for melting iron, had some fine castings on view at the recent Shipping and Machinery Exhibition at Olympia. This firm found, on a microscopic examination, that in the best iron there were patches of sulphide and phosphide, and also that the carbon stood out in lumps, while the grain was loose. By electrically melting the iron, they have eliminated phosphides and sulphides, and produced even, close-grained metal.

What is called the duplexing process will eventually be practised in many iron foundries; that is, the iron will first be melted in the cupola, and then transferred to the electric furnace to be superheated.

In the steel foundry the electric process has become popular. For the benefit of those who have not studied steel foundry practice, it may be said that there are at present four processes: the open hearth, the Bessemer or converter, the crucible, and the electric processes. Until the electric furnace was introduced, crucible steel was used for castings of the highest grade, and opinion was divided between the open hearth and Bessemer processes for general work. Now, electric steel has largely displaced crucible steel, and many castings that were formerly made by the Siemens furnace or converter, are now made of electrically-melted steel. The metal, for one thing, is much purer. A great recommendation for the electric furnace to steel foundrymen consists in its refining properties. It is frequently only used for refining. Sulphur and phosphorus, which are very objectionable elements, can be almost entirely eliminated owing to the intense heat, and almost any class of steel can be produced from the cheapest material. Another point sometimes cited in its favour is that little brickwork is necessary. In the future, electric furnaces of much larger capacity will have to be made to cope with all classes of work. It is in the steel foundry that they have made the greatest progress. Castings are more costly because, in addition to the cost of electrical energy, the

upkeep of the furnace lining is heavy owing to the high temperatures. With large furnaces, upkeep charges would be proportionately lower.

It has been found that it is more economical to keep an electric steel furnace going all the time than to allow it to cool after each heat, because it is less destructive of the furnace lining. Some firms have found that they could make the furnace pay by having two heats a day, but have been handicapped by the workmen refusing to work the necessary hours. The consumption of electrodes is also an expensive item.

Electric furnaces should make rapid headway in brass foundries; much more rapid indeed than in the iron foundry. At the present time there are several excellent non-ferrous electric furnaces on the market. In one of these, the Morgan Crucible Co.'s furnace, the crucible is made of special conducting material, and has extension rings at top and bottom to carry the terminals. The lining of the crucible is composed of an insulating material. Water-cooled gunmetal terminals are used to convey the current into the walls of the crucible. At the Shipping and Machinery Exhibition the "Leifur" furnaces of the Leeds Electrical Construction Co. proved of great interest to foundrymen.

The melting of brass in the electric furnace presented peculiar difficulties. One objection to the arc furnace is that, with so high a temperature, the zinc was volatilised. Flexibility is an essential qualification for a brass foundry, because of the variety of mixtures to be melted. More types of furnaces have been evolved for brass melting than for iron and steel, and there has been more disagreement among foundrymen as to which is best.

WATER-POWER TROUBLES.

By E. SCOTT RIVETT.

IN many newly-settled countries rainfall and stream-flow records are still in a very incomplete state, and the designer of a hydro-electric plant is hard put to it to find reliable data for the basis of an estimate of the power available at some particular fall during all the months of the year. In such a case it is not advisable to place much reliance upon the memory of the oldest inhabitant, and, besides, there may be no oldest inhabitant.

The extreme value of precise records extending over a period of years is, of course, generally recognised by hydro-electric engineers. It is therefore easy to understand that, occasionally, owing to incomplete records or a too sanguine temperament, serious mistakes are made, but the following case of the Minnedosa (Canada) plant seems almost incomprehensible.

Some years ago a local company was formed to harness a waterfall near Minnedosa on the Little Saskatchewan river, and a hydro-electric plant was installed. An earth-embankment dam about three-quarters of a mile in length was built, giving extensive water storage and the development of a head of 25 ft. A six-foot penstock led to the power-house, where a horizontal-shaft turbine was connected to a 375-kVA generator. The drainage area had not been thoroughly studied, and when the plant was put into operation and service started, the company faced the fact that during the winter months no water flowed into the reservoir, so that plant operation was possible only from eight to nine months in the year, and during the season of greatest need—the winter months—there was no delivery of power. The company spent a large sum of money in the endeavour to remedy this condition, but finally was obliged to cease operations and go into liquidation. The plant has now been taken over by the Manitoba Power Commission, and it is proposed to redesign the whole hydro-electric outfit. In the meantime two 120-h.p. semi-Diesel units have been installed, and are working satisfactorily at an average fuel oil consumption of 0.9 lb. per kWh.

In the above instance, the designers of the plant overlooked the complete cessation of winter flow. The case of Wallace, Idaho (U.S.A.), is on a different footing. Here power is developed from water collected in a catchment area of about 2,000 acres, formerly well timbered with trees from 50 to 200 years old. In 1910 the water shed was entirely burnt over. Before the fire the stream flow was never below 1,000 miner's inches, but since then it has fallen to a fourth of that quantity, and the company supplying water, light, and power in the district, has been compelled to spend considerable sums of money annually in developing power from steam and using part of it in pumping water. Records of the weather bureau at Wallace show that the precipitation has been about normal, and one is thus forced to the conclusion that the unevenness of flow is due to the destruction of the timber and not to any change of climate or rainfall.

It is not often possible to increase the average stream flow of a river, but an attempt to do this is now proposed in Northern Ontario. The growing gold-camp in the South Porcupine district has suffered from a shortage of power for some winters past, and the company supplying electricity to the mines has now developed every available foot-pound on the Mattagami river. The demand is still increasing, and the present supply will be inadequate during the next period of low water. To overcome the difficulty, it is proposed to divert the water of the Grassy river, which now discharges into the Mattagami some miles below the chief power-house. At the place where it is intended to join the two rivers they are fifteen miles apart, but by a system of dams engineers have discovered that the water can be backed up through a chain of small lakes and rivers, so that only about 300 ft. of channel cutting will be necessary. The project would change the complexion of an extensive area, and alter the lower reaches of the Grassy river from a formidable river to a trickling stream, but it would make gold production and employment at Porcupine more certain.

FOREIGN LANGUAGES AND ENGINEERING DEVELOPMENT.

By ALEC B. EASON, A.M.I.E.E., A.M.I.E.E.

At a recent meeting of electrical engineers mention was made of the great development of water-power for electricity and the widespread use of electricity in small towns and village on the Continent, as compared with what one finds in this country. Two natural factors partly account for this development: first, the average density of population is much less than in England, and this reduces the difficulties of running transmission lines, as it is easier to run them in uninhabited areas than in towns; secondly, there are much greater resources of water-power on the Continent than in this country. But the educational factor has something to do with the development: the proportion of engineers on the Continent who know two foreign languages is greater than the proportion of English engineers knowing two foreign languages. Many Continental engineers can know at first-hand from the English Press what is being done in the British Empire, while many of our engineers can only know what engineering developments go on in foreign countries by reading translations of the technical Press.

The amount of study required to give one a working knowledge of a foreign language, sufficient to be able to read foreign publications, is perhaps over-estimated. Good progress in learning to read the foreign Press can be made by an individual who puts himself, say, a Spanish grammar and dictionary, and then studies privately by reading novels. In this way one is able to understand the main story of the novel without endeavouring to read every line; the latter process may be necessary at times, so as to translate each sentence correctly for the

schoolmaster, but it is not conducive to reading much literature. One does not need to look up every unknown word in the dictionary, but goes on reading even if some words are unknown. This method does really work; such reading of novels will not teach one to speak the language, though it helps one in obtaining a vocabulary to use when the pronunciation has been learnt; but after reading twenty or thirty novels in a foreign language, one will be able both to enjoy the foreign literature and to glean items of interest from the technical Press.

If one reads while travelling, standing, or sitting in tramcars and trains, one cannot always be looking up words in a dictionary; therefore one must either stop reading foreign books in such cases, or go on reading without troubling if some words are not understood.

Access to foreign literature suggests to one what parts of our conventions and ideas are insular and not universal. This can be learnt partially by reading books of travel and history, but is better learnt by reading novels dealing with the life in foreign countries. One is always able to learn about something in which the foreign nation is ahead of our own. No nation is absolutely better than every other nation in every department of life, including government, sport, medicine, education, literature, music, painting, engineering, and science.

As regards science, in particular, one should be able to read German text-books if one wishes to get *very detailed* information on technical subjects. The expression "very detailed" is used because of a remark made by a Swedish professor to the author. He said that Swedes liked English medical text-books in preference to German books, because the English ones gave the main substance of the matter, whilst the German books gave an immense mass of details along with the substance, and the books became so bulky that it was difficult to reach the substance at all. The criticism seems reasonable.

If members of Parliament, labour leaders, councillors, lawyers, and men who draw up rules and regulations had more direct knowledge of what went on in other countries, probably engineering progress would proceed more quickly, and Parliamentary regulations regarding electrical matters might become less irksome.

HIGH-FREQUENCY STRAY SPARKS ON MOTOR CARS.

By "VOLTMAN."

Truly, we live in strange times. The man-in-the-street seems to be in a fair way of developing a super-scientific brain. Of course, one is well aware that the daily Press regales him from time to time with wonderful and somewhat fearful articles on the latest marvels of science, served up with all manner of popular trimmings, and after reading such an article one concludes that the man-in-the-street is very prone to rush along paths of super-science where a Faraday or a Kelvin would have feared to tread. These ideas came into the writer's mind when a very ordinary owner of a motor car—and a cheap one at that—stated that he could get "high-frequency sparks" by lightly touching the petrol tank with a spanner. He averred that he could see the alleged high-frequency sparks distinctly in the dark when the engine was running. The writer suggested that if this were so our friend might possibly have made an important electrical discovery, but so far as the writer was aware, an ordinary motor car was not regarded by the electrical *experts* as a perambulating generator of high frequency oscillatory discharges. The writer doubts whether our super-scientist could give an intelligible explanation of why a magnet deflects a

compass needle, yet here was he descending on his magneto radiating high-frequency oscillations as the result of "spark gaps, condensers, and capacity"!!

The high-frequency effect, he averred, fully explained why some motor cars had been known to burst into flame by ignition of the petrol when on the road and leave nothing but a charred and tangled mass as evidence of the disaster. Assuming our friend was accurate in his observations, there is quite a number of interesting little problems connected with the origin of stray sparks on motor cars generally. The writer can vouch for some that are not explainable by ordinary reasoning. It is necessary to keep in mind that a motor car is an all-insulated, large-capacity mass of metal. The insulation resistance, with clean dry tires, may be anything from 3,500,000 to 4,500,000 ohms. All the metal of a car serves more or less as the return circuit for high-voltage current, and also for low-pressure currents when single-wire lighting and starting outfits are used. Furthermore, it is true that the magneto provides the essentials of a high-frequency generator; there is, in fact, much more in its functioning than meets the eye, as research has proved. It does more than merely produce a small spark at the plug. From observation, the writer can give a few instances of stray sparks. In one case heavily-insulated high-pressure leads from a coil to the plugs passed through a brass tube to keep them to-

gether. In complete darkness a ring of minute sparks could always be seen between the end of the tube and the insulation on the leads, this insulation being in excellent condition, so that there could be no question of leakage. Doubtless in this case there was an electrostatic and condenser effect between the leads and tube. Another interesting instance showed that some stray sparks take place at loose metallic joints on the mechanism despite the fact that there exists an excellent return circuit from the plugs *via* the engine back to the magneto, this circuit having practically no resistance. To make doubly sure of a good return, a wire was connected directly from the engine to the magneto base. Nevertheless, the sparks still occurred at the loose joints and a long way from the engine. If, as seemed improbable, these sparks did not indicate that there were wandering currents finding a way back to the magneto, it must be reasonably assumed that these sparks were the result of the aforesaid high-frequency effect. Each loose joint, which, of course, is in a state of vibration, would function as a coherer or detector acting in sympathy or unison with every discharge from the magneto. There certainly seemed no reason why return-circuit currents should be passing through these loose contacts, and the true source of these seems to offer a good field for investigation. Perhaps our friend the man-in-the-street did, after all, really see high-frequency effects!

AN AID TO METER TESTING.

By R. M. M.

"CURSE——& Co.! Another batch of faulty meters!" Such a remark may be heard after a preliminary test on some freshly-delivered meters in a test room which is not provided with adequate facilities for observing the variation of the test load.

Scales not sufficiently open, use of instrument on a lower ranger of scale, or simple variation, may have been the real fault which caused the tester to swear. The volt or amp. boy may be intelligent, he certainly will be human, and may suffer from astigmatism. The boy's power of observation of 1-10th of one scale division will decrease in proportion to the length of any one test, and set of tests, so that by the time the tester has reached the twelfth meter, say, allowing for 50-second counts per

stopping his test. As the image is considerably magnified, 1 per cent. can be arranged for 1 in. travel on the screen.

The accompanying illustration (fig. 1) shows a large size projector, on legs, but in actual practice it would

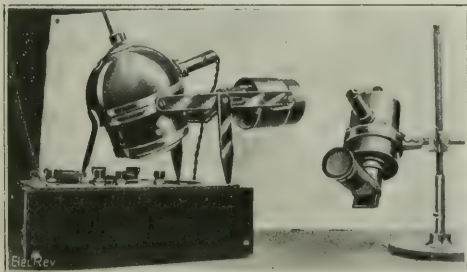


FIG. 1.—LARGE AND SMALL PROJECTORS.



FIG. 2. PROJECTOR IN USE.

meter, the probability of current variation being unnoticed is greatly increased. That 1-10th of one division at 10 divisions is 1 per cent. is obvious.

To obviate this trouble a small apparatus was recently designed, by means of which the image of the pointer and the image of the reflection of the pointer can be projected on to a screen, situated in such a position that the tester can see the images (coinciding) indirectly, but comfortably, and can readily see any variation at the same time as he is taking a count. Further, if the tester has a small two or three-plate carbon resistance handy, he can correct for a small variation without

be found more convenient to suspend this on a bracket, so as to allow horizontal rotation to give projection on one or other wall. The instrument would be supported on a pivot base, arranged so that the pointer could be brought under the projector at any part of the scale. The smaller projector shown is on an adjustable stand, but the suspended type is thought to be more useful.

The other illustration (fig. 2) shows the resultant projection photographed in broad daylight in a test room with one east and two north windows, or under rather trying conditions.

It is, of course, simple to construct a scale or scales

exactly corresponding to the standard instrument used, and corresponding to the distance of projection, or, alternatively, under certain conditions, the image of the actual scale can be projected. Both the projectors illustrated consist of: An optical mirror; a 12 volt motor can type head lamp; a condenser; a plane surface optical mirror; and a focusing lens.

If anyone considers building such a projector, it is important to remember the following details: the flatter the angle of projection the better; the plane-surface mirror must be fixed so as to be able to rotate through a sufficient angle to allow for the desired height of projection; the light source itself must be capable of being moved to suit the depth from the surface to the mirror below the pointer; and good ventilation is required for the lamp. The forms illustrated are not the best, but were made up from odds and ends of material at hand. In a slightly modified form the instrument can be used to project the image of any pointer or indicator.

LEGAL.

EDISON SWAN ELECTRIC CO., LTD., v. LAWRENCE.

ON December 20th, Mr. Justice Rigby Swift heard an action brought by plaintiffs against Mrs. Mary Eliza Lawrence, a widow, of Anna Terrace, Torquay, to recover £184 8s. 11d. under an agreement in writing dated December 13th, 1920, by which defendant agreed to guarantee payment of 5s. in the pound upon a claim against Wilfred Lawrence, such payment to become due at the expiration of nine months. Defendant denied liability on the ground that she was not aware when she signed the guarantee that he had entered into a deed of assignment with the trustee of his creditors.

Mr. Storry Deans appeared for the plaintiffs, and Mr. Stokes for the defendant.

Mr. STORRY DEANS, in opening, said that in November, 1920, plaintiffs issued a writ against Wilfred Lawrence for £895, the price of goods sold by them for use in his trade as an electrical engineer. Upon the writ being served he put himself into communication with the solicitors for the plaintiffs, and also with a firm of chartered accountants. A meeting of the creditors of Wilfred Lawrence was held in December, 1920, and the debtor who attended offered to pay 20s. in the pound, but the creditors were not disposed to accept of this unless he should give some security. Eventually it was agreed that he should pay his creditors by instalments of 5s. in the pound, by four quarterly instalments, and that he should assign his business to a trustee. It was also decided that as to the last two quarterly instalments he should provide a guarantee. He did so, and his mother, the present defendant, became the guarantor, and this action was brought under the document to recover one instalment of the amount due to plaintiffs by the son.

Mr. STOKES, for the defendant, contended that the form of guarantee sent to Mrs. Lawrence was a misleading document, and was therefore void. Plaintiffs omitted to disclose the fact that the debtor had already divested himself of all his assets.

His Lordship, in giving judgment, said he believed that the defendant did not know of the arrangement with her son's creditors when she signed the guarantee. She thought he was merely guaranteeing a trade debt to prevent legal proceedings continuing, and thus obtain for her son an extension of credit. He decided that the consideration wholly failed, and there would be judgment for defendant with costs.

WORKSHEET CONNECTIONS TO MESS.

At West London (December 11th, 1921), B. L. C. Contractors, 4 Park Street, Westbury, advertised £2000 a charge of connecting electrical wires to the cable belonging to the Workshop Urban Council without consent.

It is stated that notice that he required a licence for a 2 1/2 p. cable, and that the Urban Council refused to make the licence. The Council, it is stated, was prevented from doing so, and that the cable had been fixed, and thereby defendant obtained light and heat for residential and other purposes. Defendant was a young contractor, and had a licence and was doing so.

Defendant was a young contractor, and had a licence and was doing so. Defendant was a young contractor, and had a licence and was doing so.

ACCUMULATORS, LTD. v. AUSTRALIAN COMMONWEALTH.

Filed in the *Sydney Morning Herald*, of October 25th last, recently received, in this action Accumulators, Ltd., an Australian company, claimed about three years ago for the supply of electrical batteries, sued the Commonwealth Government for £12,000, claiming a breach of agreement in connection with a contract to supply certain parts necessary

for the erection of a counter and battery for the Postal Department in connection with the telephone exchange business. Plaintiffs stated that they packed and delivered the material ordered and fulfilled all the required conditions, but the defendants declined to pay for it. Several pleas were filed by the defendants, traversing the plaintiff's declaration, and setting up that when the battery was erected it was found that it would not carry the stipulated current continuously for three hours without excessive heating. They, therefore, refused, as they lawfully might, to accept the material, and requested the plaintiffs to remove it from the premises. Defendants also entered a plea of cross action, claiming damages for delay and inconvenience in excess of the amount claimed by the plaintiffs.

The case was part heard.

CHARGE OF STEALING LAMPS.

At Bow Street Police Court on 23rd inst., Edward Alexander Kann, 35, was sentenced to six months' imprisonment in the second division for stealing Osram lamps, belonging to his employers, the General Electric Co., Ltd. The earlier hearing was reported in our last issue. On December 23rd, according to *The Times*, the thefts had been going on for about 12 months, and had involved the company in a loss of nearly £2,000.

REVIEWS.

Power House Design. By Sir JOHN F. C. SNELL. Second edition, 1921. Pp. 535; figs. 201. London: Longmans, Green & Co. Price 42s. net.

A second edition of Sir John Snell's valuable work will be welcomed at the present time, when the important question of adequate supplies of electrical energy is receiving attention not only in Britain and the Dominions overseas, but in nearly every industrial country in the world.

A period of ten years having elapsed since the original edition was written, many important developments in power house design have taken place, and the author has taken the opportunity to rearrange the subject matter and bring it up to date, whilst some of the chapters have been entirely revised, and the minor typographical errors of the first edition corrected.

The aim of the author has been to give reliable and up-to-date information on the design and equipment of various types of power stations for the supply of cities and wider areas, and also for railways, mines, and factories, or where smaller independent power houses and sub-stations have to be designed and constructed.

The subject matter has been conveniently arranged in twelve chapters, and a feature of the book is the tabulation of useful data and costs, &c., the latter being on a pre-war basis, so that for estimating purposes a correction factor can easily be applied to suit the particular conditions obtaining.

In the opening chapter, systems of supply are considered, and the author makes a strong plea for the standardisation of voltages and frequencies, recommending 6,600 volts as a reasonable maximum generator pressure, and showing that only four standard pressures would be required, excepting, of course, high-pressure d.c. systems. In assessing the probable load factors, it is interesting to note that the figure for power supply over large areas is 35 per cent., and for general supply to large cities a load factor of about 30 per cent. may be expected; these figures in the earlier edition were given as 25 per cent. and 22 per cent. respectively.

The choice of site and type of plant are considered in the following chapter, and it is clearly shown how these two matters are closely related and also may be wholly determined by the character and location of the ultimate source of power. With regard to coal supplies, the figures given in Table IV are still based on high-grade coal of 13,500 B.t.u. per lb. (presumably as fired), and although great improvements in thermal economy have been made in the past ten years, the consumptions quoted do not take this into consideration. If we assume a 60 per cent. load factor and coal having a calorific value of 13,500 B.t.u. per lb., as fired, the heat consumption per watt-hour generated would be 34.7 B.t.u., or an overall efficiency of only 9.8 per cent. Unfortunately, coal of this value is the exception and not the rule in this country, and if it were available it would be a comparatively easy matter to obtain an overall thermal efficiency of at least 15 per cent. on this load factor with up-to-date steam plant, whilst a figure of 18 per cent. is now possible, including steam by losses.

Power-house buildings are considered in Chapter III, and the data regarding foundations and loading on various sub-soils should prove useful to the designer, whilst the importance of piling and rafting the subsoil in the case of most large modern water-side stations is referred to, and examples are given. Reinforced concrete receives brief mention, but in view of the economies that can often be effected by its use, it is disappointing to find less than half a page devoted to this type of construction.

Chapter IV is devoted to steam-raising plant, and many

useful data have been included, the text having been revised and brought up to date. In table XVI particulars of standard Lancashire boilers are given, but the evaporative capacity has been based on a coal of 13,500 to 14,500 B.t.u. per lb., and properly proportioned consumers are assumed. A useful table of particulars of the E. & W. marine type boiler is given, but the actual evaporations quoted appear to be based on high-grade coal, and the author mentions that the normal output is obtained with a consumption rate of about 23 lb. of coal per hour per sq. ft. of grate area. Nowadays, however, the power house engineer in this country has to be content with coal of from 10,500 to 11,000 B.t.u. per lb., as fired, with, of course, a higher consumption rate per sq. ft. per hour, and a diminution in efficiency.

CO₂ recorders are mentioned, and it is recommended that one should always be fixed to each range of boilers, in modern practice it is becoming more usual to provide an indicator or a recorder for each boiler, except, of course, in very small stations. Useful notes are given on boiler draught and coal storage and handling, but it is disappointing to find no data regarding modern ash handling plant, and only some fifteen lines devoted to the whole question of ash disposal.

The author gives some brief details of oil-fired boilers in this edition, and it is interesting to note that it will generally pay to burn crude fuel oil (18,000 to 19,000 B.t.u.) when its cost does not exceed one and a half times that of good steam coal (14,500 B.t.u.) or one and three-quarter times that of bituminous coal (11,500 to 12,000 B.t.u.).

Gas firing is also mentioned, but few data are given, possibly because test results are difficult to obtain, and gas-fired boilers at present can hardly be regarded as part of the usual power-house equipment.

Steam and feed-pipe systems are considered in the following chapter. In table XLIV, the properties of saturated steam up to 500 lb. per sq. in. abs. are tabulated, the authority being *Alarks & Davis, 1909*, but no data for superheated steam have been set out, and Callendar's values are usually considered to be more up to date.

Chapter VI is devoted to steam engine and turbo-generators, and forms naturally one of the most important sections of the book. As in the former edition, the author considers that generally the limit of size up to which reciprocating engines may be used is about 750 kW. In view of the developments of geared turbines and the fact that there is not much to choose between the reciprocator and the turbine in either capital cost or heat consumption in small sizes, the reviewer is inclined to place the limit at about 500 kW, and recent figures quoted tend to place it even as low as 350 kW.

Regarding reaction turbines, the author is careful to point out their inherent weaknesses, although little is said of the modern improvements effected in construction, and no mention is made of the new Parsons type of blading.

There is an absence of really up-to-date test results for either impulse or reaction machines, and it seems a pity that turbine manufacturers are so jealous of their results that the most up-to-date information is not readily available for publication in a work of importance.

The subject of condensers is considered in Chapter VII, and some useful tables and costs are given, although it is rather disappointing to find that the most up-to-date types of air pumps and auxiliaries are not dealt with, and as in the former edition a considerable amount of space has been devoted to jet condensing plant.

Chapter VIII deals with gas engines, gas producers, and oil engines, and it is interesting to note that the author considers that the i.c. engine in its present state of development is only economical from the aspects of both capital and running costs in stations of small or moderate capacity. In connection with power gases, methods of gasifying fuels are considered from a power-station engineer's point of view. Regarding solid fuels for gas production purposes, the formula given on page 257 in the first edition has been corrected, and its value enhanced by the caution given as to the effect of higher oxygen contents when compared to calorimetric determinations.

A chapter of practical notes on generators, motors, boosters, and transformers follows, and contains particulars regarding the specification and construction of electrical plant. The description of a typical turbo-alternator is similar to that given in the former edition some ten years ago, although great progress in design has been made in the interval. With regard to alternator rotors, mention of solid-core designs, and water cooling, has been omitted. Commutation difficulties on turbo-generators are referred to, but surely these are troubles of the past. With regard to tests on insulating materials and temperature limits, &c., no mention of the British standard specifications is made, although nowadays the purchaser is more or less obliged to keep to standard specifications unless cost is a secondary consideration. In connection with works auxiliary transformers, the author now recommends a secondary pressure of 415 volts for motors and 220 volts for lighting, but no mention is made of the convenience of adopting a pressure of 240 volts for the lighting, so that a supply can be obtained if desired from the same 415-volt transformers. Table XCIX gives particulars of standard static transformers, but as in the former edition, the outputs are only tabulated up to 50 kVA.

Switchgear is considered in Chapter X. The layout of the Greenwich switchgear is selected probably as being typical of a large machine power house, but of course about 100 years ago, in control gear, have been made in the last few years, and one is somewhat disappointed to find no attention devoted to enclosed types of gear. Modern practice dictates that reliability is a prime consideration, and to this end the adoption of a separate switch house and completely enclosed control gear is warranted in stations even of moderate capacity. The Dartmouth power station in Glasgow is probably the most up-to-date example of switchgear lay-out, but no description of this gear is given, and only brief mention of it is made elsewhere in the book. The author gives some of the salient features of a typical specification for 3-phase high-pressure switchgear, and still includes a reverse-current relay as part of the generator equipment. Against the absence of some type of automatic fault protective gear and of an automatic field-breaking switch are noticeable omissions.

Chapter XI is devoted to a consideration of some of the salient features of large and small power houses and sub-stations, and the subject matter has been entirely revised and brought up to date, so that it contains much of value to designers. Brief particulars are given of the lay-out of some typical waterside power houses, and some useful estimates of the capital costs of power houses are given. The author goes fully into the question of combined by-product recovery and generating plant, including the findings of the Nitrogen Products Committee's Final Report of 1920. Finally, waste-heat utilisation is considered.

Hydro-electric power houses are dealt with in the last chapter, and the subject matter has been revised and brought up to date. Water turbines of various types are considered, and the more modern method of comparing machines on a specific speed basis has been incorporated in the present edition. Convenient tables of capacities, sizes, and costs of reaction and impulse turbines are given.

The book is most lucidly written, free from mathematical formulæ, and exceptionally well illustrated, so that as a work of reference for professional engineers it will prove convenient and valuable.

The author has been most successful in collecting and classifying the experiences of eminent engineers, and in drawing upon his own knowledge in incorporating the information into a really valuable volume which will become the standard work on the subject of power-house design.

L. M. J.

The Testing of Continuous-current Machines. By C. F. SMITH, D.Sc., M.I.E.E., A.M.I.C.E., Whitworth Scholar. Pp. x+109; 21 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

This small book forms one of the numerous volumes on engineering included in Messrs. Pitman's Technical Primers, and in it the error, so common in books of this class, of attempting to cover too great an amount of ground in too small a space, has been carefully avoided.

The first chapter deals with the general principles of direct-current dynamos and motors, and is followed by others dealing respectively with measurement of resistance and temperature rise, no-load tests on machines, load tests on generators, and load tests on motors, in which all the tests likely to be of usual application in ordinary test-bed work are adequately described.

With regard to the methods of taking insulation resistance, it would be well to point out that, when taking an insulation test on a running machine by noting the pressure between each terminal and the frame and between the two terminals, the machine must not be connected to an external circuit, otherwise the result obtained will not be the insulation resistance of the machine itself. The diagram for the series Hopkinson test on p. 72 contains a slight error, as the voltmeter connection shown would short-circuit the supply pressure (the single-pole switch should be shown on the other side of the instrument), and in the formula for the losses in a series motor (using Field's method) given on p. 95 a printer's error has apparently resulted in a mixing-up of the various suffixes.

Apart from these small points, which will doubtless be put right when a further edition is required, the text is accurately written, and the "get up" of the book does credit to the printer and publisher.

The work can be heartily commended to assistants on machine test beds and to students taking a practical class in the testing of direct-current machines.

The Steam Turbo-alternator. By L. C. GRANT, M.I.E.E. Pp. xvi+260; 160 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 15s. net.

In writing this book the aim of the author has been to give the reader a good general knowledge of the principles, construction, and operation of the steam turbo-alternator, so that recourse to specialised text books on either steam turbines or alternators will be unnecessary.

The dual nature of the subject matter, and the fact that the work has been written to suit the needs of engineering students, central station engineers, draughtsmen, and others who are interested in the steam turbo-alternator combination,

have rendered the author's task a somewhat difficult one to perform.

The steam turbine is considered in its various details in the first six chapters, whilst the succeeding eight chapters are devoted to alternating currents and the theory and construction of modern alternators, followed by sections on control apparatus, operation notes, and examples of modern practice.

In connection with the notes on the development of the turbo-alternator, the illustration of a 7,500-kW, 1,500 r.p.m. turbine erected alongside one of the 4,000-h.p., 75 r.p.m. engine-driven alternators in the Glasgow tramway power house is quite interesting, and brings back to the reviewer memories of many anxious times on the d.r.t. control board and the effects of heavy flywheels.

Steam flow in reaction and impulse turbines, pressure and velocity changes and the effects of variations in pressure and temperature are considered in Chapters II and III, and the Emmet mercury steam turbine is briefly described. On p. 31 a curve of efficiencies at various pressures and temperatures is given, but its value is somewhat doubtful owing to the errors in the accompanying text. The feed-water temperature is given as 800 deg. F., and the efficiency ratio is expressed as the amount of heat which can be utilised when compared with the total heat content of the fuel. The feed-water temperature should doubtless be 80 deg. F., and the "efficiency ratio" is probably intended to be the available heat per lb. of steam divided by the total heat per lb. of steam.

In considering the power available and the efficiency ratio, the author gives the theoretical steam consumption as:—

$$2545/\text{Available heat per lb. of steam}$$

instead of the more convenient expression, using the value of 3415 in the numerator, which gives the consumption in lb. of steam per kWh instead of per h.p. hour on the shaft. "Indicated h.p." and brake h.p. tests can only be conducted on small turbines, and such terms are of little commercial importance in connection with turbo-alternators. Rankine cycle efficiency assuming isentropic expansion is not explained, whilst somewhat loose expressions such as "lbs. per square inch" and "a few ounces pressure to the square inch" occur in the text. It is usual nowadays to express expansion down to condenser pressures in inches of mercury (abs.) back pressure, or lb. per square inch (abs.).

In Chapters IV and V, steam turbine details are considered, and some interesting particulars of modern machines are given. Under the subject of rotors, the Michell thrust bearing (spelt Mitchell) is mentioned, but no illustration of it is given. Constructional details such as rotors, types of blading, packings, couplings and bearings, &c., are described and illustrated, whilst lubrication and governing systems are fully dealt with.

Before dealing with the theory of alternators, the author gives a chapter on alternating currents, but here again one comes across some rather loose expressions in the text. Ohm's Law is not defined in the usual manner, and an equation is merely given that $E = I \times R$, where E is the voltage, I is the current, and R is the resistance, although it is assumed that the law has been stated. Inductance and capacity are then considered, but the author does not take the trouble to explain his formulae or even state the units of measurement. Frequency is denoted by the equation: $f = 2p \times n$, where $2p$ is the number of pairs of poles and n is the revs. per second, although the number of pairs of poles is usually given by $p/2$ or simply by p . On p. 101 in the equation for average e.m.f., the demonstrator of 108 is obviously a misprint, but later the author states that the work done in a circuit is proportional to the square of the current, although he is considering the e.m.f., and there is no mention of work or energy units. Figs. 55, 56 and 57 do not appear to have any connection with the text of the chapter. The characteristic features of single and polyphase alternators and alternator windings are considered in the two following chapters, but on p. 122, in considering the relative outputs, the three-phase grouping is given as 0.51, whereas a factor of 1.51 is probably intended. Alternator output is next considered, and the author shows the importance of limiting temperatures to a safe figure. A safe final air temperature of about 130 deg. F. is mentioned, but as this figure is based on an engine-room temperature of 90 deg. to 100 deg. F., the available temperature rise is only some 40 deg. F. The usual of conventional figure of 40 deg. C. temperature rise is not mentioned, and a normal engine-room temperature of 90 deg. to 100 deg. F. is not the usual practice in this country, whilst the B.E.S.A. figures are not referred to in this chapter. The constructional details of alternators are described, and notes on up-to-date features, such as air filters and thermo-couples, are given in the following chapter. Excitation and regulation matters are dealt with in a practical manner, and short circuits and other troubles are considered in an interesting section which follows. Reactances, harmonics, and the earthing of the neutral are dealt with in turn and useful practical notes given. Chapter XIV is entitled "Generator Tests," and methods of determining the various losses are explained, although the details given are necessarily very brief. Control apparatus next receives the author's attention, and notes on switchgear and protective devices are given. Reverse current relays are not usually considered desirable on modern alternators, and overload time-limit protection is hardly a sound method to adopt for the protection of a generator. Protective gear is described with the aid of a diagram, and notes on synchronising

apparatus are given, the Weston synchroniser being illustrated. "Miscellaneous notes on operation and maintenance" is the heading of the next chapter, and practical hints on running and repairs are given. In starting up turbines, the author advises a period of at least three hours' preliminary warming up, and after warming up is completed the circulating and other pumps should be got away. Three hours is an unusually long period, and if the rotor is at rest, trouble is likely to occur with reaction machines on running up, whilst overheating at the exhaust and condenser can easily happen under the conditions stated. The final chapter is devoted to examples of modern practice, and some interesting details of existing machines are given, whilst the importance of higher power-house efficiencies is considered. An appendix gives useful notes on various steam and electrical matters referred to in the text.

On the whole the book is a very fair practical exposition of turbo-alternator practice, and should prove useful to students and operating engineers who desire to obtain a good general knowledge of the subject without having recourse to the more conventional text books or technical papers dealing chiefly with turbine design or alternating-current theory.

L. M. J.

AERO ENGINE IGNITION.

(Concluded from p. 836.)

Potential Wave-Form of a Magneto.

Potential Wave-Form of a Magneto. A fourth report, No. 47, September, 1918 (I.C.E. 241), by Dr. N. R. Campbell, shows that accurate knowledge of the wave-form is not as important as had been suggested. For it appears that the efficiency of the magneto as a means of producing ignition is by no means closely related to its wave-form; since, provided the necessary maximum potential is reached, it matters little or not at all in what way the rise to that potential takes place. So long, therefore, as it is only a question of determining which of several magnetos already constructed is likely to be the most efficient, a knowledge of the wave-form is not required.

On the other hand, if an attempt is to be made to design the magneto which will give the greatest maximum potential for the least weight and subject to the satisfaction of the necessary mechanical conditions, then a determination of wave-forms is almost necessary if any but purely empirical methods are to be used. For the inductances (and to a lesser extent the capacities) of the primary and secondary circuits vary so rapidly with the frequency of the oscillations passing in those circuits that it is necessary to determine the inductances at the frequencies which will be actually used; a knowledge of the frequency is thus needed and can only be obtained by some method which is equivalent experimentally to the tracing of the wave-form.

I. The first method investigated was that of the oscillograph. Since the frequencies of the oscillation in a magneto are of the order of 10,000 per second, the kathode-ray oscillograph (similar in principle to the Braun tube) seemed much more promising; such instruments are known to deal satisfactorily with oscillations of much greater frequency. But the difference between the widely separated impulses given by the magneto and the regular trains of waves to which the Braun tube has been applied, introduced almost insuperable difficulties.

II. The second method is that of the Helmholtz interrupter, in which the connection between the secondary terminals and the measuring instrument is broken at a known interval after the interruption of the current in the primary. In any "point-to-point" method, the determination of each point on the wave-form involves a separate experiment; it is absolutely necessary, therefore, that the wave-form should be identical in successive experiments. In a magneto this condition is not fulfilled.

When the problem was attacked once more, efforts were directed primarily to producing a more satisfactory break. If no attempt is made to design a break which will work continuously (like the cam-operated break of the magneto), there is no difficulty in securing accurate and regular timing. But even when the timing is accurate and consistent there remains the difficulty that the peak potential attained at successive operations of the break is not the same, but may easily vary by 20 per cent. It was finally discovered that much greater regularity was obtained if the rate of separation of the contacts (or at least the speed of the moving part which caused that separation) was decreased and not increased. In a subsequent report it is hoped to give a more detailed account of the circumstances which tend towards regularity at break; here it will suffice to say that, by reducing the speed of the part operating the contacts to 1 metre a second or less, it was possible to produce a contact which, at successive operations, would give peak potentials agreeing to 1 or 2 per cent. With such a contact a point-to-point method of tracing the wave-form becomes practicable.

Accordingly, the magneto armature was kept at rest, in the position relative to the pole pieces at which break occurs when the armature is rotating, and the current from an

external battery passed through the primary and broken by a pendulum.

Fig. 4 shows the secondary wave-form of a Thomson-Bennett magneto when a current of 2 amp. is broken in the primary and the armature is in the position which makes all the inductances a maximum. There was no spark gap in the secondary circuit. To indicate the consistency of the measurements all the experimental points are shown.

A full discussion of the significance of these results is reserved until more complete material is available, but a few points may be noted. The oscillations in coupled circuits are compounded of two damped harmonic vibrations, the frequencies of which are different from those of either of the two circuits when uncoupled. The ratio of the frequencies of the two harmonics depends chiefly on the coupling of the

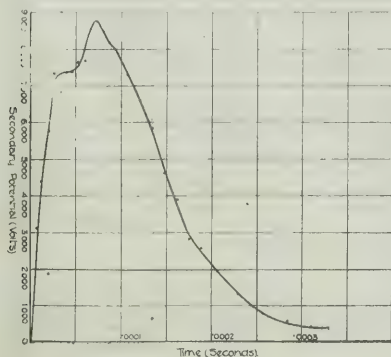


FIG. 4.

two circuits. In order that the secondary potential should be a maximum for a given value of the primary current, it is necessary (but not sufficient) that the coupling should be such that this ratio has one of a certain series of values which makes the peak of the harmonic of lower frequency coincident with one of the peaks of the harmonic of higher frequency.

In fig. 4 the presence of the two harmonics can be traced clearly. That of lower frequency is represented by what appears to be the main oscillation, while the harmonic of higher frequency is represented by the slight "hump" on the steep initial rise of the curve. Further, the frequencies in the secondary and primary circuits are very nearly the same, and the oscillations in the two circuits are very nearly in the same phase. The period of the harmonic of lower frequency is increased by the addition of capacity to the secondary, but it is not certain yet what change has been effected in the higher harmonic. These results are in complete accord with the theory. But the curve shows also that the coupling of the circuits is not such that the maximum secondary potential is attained, for the peak of the harmonic of higher frequency does not coincide with that of the harmonic of lower frequency; an alteration in the coupling should produce a more efficient machine. Again, the very heavy damping of the oscillations should be noted; if this damping could be reduced, the peak potential might be raised considerably, but since the damping is probably mainly due to iron losses, it is not certain whether any improvement in this direction is practically possible.

III. A third method of determining the wave-form was suggested by Mr. F. Young, of the British Thomson-Houston Co. It depends on the use of the rotary spark gap, but cannot give the time at which a given potential is attained for the second or any subsequent time. This limitation prevents the method giving all the information which is required. The method is feasible for obtaining at least an estimate of the periods concerned in the wave-form; it is capable of great improvement, but cannot compete with the point-to-point method in accuracy, and will not give the complete wave-form.

Spark Synchronism.—A fifth report, No. 22, January, 1918 (I.C.E. 171), contains a description by Dr. G. E. Bairsto, A.M.I.E.E., of tests that show that the synchronism of the sparks of a left and right-hand Dixie magneto, timed correctly, when at rest, may be out by as much as 2 deg. at engine speeds, which may cause, in certain cases, a drop in engine power of from 3 to 4 per cent. when using dual ignition.

The source of these irregularities is to be found in the contact breaker, which in a Dixie magneto is stationary, and is actuated by a rotating four-break cam. The fibre block in the right-hand magneto is struck by the crown of the cam in the usual manner, i.e., on the inside edge (fig. 5a). On the other hand, the contact-breaker of the left-hand magneto, instead of being turned through 180 deg. (i.e., inverted like the reflected image in a mirror) to suit the opposite direction of rotation, is kept the same, and the cam therefore strikes the fibre block on the outside edge (fig. 5b).

The only alteration that is made to the magneto is to turn the cam through a small angle corresponding to the arc subtended at the centre of the cam by the length of the fibre block. As the accompanying diagrams show, the actual forces on the cam are quite different in the two cases. In the case of the left-hand machine the impact is of a glancing nature and gives the contact-breaker arm an opportunity to rebound and make contact again before it is finally opened, thus giving two sparks. This point is still under investigation.

Using dual ignition with two magnetos, one a left-handed one and the other a right-handed one, the result of this abnormal behaviour is to cause the two sparks, which synchronise at very low speeds, to alter in phase in some cases to as much as 2 deg. (i.e., one retards by 1 deg. to 1 deg. and the other advances 1 deg. to 1 deg.) when the engine runs at top speed. The benefit of using two sparks simultaneously firing two plugs is thus to a great extent lost. Actual tests on engines have shown that this may cause a drop in power of from 3 to 4 per cent. below that obtainable with two perfectly synchronised sparks.

Where dual ignition is used, it is recommended that as far as possible the Dixie 8-cylinder magneto with left-hand direction of rotation be not used. A compromise might be made, which will, however, not meet all cases, by timing the two magnetos differently, the left-hand one 2 deg. in retard behind the right-hand one.

Magneto Faults.—The report on this subject, No. 18, August, 1917 (I.C.E. 158), is also by Dr. G. E. Bairsto, and comprises a summary of the experience gained at the Royal Aircraft Factory during the two years ended August, 1917.

American and London Bosch.—This type may be considered as fairly reliable. The total percentage of rejections was 164 per cent., and the very large number of machines which fired at the safety gap illustrates the inherently weak design of the safety gap which is used on the D.V. type of Bosch magneto.

B.T.H. (A6 and A8).—The chief objection to the B.T.H. magneto is the lack of refinement in constructional details. Only one 12-cylinder magneto has been tested so far, but a number of small defects still remain to be eliminated before it can be called satisfactory.

Dixie. (6, 8 and 12 cylinder.)—Very compact, sound in the general electrical design, but the workmanship in many parts is inferior. The design of the magnetic-field path is also weak. More insulation is required in places, and the design of the safety gap needs alteration. Out of 12 machines so far tested, only three were satisfactory, but in nearly all cases modifications made to the faulty machines enabled them to pass the tests.

Fellows. (F.R.4.)—A copy of the Bosch D.U.4. Twenty-nine of these magnetos have been tested and only one has been rejected. They are well made, but no larger size than a four-

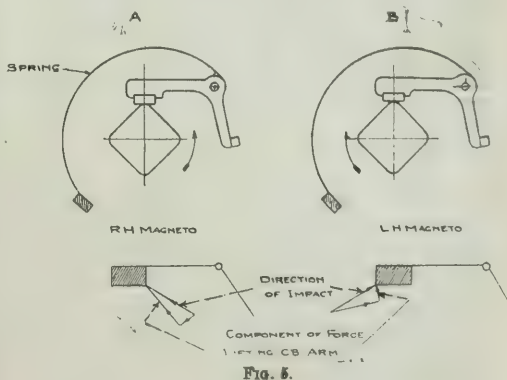


FIG. 5.

cylinder machine has been tested, so the reliability of a magneto made for more leads than this number is not known.

Simms. (6 cylinder.)—Only four of these have been tested and all failed to pass the tests. The workmanship is excellent, but more attention should be paid to the tuning and timing. All the above rejected magnetos ran satisfactorily when fully retarded, but failed to do so when fully advanced.

Peel Conner. (6 cylinder.)—Practically a copy of the Bosch D.U.6. Only three have been tested, but these have given full satisfaction. The manufacture is excellent.

Watford.—Only three machines have been tested, but all were defective.

Berling. (8 cylinder.)—This magneto cannot be considered as satisfactory.

Ruthardt.—Very unsatisfactory and discarded completely.

Morris & Lister. (A.D.S.)—Fairly satisfactory, but the workmanship is not perfect.

Hollister. (12 cylinder.)—Only one of this recent type of magneto has been tested. It is an experimental machine.

and of very excellent manufacture. It has several novel features which overcome some of the existing sources of trouble. The arrangement of the field magnets does not, however, seem to give the best possible results, as the secondary voltage is not high enough to give the sparking qualities desired.

Coil and Battery Systems. Besides the above types of magnets, experience has been obtained on the following three than that of either of the two following systems.

Remy (8 and 12 cylinder).—The constructional details in many points are very weak and have caused a lot of trouble. The design is sound and the synchronism of the sparks practically perfect. The current consumption, however, is greater than that of either of the two following systems.

Atwater-Kent (open circuit). (4 and 8 cylinder).—The constructional details are perfect, and the machines are exceedingly well manufactured. They are very light, and the current consumption is low. On the other hand, the sparks are not perfectly isochronous, due to the mechanical lag in the contact breaker. The only mechanical defect that has occurred has been the breakage of the contact breaker "lifter."

Atwater-Kent (closed circuit). (4 and 6 cylinder).—This is full of weak points. The unit is, however, very light, and the current consumption low.

The report summarises the tests carried out, mentions the sources of trouble and suggests means of improvement.

CORRESPONDENCE.

Letters received by us after 5 p.m. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Durability of Lead-covered Cable.

Your correspondent, Mr. R. Hampson, is to be congratulated on his very excellent letter on the above subject, but I am afraid he is not a regular reader of the REVIEW, or perhaps is too busy to study your advertisement pages, otherwise he would have been aware of at least one system which comes very near to his ideal. The system I refer to consists of a one-piece bonding ring, which clamps each cable independently, and a real universal connector box, which can be used as a four-way, tee, right-angle, or straight-through box, without alteration, and yet be totally enclosed at any position. No special cutting tools are required. Like our friend Mr. Raphael, modesty forbids me saying to which system I refer.

With reference to Mr. P. T. Kimmins's comments on the wiring at Lynton Town Hall, I venture to say that the trouble in this case was chemical contact corrosion due to the oak having been matured in salt water, or quite possibly the beams are part of some old oak sailing ship.

This is, of course, purely a suggestion, and put forward in the hope that it may assist you in diagnosing the case, as I think you are going to refer to it again.

J. C. White.

Manchester.

December 19th, 1921.

Mr. Hampson, in your issue of December 16th, while approving of lead-covered systems in principle, makes a general attack on the technical details of wiring systems, and directs his criticisms particularly to the one for which my firm is responsible. I trust, therefore, that you will permit me to reply, although a short letter from me has already appeared on the subject in this column.

The first objection raised by Mr. Hampson is that our junction box has four ways, so that, when used for a T, one way is left open. We assure Mr. Hampson that no objection has been raised to this, either by the fire offices or any other authority. The advantage of the 4-way junction box is that it can be considered "universal," and thus diminishes the number of accessories the contractor has to carry in his stock. We are ready to supply a 3-way box if there is any demand for it, and if Mr. Hampson desires a supply of a few hundred (for I am sure that he will adopt our system wholeheartedly after reading this letter), we shall be pleased to supply them. We have, however, sold many thousands of 4-way boxes, and have not yet had a single demand for a 3-way box. In the parallel case of the use of circular boxes in screwed conduit wiring, Mr. Hampson will find that a large number of leading contractors carry only 4-way boxes, and in surface work with screwed conduit it is quite a usual practice to leave one way open in dry situations.

Regarding bonding behind wood blocks, the criticism that a single centre screw is not sufficient security to keep the bonding ring in good contact with the cable has been raised before. There is no shrinkage if the blocks are of well-seasoned wood, and we do not think that Mr. Hampson need have any fear on this score in the case of the grooved blocks we supply for our system. On the other hand, I recognise that if the block is fixed to a plugged wall there is a possibility of a plug working loose, and this can be guarded against by the simple

expedient, well known in the contracting trade, of making a second hole and using two screws to fix the block, a practice on which many consulting engineers insist even in ordinary work. We are always ready to supply blocks with two fixing holes, if required, to save the second hole having to be made on the job, but so far there has been no demand for this.

The other "weak points" mentioned by Mr. R. Hampson do not occur in the Edison wiring system. The number of parts to be carried is extremely small, the cable fixers are standard for all sizes of cable, no special tools are required, and such few screw threads as are used are tapped into a thick iron backplate, not into soft metal.

I endorse Mr. Hampson's view as to the standard type of porcelain connector. It is not always satisfactory, and my firm has just placed on the market a new design—the Edison Acorn connector—which, although not so cheap, offers distinct advantages in rapid connection and absolutely certain contact, besides leaving no live screw-heads exposed.

I am extremely interested in Mr. Kimmins's letter on the action of oak on lead in the particular case he mentions, and look forward to your further reference to this, which I hope will include an analysis of the by-product. One thing is certain, however, that whatever the particular acid may be which has acted on the lead, whether a natural product of the wood or something used in seasoning or preserving it, its corrosive action would have been greater and more rapid on iron than on lead, and (dare I suggest it in face of the multitude of cable enthusiasts?) I doubt whether ruber would resist it over a long period.

Charles Raphael.

Ponders End, Middlesex,
December 22nd, 1921.

With reference to Mr. Kimmins's remarks in your last issue, I am inclined to think that the oak beams have been treated with a preservative to kill the weevils in the wood, and during this treatment the cables had what was never intended for them.

The weevil-killing solutions are composed of various ingredients—some include solutions of mercury, others, strong washing soda or caustic potash.

Many of our jobs have cables running on oak beams, and I have to-day inspected a number and find them quite perfect, so I feel sure that the trouble has nothing whatever to do with the lead-covered cables being on oak beams. There are plenty of jobs in Gloucester which were wired with the B.I.W. system (paper insulation with lead covering) that are running on oak beams and have stood up for quite 20 years; these are not earthed or bonded.

Richard A. Parsons.

Gloucester,
December 19th, 1921.

The Installation and Use of Electricity in Coal Mines.

I read with great interest the letter from Mr. Travis with regard to the use and protection of electricity at coal mines when the supply of current is taken from large stations. The question of providing proper switchgear at the point of supply will be one that will require careful consideration, but I do not consider it beyond the ability of our switchgear manufacturers to supply a suitable apparatus.

Your correspondent, Mr. Millard, although he agreed with Mr. Travis, does not in any way indicate that the E.A.C. switchgear would comply with the requirements which would be called for in dealing with stations up to 40,000 kW.

I believe I am correct in stating that colliery engineers are fully aware of the type of switchgear which will be necessary to comply with rule 132.

A. W. Williams.

Nottingham.
December 17th, 1921.

High-pressure Fuses.

My attention has been directed to an article on "Fuses" by a "Central-Station Engineer," appearing in your issue of November 25th last, in which it is stated that auto switchgear is subject to trouble and liable to be blown up. Your contributor suggests, on account of the heavy cost thus entailed, the use of certain high-pressure fuses in place of the automatic tripping coils, or as a safeguard to protect the oil circuit breakers from damage on a short circuit occurring. He, however, appears to have overlooked a serious objection to the use of fuses for this purpose on a polyphase system. The fundamental difference between a fuse and a circuit breaker lies in the fact that a fuse will interrupt a multipole circuit as a rule in one pole only, whereas a circuit breaker under the same conditions will interrupt the circuit completely. This is of particular importance in the case of three-phase circuits feeding a number of motors when a single phase interruption, either on the primary or secondary side, will subject all the motors on the affected circuit to the danger of excessive temperatures, and consequently to the possibility of defects in the armature winding. For this reason fuses for protecting such circuits are being given up.

There is no reason why oil circuit breakers should not give adequate protection without any damage under short-circuit conditions, provided they are of sufficient breaking capacity,

which there is no difficulty in guaranteeing when they are designed in accordance with the recommendations of the Swiss Association of Electrical Engineers, which are based on actual short-circuit tests by an independent committee.

The S and C fuses described in the article are apparently similar to those made by Messrs. Schweitzer & Conrad, of Chicago, which are filled with carbon tetrachloride, the disadvantage of which is the formation of certain fumes when the fuse blows, which oxidise and detrimentally affect the metal parts.

With a view of employing this liquid in place of oil-filling for high-pressure circuit breakers, official tests were carried out by the Swiss Association some years ago, the result of which proved that the advantages and disadvantages of oil against tetrachloride did not justify a departure from employing oil, and those undertakings which have employed tetrachloride have now returned to the use of oil.

J. B. Rudkin.

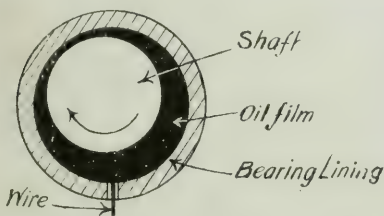
London.

December 21st, 1921.

Worn-bearings Alarm Device.

I read with interest the brief details of the device, described under "New Electrical Devices, &c." in your issue of December 16th, for giving warning of undue wear in bearings. The idea is undoubtedly ingenious, but it brings up several of the interesting problems which arise in connection with the lubrication of bearings.

It has been found by careful experiments carried out by Beauchamp Towers, Goodman, and others, that high-speed oil-lubricated journals assume a position, with respect to their bearings, somewhat as shown in the appended rough diagram. The arrow shows the direction of rotation, and the blacked-in portion the oil film (greatly exaggerated) surrounding the journal.



This film is actually thickest towards the bottom of the bearing, due to the feeding-down action of the rotating shaft carrying the oil round from the oil-ring grooves. The film of oil is at a very high pressure towards the bottom of the bearing. Naturally the above condition applies only to a rotating shaft.

It is evident that wear takes place during rotation, and, reasoning from this, we must conclude that the actual wear on the lining is caused by the high-pressure oil film. If the wire introduced at the bottom were of approximately the same degree of hardness as the lining, it is reasonable to suppose that the end of the wire would wear uniformly with the lining—thus keeping the film of oil between it and the journal. Hence it would appear that there is a possible cause for failure of the device here, on a high-speed journal running for very long non-stop periods, due to the insulating effect of the oil film. The thickness of the film varies, of course, but an average figure, that has been found by actual measurement, is round about 0.0005 in. This oil, at a very high pressure, would require a fairly high rupturing voltage.

It is easy to see that such a difficulty could be easily overcome by the use of a sufficiently high voltage or the use of a very hard material such as cast steel, for the introduced wire. The latter would probably prove more definite in action, though it would be bad for the journal.

Naturally the above trouble would not crop up with the bearings on a machine that was started and stopped frequently.

This is not intended as a criticism of the device, but merely to point out a difficulty that might occur under certain conditions.

E. R. Sanderson.

Bredbury.

December 20th, 1921.

[As mentioned in our note, the device can equally well be fixed outside the journal bearing, where there is no oil under pressure. We think there would be no risk of injury to the journal by using a hard wire, if it were found necessary, as the first contact would actuate the alarm.—Eds. *Elect. Rev.*]

Leaves from an Inspector's Note Book.

In reply to the letter from Mr. N. W. Walker, I hasten to state that with the exception of men like "Anode," I do not think engineer surveyors are fools. As a rule they are very tactful, nice engineers, but the few exceptions are, as I

stated, bossy, conceited, and unlikeable individuals with opportunities. Of course, there are black sheep in every flock.

I did compare certain wealthy insurance companies to Hebrew money lenders, for at that time some of them were practically starving their inspectors. I am glad to note from Mr. Walker that since those days, owing to the efforts of the Engineer Surveyors' Association, they are obtaining more reasonable remuneration.

No plant under my care is insured against break-down. My Council employ engineers of their own and cannot afford such luxuries! So that my "throne"—as Mr. Walker calls it—has not lately been shaken by an inspector's report! Fifteen years ago, however (and before I knew what I know to-day), after I had foolishly recommended that the plant under my care be insured against break-down, an "Anode" type of inspector certainly did attempt to shake my "throne," so I reported him to my Committee, who promptly shook his "throne" by ending the insurance with his company, thereby, to my knowledge, saving the premium during the remaining four years I had the honour to serve them. No break-down took place in this time, nor were the engineers and myself disturbed by insurance inspectors with their everlasting foot- rules and written rules, and the borrowing of meggers! As that time a megger appeared to be the height of their ambition in the way of testing, but, of course, things have probably altered.

Again, no comment has ever been made about my balancer fuses being too heavy; as a matter of fact, my balancers have no fuses!

I have heard of motors being overloaded, but the motor which I gave as an example was (unfortunately for Mr. Walker's argument) connected to a blower. Mr. Walker will therefore see that it could not have been "badly overloaded," and guess again. Let insurance companies stick to inspecting and insuring plant against break-down which is in the hands of laymen and handymen—especially handymen. For an insurance inspector to come poking his nose into a power station, where even the shift engineers, and sometimes the switchboard men, are at least his equals, is silly, and I should say rather uncomfortable for the average inspector. Of course, "Anode" would probably give a lecture from the switchboard gallery about the mistakes the plant designers had made!

In conclusion, allow me to inform Mr. Walker that I have the honour to number amongst my friends at least one engineer-surveyor, and my previous letter was not directed against these gentlemen as a class. An ass is often unnoticed for quite a long while in many branches of engineering, but once let loose on society as an engineer-surveyor he cannot for long hide his light under a bushel.

A. J. Abraham.

Electricity Department,
Aberdare,

December 23rd, 1921.

With reference to Mr. A. J. Abraham's criticism on the above article by "Anode," it seems to me that Mr. Abraham is just a little too severe, and I give the opinion of quite an ordinary electrician. Having had dealings with electrical inspectors (both good and bad) and having read "Anode's" article, I cannot say that the article left me with the nasty taste complained of by Mr. Abraham. On the contrary, I think the article was humorous, and "Anode's" observations seemed to be quite true, judging by my own experiences in similar circumstances. Also, I do not think that "Anode" was posing as a judge over electrical engineers, but merely giving observations he had taken whilst on his daily rounds. He also states that he made a mistake in the connecting of a motor; in other words, he points out that he is not "infallible." Surely Mr. Abraham would not give instructions to any layman as to how to connect a motor or any other piece of electrical apparatus, and I fail to see where the "dirty trick" (as Mr. Abraham calls it) comes in. "Anode" (in my opinion) acted diplomatically when he sent the man for something whilst he ("Anode") changed the connections referred to. Had the man been an electrician and inadvertently made a mistake, it would have been an entirely different matter, but—a pork butcher!

In my opinion "Anode" is a young fellow, and I am inclined to think that Mr. Abraham has had trouble with one or two idiotic insurance inspectors, but he has applied the "cane" too hard on "Anode."

Contractor's Foreman.

December 17th, 1921.

A Disputed Meter Reading.

In reply to "Perplexed," I take it that the meter in question is of the mercury ampere-hour type. This meter will only register when current is passing through it. The case mentioned by "E.T.B." does not apply to a meter of this type.

"Perplexed" mentions having taken tests to earth, but does not say if he has tested "between." It is just possible that there may be a leakage between the wires without its showing as an "earth."

If the meter has a clock dial, i.e., pointers, one of them may have slipped if improperly fixed. If it became so loose as to slip, it is scarcely possible that it would escape notice.

Another possible solution is that the meter had been read inaccurately on more than one occasion, and the mistake discovered and rectified on the June reading.

The test obtained on the meter is a very usual one for that type.

Cases similar to "Perplexed's" come up occasionally, and usually result in the consumer paying.

Every care is taken to provide a consumer with an accurate meter. It cannot work unless current flows through it, therefore I think the Corporation would be rather unwise not to charge for units registered.

Stop Watch.

December 22nd, 1921.

Switching Certificates.

I should like to obtain the views of your readers on the value of Messrs. A. P. Lundberg's switching certificates. In my search for employment I have met a large number of contractors who term them valueless. However, I should imagine that a wireman who possesses one or more certificates would be of more value to a contractor than the wireman who has no study about him. My employment-seeking travels have shown me that the average contractor is only conversant with simple controls, and thus cannot give his customers the true convenience of electric light. A good wireman is an asset,

but the same man with a knowledge of variable controls, &c., is surely doubly so. I trust I am voicing the views of numerous other certificate holders.

Intermediate.

December 23rd, 1921.

Liquid Starters

In your journal of this week I notice remarks made at the discussion of Mr. Wilson's paper on the above subject, when it was asked why these starters could not be made so that the blades were always immersed in the liquid. This has been the practice of a well-known firm (Messrs. Allen West & Co.), and their starters have given entire satisfaction and comply with the Mining Regulations. I have also found liquid starters to be quite suitable for the control of main and tail haulage gears; such liquid starters should be rated in accordance with the duties placed upon them. Metallic resistances are apt to give trouble unless they are properly rated. It is no use condemning liquid starters because of the insufficient attention given to them by motor attendants.

C. Jones.

Chasetown,

December 19th, 1921.

BUSINESS NOTES.

Bankruptcy Proceedings.—FREDERICK ALFRED STANLEY WORMULL, trading as Lewisham Electric Wiring Co., 273, High Street, Lewisham, electrical engineer. The following are creditors herein:—

Aladdin Renew Lamp Co. ...	£ 10	Southern Electric Co. ...	£ 28
A. Garner ...	17	J. Watt ...	12
General Electric Co. ...	15	Mrs. Wormull ...	3,583
H. & J. Stevenson ...	13		

GEORGE WILLIAM ENDALL, trading as Endall & Co., Canal Motor Works, Canal Bridge, Church Street, St. Helens, Lancs., electrical, mechanical, and automatic engineer. The adjourned public examination of this debtor was held recently at Liverpool. The Deputy Official Receiver stated that the examination had been adjourned in order that the debtor might amend his statement of affairs. This had been done, and the examination was ordered to be closed.

B. BARNETT, electrical engineer, 104, Whitechapel Road, E.1.—Receiving order made December 20th on creditor's petition. First meeting, January 6th; public examination, March 8th; both at Carey Street, W.C.2.

A. J. MULCOCK, motor and electrical engineer, The Garage, Farnham Common, Bucks.—Receiving order made December 19th on debtor's own petition.

W. HILL, seedsman and electrician, Leigh, Lancs.—First meeting, January 4th, at the Official Receiver's offices, Byrom Street, Manchester; public examination, January 18th, at the Court House, Bolton.

T. D. WARING, electrical engineer and draper, 55, Walmgate, York.—Last day for proofs for dividend, January 11th. Trustee: D. S. Mackay, Official Receiver, Red House, Duncombe Place, York.

WILLIAM ASHMORE BENNETT, electrical contractor, 1, Richardson Street, Derby.—At the Derby Bankruptcy Court, on December 20th, the public examination took place. The liabilities were £129, and there was a deficiency of £99. The business was commenced in October, 1919, with £200 of borrowed money, which had been paid back with 10 per cent. interest, and debtor had no receipts for the repayment of the £220. He attributed his failure to depression in trade, keen competition, and ill health. He said his profits did not reach more than £2 per week. The examination was closed.

JOHN GLYNN WILLIAMS, 4, Blaenannant Street, Duffryn, Cymmer, Port Talbot, Glam.—electrical engineer.—The first meeting of the creditors of the above was held recently at Swansea. According to the statement of affairs, the gross liabilities amounted to £4,433, of which £393 was expected to rank for dividend, against assets estimated to realise £11, or a deficiency of £382. The meeting was adjourned.

Company Liquidations.—THE ILFORD DRY BATTERY CO., LTD., Wool Exchange, London, E.C.2.—The statutory meeting of the creditors of the above was held recently at the offices of the Liquidator, 2, Guildhall Chambers, E.C., when it was reported that the shareholders had passed the usual resolution for voluntary liquidation, and appointed Mr. G. W. Roberts, I.A., to act as liquidator. The statement of affairs presented by the liquidator showed liabilities totalling £1,977, made up as follows:—Unsecured creditors, £748; bank overdraft, £163; and debenture interest, £1,045. The assets were estimated to realise £713, from which had to be deducted £31 for preferential claims, leaving net assets of £682, or a deficiency of £1,294. The assets comprised stock, £319; fixtures and fittings, £61; German marks, £2 13s.; and book debts, £330. The statement also showed patents of the book

value of £1,500. For the moment no value was placed upon these patents. It was stated that the company was originally interested in the manufacture of batteries under French patents, and in 1919 one of the patents was sold for about £2,000, and that money was utilised in discharging liabilities and wiping out a debenture. Since that date the company had traded in various goods, but had not succeeded in making a profit. It was pointed out that the assets shown in the statement of affairs were not sufficient to fully discharge the claims of the debenture holder, and there was nothing left for the unsecured creditors. After discussing the position a resolution was passed confirming the voluntary liquidation of the company with Mr. Roberts as the liquidator.

AUTOMOBILE ELECTRICAL REPAIRERS.—Winding up voluntarily. Liquidator, Mr. N. J. Dodd, Sardinia House, Kingsway, W.C.2. Meeting of creditors, January 5th at Sardinia House. Claims to the liquidator by February 5th.

ANGLO-FRENCH WIRELESS CO., LTD.—Winding up voluntarily. Meeting of creditors called for January 3rd at 10 and 12, Bishopsgate, E.C. Liquidator: Mr. S. Powell.

WELLMAN, HEAD, STOTHERT & PITT, LTD.—Meeting called for February 13th to hear an account of the winding up from the Liquidator, Mr. C. J. Barker.

Dissolution of Partnership.—E. DURDEN & Co., electrical engineers, 13, Queen Street, Liverpool.—Messrs. E. Durden, G. W. Thompson, and A. S. Allford have dissolved partnership. Messrs. Durden and Thompson will attend to debts.

Trade Announcements.—BRITISH OXYGEN CO., LTD., advise us that the registered office and works of the company are transferred, as from December 28th, to Angell Road, Upper Edmonton, N.18.

MESSRS. H. G. MABBS & SON have removed to Sussex Street, Lower Broughton, Manchester, and all communications should be sent there.

From January 1st Mr. A. HINDERLICH (late Capt. R.G.A.) is taking over from the Protector Co., Ltd., the business of supplying wrought copper cable sockets and asbestos-woven resistance nets and grids hitherto carried on by it at Central Hall, Southall. Price lists of these manufactures have been received. He is also taking over the major portion of the premises, and the telephone number (Southall 121). He is relinquishing all other interests except the sale of instrument wires in small quantities for experimenters.

THE KARTRET ENGINEERING CO., LTD., has now removed to its new works at White Street, Southall, and all communications should be sent there.

MESSRS. ENGINEERING SUPPLIES, LTD., state that the new telephone number for their offices and warehouse at 155a, Upper Thames Street, E.C., is City 2299.

MESSRS. JOHNSON & PHILLIPS, LTD., state that the telephone number of their new Liverpool branch (57, The Albany, Old Hall Street) is "Central 5145."

Catalogues and Lists.—MESSRS. SIMPSON, BAKER & Co., 4, St. Augustine's Place, Bristol.—Three illustrated and priced leaflets advertising pendants, bowls, and other lighting fittings. Also a blotter bearing a merry picture.

THE "G. & P." ELECTRICAL CO., 29, Heathcote Street, Nottingham.—A leaflet giving prices of v.i.r. cable, ceiling roses, switches, &c.

MESSRS. WARD & GOLDSTONE, LTD., Frederick Road (Pendleton), Manchester.—An illustrated and priced leaflet dealing with the "Facile" electric sealing machine. Also List W 100, giving prices of cables and flexibles.

MESSRS. CHARLES FER & CO., LTD., Kenzie House, 42, Newgate Street, E.C. 1.—An illustrated leaflet giving particulars of the "Hecia" pedestal bowl fire.

ST. HELENS CABLE & RUBBER CO., LTD., Warrington.—A card giving in several illustrations a contrast between the "good old days" and the "good new days" brought in by St. Helena C.T.S. cable and band tires.

Private Arrangement.—GREEN, NUTTALL & Co., electrical engineers and contractors, 76, Victoria Street, Manchester.—The creditors of the above were called together last week, when a statement of affairs was presented, which disclosed total liabilities of £598, all of which was due to trade creditors. After allowing £25 for preferential claims, the assets were estimated to realise £135, or a deficiency of £463. It was reported that the business was commenced in March, 1921, with a capital of £150 found by Mr. H. Nuttall. In August Mr. A. Green came into the business, and from that date books of account had been kept. The present position was attributed to insufficient work due to lack of capital and the slump in trade. After a short discussion it was unanimously decided that the estate should be dealt with under a deed of assignment with Mr. Arthur T. Eaves, C.A., of Messrs. Harry L. Price & Co., 15, Fountain Street, Manchester, as trustee. The following are creditors:—

	£	Falk, Stadtman, Ltd.	29
City Electrical Co.	117	Adams & Co.	26
R. S. Newton & Co.	70	Arthur H. Lewis	23
General Electric Co., Ltd.	75	A. & A. Electrical Co., Ltd.	18
Hart Accumulator, Ltd.	54	W. T. Rawcliffe, Ltd.	17
Electrical Supplies, Ltd.	45	Hough (W.) & Sons	14
Higgins, Ltd.	41	Driver, Drennan & Cooper	13

Calendars and Almanacs.—MESSRS. MATHER BROS., 36, Farringdon Street, London, E.C. 4, have sent us a wall calendar with monthly sheets (each of which also has a complete calendar for 1922) mounted on stout card, and with a useful contrivance for bringing out the correct date "at a glance."

MESSRS. ROYCE, LTD., of Trafford Park, Manchester, have issued a calendar for 1922 consisting of monthly sheets, each carrying a picture of one of the company's electric cranes.

MESSRS. F. W. PARKES & Co., of 65, Dame Street, Dublin, have issued a wall calendar with monthly sheets for 1922.

From Mr. HARRY MOSS, 82, Leeds Road, Bradford, we have received a wall calendar with two-monthly sheets for 1922, each of the six sheets being humorously illustrated.

From the ALLIED NATIONAL CORPORATION, LTD., British agents for La Métallurgique Electrique (formerly Vedovelli, Priestley & Co.), we have received an ash-tray of wrought and polished marble, as a specimen of the products of their marble works.

Wages in the Electricity Supply Industry.—Under the agreement made in November, which provided for a reduction of wages by 3d. per hour for each fall of six points from the cost-of-living datum level of 120, wages are to be reduced by a further 1d. as from January 1st.

Unemployment.—The Ministry of Labour's statistics regarding the position on December 16th showed that the total number of unemployed fell during the week from 1,833,689 to 1,824,500. Short-time workers increased from 265,504 to 273,800. On December 9th, 107,638 men were employed on special relief schemes.

An Atlantic-Pacific Exhibition in 1925.—A Reuter message from Portland, Oregon, (U.S.A.) says that Portland has accomplished the first step in plans for the holding of a world's fair there in 1925—endorsement by the voters of a 2,000,000-dollar tax levy to be spread over three years—and attention is now directed to the second effort in the financing of the project, approval by the people of the State. This is a 5,000,000-dollar tax which, added to the amount Portland will raise and 1,000,000 dollars to be obtained by public subscription, will complete the financing. The fair, officially designated, as the Atlantic-Pacific Highways and Electrical Exposition, was projected to celebrate the completion of trans-continental highways, and the centenary of the invention of the electro-magnet.

Patents Applications.—Application has been made for the restoration of Patent No. 128316, of 1917, for improvements relating to electric batteries granted to George Nikolayevich Antonoff. Also for the restoration of Patent No. 93817, of 1915, for an improved method and apparatus for automatically compensating the expansion or contraction of wire, rods, or the like, granted to Walter Harrison Biddle.

Our American Contemporaries.—The American *Electrical Review* (Chicago) which was started about forty years ago, and has been on our exchange list as long as we can remember, has been sold by the *Electrical Review* Publishing Co., Inc. to the McGraw-Hill Co., Inc., and will be taken over by the purchaser on January 1st, 1922. The *Review* will continue to be published in Chicago, and will be issued monthly instead of weekly, as the *Electrical Review* and *Industrial Engineer*. The new proprietor describes it as an extension of the work of the *Electrical World*. Mr. C. W. Price, who has been at the helm of the *Review* for nearly forty years, issues his last word as editor in the December 31st issue.

For Sale.—By direction of the Disposal Board, Messrs. BUCKNELL, BALLARD & PENNINGTON will sell by auction in the Biester Aerodrome, buildings and plant, including oil engines, dynamos, switchboard, &c.

MESSRS. HILLIER, PARKER, MAY & ROWDEN will sell by auction at the Grand Hotel, Bristol, on January 12th, factory premises with a total area of 42,000 ft., &c.

MESSRS. LEOPOLD FARMER & SONS will sell by auction early in January the metal plating and depositing plant and radiator tube machinery of Radiator Tubes, Ltd., of 114, Great Dover Street, S.E.

ASSETS AUCTIONS CO., LTD., will sell by auction on January 5th, at 119-121, Newington Causeway, S.E., electrical material and accessories, including motors, drillers, radiators, meters, fans, &c., also a quantity of wood blocks. (See our advertisement pages to-day.)

A Telephone Card.—The County of London Electric Supply Co., Ltd., has sent us a telephone card as in previous years. A picture gives an aeroplane view of London from the West, illuminated by an electric light—"the light for London."

Russian Electrical Undertakings.—According to an Exchange Telegraph dispatch from Berlin, the Soviet Foreign Trade Commissariat has published a first list of undertakings which are to be leased to foreign concessionaires. These include the Krivoi-Rog Smelting Works, the Nizhni-Dnieprovsk Engineering Works, all steel works and electrical stations of the Dnieper district, and the tramways of Kieff, Kharkoff, Ekaterinoslav, Elizabetgrad, Odessa, Krementchug, Orel, Winnitsa, and Nikolayeff.

According to the *Financial Times*, the dispatch states that the concessionaires will be obliged to undertake to restore production to a certain level. Of the output 10 per cent. will be put on the home market, 20 per cent. will be bought by the Foreign Trade Commissariat, 10 per cent. will be bought by the State for internal trade, and 5 per cent. will be reserved for the supply of Soviet landed properties. The State will take from 20 to 50 per cent. of the net profits. The concessionaires will be given security of tenure, but will have to undertake to feed their employees. The original owners of the undertakings will have a prior right to get concessions.

The Resources of Siberia.—In last week's *Manchester Guardian Commercial* appeared a report of an interview with Mr. A. G. Marshall, managing director of Beccus Italers, Ltd. (formerly known as the British Engineering Co. of Russia and Siberia), which is a combination of some two hundred British engineering and allied firms associated for trade in Russia and Siberia. Mr. Marshall says that the resources of Siberia are so great and varied that there is hardly a metal or mineral which could not be produced. Development has been retarded by the lack of transport; the railways consist practically of the one main Trans-Siberian line. The Germans, before the war, recognised the possibilities of the country, and indications point to their desire to recommence operations as soon as possible. Eastern Siberia is largely under Japanese influence, but it is desirable to have international co-operation, so that the country came under no particular country's influence. The Russian Government is said to be anxious that British and other foreign firms should help to develop the resources of Siberia.

New Steel Works at Dowlaiss.—MESSRS. GUEST, KEEN AND NETTLEFOLDS, LTD., are putting down the foundations at the Dowlaiss Steel Works of new steel railway sleeper mills, which will replace, with the most modern equipment, the existing mills. The new auxiliary works and plant will be ready at the end of next year.—*The Times*.

Social Events.—To commemorate the making of 30,000 motors, Messrs. E. Brook, Ltd., of Huddersfield, invited their employes to a dance, which was held on Friday last at the Friendly and Trades Hall. In addition a small sum was handed to each employe, and a dinner, provided in the company's own canteen, was given to each. The dance lasted from 7.30 p.m. to 1 a.m. Messrs. J. Rattigan and W. McGaffie acted as M.C.'s. It is interesting to learn that Messrs. Brook report a decided turn for the better in trade. They attribute this to two reasons. First, that prices have been reduced to such an extent that electric motors can now be purchased at or about pre-war prices; and secondly, that with the establishing of cut-low prices, wholesale houses have been induced to place orders, and thus bring into being trade which had been dormant for some time.

B.T.H. Operatic Society.—Once again the Amateur Operatic Society of the British Thomson-Houston Co., Ltd., has gone to Gilbert and Sullivan, and, by permission of Mr. Rupert D'Oyley Carte, has produced "The Yeomen of the Guard," probably the most tuneful of all the celebrated group of operas. Performances were given at the Rugby "Hippodrome" from December 12th to 17th, and proved of great merit. This was the society's third show during 1921, and the sixth Gilbert and Sullivan opera performance—the "Mikado" having been given on two occasions.

The Swedish Telephone Fusion.—An extraordinary meeting of the L.M. Ericsson Telephone Manufacturing Co., held at Stockholm last week, accepted by an overwhelming majority the board's proposal for fusion with the H. T. Cedergerm concern and an increase of the share capital.

Indian Telegraph Apparatus.—The workshops of the Indian telegraph service in Calcutta now rank as one of the principal undertakings in the city. The work undertaken includes the production of steel poles with fittings, masts, the supply of quantities of special furniture, a large proportion of the telegraph instruments used by the Department, telephone exchange switchboards, certain wireless requirements, and the maintenance of the postal fleet of forty motor lorries in Calcutta. The works also comprise a modern foundry capable of producing 200 tons of castings per month, and plant for making cables, steel tubes, nickel plating and galvanising. In the instrument branch, a system of apprenticeship has been introduced, which is expected to produce a body of workmen suited to high class work.

United States and Trade with Central America.—The organisation of a Central American Chamber of Commerce in the United States, which will work to maintain U.S.A. supremacy in trade with the Central American republics, is announced in connection with the Independence Centenary Celebration of the Central American States. The activities of the Chamber will be limited for the present to the Republics of Costa Rica, Guatemala, Honduras, and Nicaragua. Other countries will be included later. The United States now controls from 70 to 90 per cent. of the foreign trade of Central America, the announcement says, and the Chamber will devote its efforts to development of trade relations, so that this percentage can be maintained, or even increased.—*Reuter's Trade Service* (New York).

Trade with Rumania. The recent decree of the Rumanian Government prohibiting all transactions on deposits held in that country by foreigners except under licence has naturally caused great perturbation in the minds of British exporters, and called a considerable amount of attention to the financial conditions of that country. The latest advices, however, point to the probability that this decree may not remain long in operation, at least in its present form. Detailed information on the finances of Rumania is contained in the "Report on Economic Conditions in Rumania, April, 1921," by the Commercial Secretary to H.M. Legation at Bucharest (Mr. Alexander Adams). Owing to the wide demand for this report it has been found necessary to issue a reprint, copies of which may be obtained through any book-seller, or direct from His Majesty's Stationery Office (price 2s. 11d. post free).

American Electrical Exports.—The Department of Commerce reports that American exports of electrical goods during October were considerably below the total for the corresponding month of 1920. Exports for October, by classes, together with figures for October, 1920, were as follows:—

ELECTRICAL MACHINERY AND APPLIANCES	October, 1920		October, 1921	
	dollars.		dollars.	
Batteries	483,109		211,738	
Carbons	137,790		36,326	
Dynamos and motors	970,490		779,339	
Fans	55,212		15,444	
Heating and cooking apparatus	182,715		74,302	
Insulating wire and cable	575,041		177,536	
Interior wiring apparatus, fixtures, &c.	282,499		80,822	
Lamps, etc.	1,548		1,230	
Lamps, incandescent	16,871		3,990	
Carbon filament	354,536		104,880	
Metal filament	317,891		104,068	
Magnets, spark plugs, &c.	254,476		161,462	
Meters and measuring instruments	1,255,339		325,182	
Motors	64,351		77,735	
Rheostats and controllers	425,615		176,154	
Switches and accessories	24,751		42,769	
Telegraph apparatus, including wireless	262,488		375,398	
Telephones	765,390		494,281	
Transformers	3,516,873		1,637,439	
All other				
Total	9,988,215		4,970,332	
Electric quantities	17,430		236,845	
Grand total	10,005,645		5,207,177	

— *Reuter's Trade Service* (Washington).

E.D.A. Salesmanship Conferences.—At the second of these conferences, held on December 16th, Mr. J. W. Beauchamp spoke of the interest the meetings were arousing. He stated that in several districts in the provinces arrangements were being made for similar lectures to be given by bodies affiliated to the E.D.A.

It was also announced that the next London conference would be held on January 20th at the rooms of the Chartered Institute of Patent Agents, when Mr. W. A. Gillott would speak on "Salesmanship in Relation to Electric Heating and Cooking."

A New Hungarian Cable Factory.—It is reported from Budapest that the Pressburg Cable Works Co., and the Hungarian branch of the Vienna Bank Verein are in negotiation with regard to the establishment of a new cable factory in the vicinity of Budapest, for the production of cables, insulating tubes, and hard rubber articles.

Engineering Wages and Trade Depression in Australia.—The Clyde Engineering Works is dismissing 1,150 employees owing to the refusal of the Government to allow for the increased cost of constructing locomotives resulting from the increase in the basic wage.—*Reuter's* (Sydney).

Tokio Peace Exhibition.—The Department of Overseas Trade is in receipt of information from the Commercial Counsellor of H.M. Embassy in Tokio regarding the Peace Exhibition which is to be held there from March 10th to July 31st, 1922. It is thought that this exhibition may prove a good opportunity for showing new British goods, and it is recommended that British firms should make a small exhibit. It would appear that all the space available for foreign exhibits has been over-applied for. Messrs. Arthur Buckley & Co., of Tokio, have, however, secured a special site for the erection of a British pavilion, and intending exhibitors can obtain space therein on application to the London office of the firm at 40, Westminster Palace Gardens, Victoria Street, S.W.1. Rebates of freights on goods for exhibition have been arranged by Messrs. Buckley, ranging from 20 per cent. to 50 per cent., according to date of shipment.

Book Notices.—*Practical Electrician's Pocket Book and Diary for 1922.* London: S. Rentell & Co., Ltd. Price 3s. net.—The twenty-fourth edition of this useful little electrical guide has been further expanded by the addition of over 30 pages. Among the items appearing for the first time are chapters on the Tungar rectifier, electricity in motor vehicles, railway signalling, and current limiters. Other sections have been re-written in the light of later developments, and among these are the sections dealing with steam turbines, oil and petrol engines, mercury-vapour rectifiers, electricity in mines, and heating and cooking. As usual, references are made to works from which fuller information regarding the subjects dealt with may be obtained.

Universal Exchange and Interest Tables, by A. J. Lawson, M.Inst.C.E. Pp. 242. London: Thomas Skinner and Co. Price 15s. net.—These tables have been reproduced from "Foreign Trade Tables," by the same author, whose enthusiasm in undamped even by failing eyesight, largely due to his trying labours on these thousands of numerical expressions. The tables have been rearranged and amplified, and are based on the decimalisation of British money in terms of florins and cents, after the manner recommended by the Institute of Bankers and the Decimal Association; the first table gives the conversion equivalents, advancing by one farthing, for all amounts up to £1, and of course simultaneously gives the corresponding decimals of £1, the figures being identical. One wonders whether the many traders who are now using the decimalised pound in their catalogues and quotations for foreign business are aware that this is so. Next come interest tables at any rate from $\frac{1}{4}$ to 10 per cent. per annum, applicable to any capital sum; multipliers to reduce interest per annum to interest for any required number of days; and the same modified to take account of leap years. These tables are accompanied by explanatory notes and suggestions for shortening computations, and a table is given showing the number of days between any two dates in a year. Other tables relate to depreciation, exchange, the purchasing power of the sovereign abroad, and equivalent prices for British and metric weights and measures. The author gives the foreign rates and their reciprocals, pointing out the ease with which the latter can be used to convert British money into the equivalent value in any foreign currency. The rate tables run from 3,000 by steps of 0.005 up to 100,000, thus comprising about 4,800 items, in 40 pages, and the conversion tables for foreign currencies at par cover almost all countries and occupy 38 pages. For further details we must refer the reader to the book itself, which, we are sure, will more than fulfil the expectations that may be based on this brief review.

The Electrical Engineer's Diary and Year Book (534 pp. and diary). London: S. Davies & Co. Price 10s. 6d. net.

The fourteenth edition of this large, all-embracing work has been revised and brought up to date. A new section, dealing with "Trade Promotion," appears. This consists of 24 pages, giving directories of central station showrooms and electrical shop-window displays; notes on the preparation of tenders, the rating of electrical machinery, and conditions of sale of goods have been transferred from the "General Information" section. The last-named section has been somewhat curtailed, and we notice the omission of the "Trade Names" index, which, while occasionally useful, could not possibly be comprehensive enough to find room in a volume of this nature. In the "Electric Motor Control" section items on car switch control, rope control, and series control have been added. Other additions are notes on electric grills and large electric water heaters, and an index of vehicle battery charging stations in the British Isles. As usual the "Diary" is published in two forms, one with stiff covers and diary and the other with limp covers and the diary omitted.

"The Signal Service in the European War of 1914 to 1918 (France)," by R. E. Priestley. Chatham: The Secretary, the Institution of Royal Engineers and the Signals Association.

"The Henley Telegraph," Vol. I, No. 7, December. (40 pp.). London: W. T. Henley's Telegraph Works Co., Ltd. Price 6d. net.—This little magazine is up to its usual fine standard, and contains a number of interesting and amusing articles and notes.

"The Metropolitan-Vickers Gazette," Vol. VI, No. 104, November. Price 1s. post free.—This number describes the switchgear at the Jubilee Street station, Blackburn, and improvements at the Attcliffe Common Works. The special articles include "Limitations in the Design of d.c. Railway Motors," by E. A. Binney.

German Trade in Argentina.—Germans are making determined efforts to displace other foreign traders in the Argentine market. Eleven steamers have arrived at Buenos Aires from Germany within the last five weeks heavily laden with hardware, machinery, textiles, chemicals, and paper. Whereas steamers from other countries arrive partly loaded, those from Germany are full. The German factories are up to date with their deliveries on Argentine Government contracts, and they are having little difficulty in getting all the new Government business that is awarded on a competitive basis. The Krupp and Stinnes interests have just obtained each a half of a Government contract for 40,000 tons of rails, while the War Ministry is placing an order for tents, canvas and waterproof fabric in Germany to cost more than 22,000,000 marks. The Government last week awarded a German firm a contract for a steel bridge over the Riachola River at Buenos Aires. It will cost 310,000 gold pesos.—*Reuter's Trade Service* (Buenos Aires).

Price Guarantee.—MESSRS. A. H. HUNT, LTD., manufacturers of accessories for the motor trade, have circulated among their customers a price guarantee for 1922, under which they have guaranteed to maintain prices until November next. Their object is to inspire a greater degree of buying confidence. They mention under the heading of "exceptions" that "the removal of the Government Import duty in April next on genuine Hellenes dry batteries" is beyond their control, and must be an exception, "but the present list prices will remain the same."

LIGHTING AND POWER NOTES.

Accrington.—ELECTRICITY SCHEME.—The Electricity Commissioners have sanctioned the borrowing of £15,000 for electricity extensions, provided an agreement can be arranged with the Blackburn Corporation with regard to the laying of a 33,000-volt cable between the generating stations of the two towns at an equal cost to each Council, for the purpose of reciprocal supplies. The Accrington Council has approved of these terms, and has arranged a conference with the Blackburn authority to link up the two towns.

Blackburn.—NEW SUB-STATION.—The new electric sub-station at Mill Hill was opened last week. The plant will receive power from the Jubilee Street distributing centre to produce extra-high-pressure energy for the district. Two of the largest mills in the vicinity are being equipped with electrical machinery.

Brackley.—PROPOSED ELECTRICITY SUPPLY.—A committee has been formed to canvass the town with a view to ascertaining the probable number of consumers of electricity and likely supporters with capital. The proposal is to form a company to carry out a scheme at a cost of about £5,000.

Brentwood.—APPLICATION FOR ORDER.—The Brentwood District Electric Co. is applying to the Electricity Commissioners for a special Order for the supply of electricity to the district.

Cannock.—LOAN.—The Urban District Council is applying to the Electricity Commissioners for sanction to the borrowing of £36,753, to cover the cost of erecting a new transformer station.

Chichester.—SALE OF UNDERTAKING.—The Corporation is applying to the Electricity Commissioners for a special order revoking the Chichester Electric Lighting Orders, 1898 and 1911, to annul the deed of transfer, and to authorise the Chichester Electric Light & Power Co., Ltd., to sell its electricity undertaking and works to the Corporation, and to authorise the Corporation to generate and supply electrical energy.

Christleton.—ELECTRICITY SUPPLY.—Chester Town Council is canvassing the parish, with the object of ascertaining the probable number of consumers of electricity.

Colwyn Bay.—WAYLEAVES.—It was reported at a meeting of the Urban District Council that the new transformer station was practically completed and the underground main from the North Wales Power Co.'s Bronynant sub-station had been laid. The scheme has been delayed, however, by a dispute in connection with wayleaves, which has held up the erection of the overhead line from Dolgarrog to Bronynant. Representations are being made by the Council to the Electricity Commission.

Croydon.—ISSUE OF STOCK.—The Corporation is to issue stock to the value of £500,000. The funds so raised will be used, *inter alia*, for the provision of new sub-station buildings and plant, mains, switchgear, cooling towers, &c., expenditure which has received the sanction of the Electricity Commissioners.

Dartmoor.—NEW HYDRO-ELECTRIC SCHEME.—It will be remembered that about a year ago a scheme to utilise the River Dart for the production of electricity was drawn up but abandoned on account of local opposition to what was called the "industrialisation" of Dartmoor. It is now stated that Sir W. G. Armstrong, Whitworth & Co. have projected another scheme which aims at developing about 10,000

water h.p. in two equal instalments. Reservoirs would be constructed on the higher waters of the East Dart and immediately below Dartmoor.

The whole of the scheme is said to involve an expenditure of about £500,000. The Devon County Council appears to be not unsympathetic to the project, but the Dartmoor Preservation Committee desires the submission of the scheme to it.

East Dean.—ELECTRICITY SCHEME.—The Urban District Council has approved of a scheme proposed by Mr. W. T. Kerr, of Hereford, for the formation of a company to purchase the Beachley power station and to link up with the Hereford electricity undertaking, from which steps are being taken to supply Lydbrook with electricity in order to serve the collieries and Forest of Dean.

Edinburgh.—PRICE INCREASE.—The Electricity Committee recommends that the charge for electricity for power purposes be increased by 4d. to 2d., and the price of lighting energy by 4d. to 5d. per unit, the increased prices to take effect from January 1st.

Electricity District. NORTH LANCASHIRE AND SOUTH CUMBERLAND.—The Electricity Commissioners give notice that they will hold a local inquiry at the Town Hall, Barrow-in-Furness, on January 31st, 1922, at 10.30 a.m., and following days, with reference to the area to be included in the above-named district and to consider a scheme which has been submitted by a Provisional Joint Committee for the establishment of a Joint Electricity Authority.

Harrogate.—LOAN.—Application has been made to the Electricity Commissioners for sanction to the borrowing of £3,250 for mains extensions.

Hastings.—MAINS EXTENSIONS.—The Town Council has adopted a report of the Electricity Committee recommending the laying of mains to St. Leonards, where the demand has exceeded the safe limit of the present mains. The estimated cost is £8,327.

High Wycombe.—REDUCED CHARGES.—The Electric Light and Power Co., Ltd., has decided to reduce the price of electricity for power by 10 per cent., from January 1st.

Hull.—EXTENSION OF SUPPLY.—At a meeting of the Corporation on December 15th, the engineer reported that the installation for the supply of electricity to Melton and Welton was practically completed. These extensions, which have cost about £55,000, transmit 2,000 kW at a pressure of 22,000 V, from the Corporation's power station to the two sub-stations, where the pressure is stepped down to 400 V. Two 1,500-kVA transformers installed at the power station bring the energy up to transmission pressure from the generated pressure of 5,600 V. The Corporation will sell about 94 million kWh per annum through these extensions.

Horsham.—YEAR'S WORKING.—The accounts of the municipal electricity undertaking (Engineer: Mr. F. French) for the year ended March 31st last, show a total revenue of £8,679, as against £7,675 in the preceding year. Working expenses amounted to £5,287, as compared with £4,891, leaving a gross surplus of £3,292 (£2,784). The net result was a profit of £374 as against £785 in 1919-20. The number of units sold rose from 273,952 to 313,531.

Keighley.—SUPPLY TO SKIPTON.—On December 20th the Corporation approved a recommendation of the Electricity Committee to apply for sanction to borrow £10,000 for the provision and installation of a transmission line from East-burn to Skipton, together with the necessary control gear.

It was also decided to carry out, at a cost of £8,000, certain cable extensions, provided that assistance was forthcoming from the Unemployment Grants Committee.

Kettering.—PLANT EXTENSIONS.—We have received from the electrical engineer (Mr. W. A. Walker, A.M.I.E.E.) an illustrated brochure describing the plant recently installed at the municipal electricity works. This comprises a 1,500-kW set, consisting of a Parsons turbine, driving through double-helical, single-reduction gearing, a Mather & Platt alternator, generating at 500 V; a 30,000-lb. Stirling boiler with super-heater and two Babcock & Wilcox chain-grate stokers; a cooling tower and tank, the tower cooling 175,000 gal. of water per hour from 100 to 80 deg. C.; a Weir turbine feed-pump capable of dealing with 5,000 gal. per hour; and switchgear made by Messrs. Ferguson & Pailin, Ltd., for controlling the generator and two feeders of 300 A and 600 A capacity. The total cost of the plant was approximately £40,000.

Leeds.—PROPOSED PRICE REDUCTIONS.—The City Council is recommended by the Electricity Committee to reduce the charges for electricity as from April 1st next. It is proposed that the present all-round increase of 80 per cent. upon pre-war prices shall be adjusted to 50 per cent. for power and 70 per cent. for energy used for other purposes.

Liverpool.—PROPOSED AMALGAMATION OF STATIONS.—At a recent meeting of the Liverpool Tramways and Electric Power and Lighting Committee it was decided to recommend the City Council that the electricity undertaking of the Bootle Corporation, including the supply to the Urban District of Litherland, be amalgamated with the Liverpool electricity undertaking on terms and conditions set forth in a draft agreement between the two Corporations.

London.—**ST. MARYLENE.**—The Electric Supply Committee reports that the peak supply demand of the Hampstead Borough Council has not exceeded 1,200 kVA; the agreement was for a maximum of 1,500 kVA. The present rate of charge is 38s. per kVA per half-year plus 7d. per unit, subject to slight variations. The Hampstead Council has been advised to close down its generating station and take a larger supply from an outside source. Terms have been arranged whereby the St. Marylene Council will supply the needs of Hampstead. These terms involve the determination of the present agreement and the completion of a new agreement to provide for bulk supply for a period of 42 years from January 1st, 1922, subject to review at the close of every fifth year, the review at the end of the 35th year to suffice for the remaining seven years; the respective Councils to provide and lay at their own expense the necessary additional cables and apparatus within their own boroughs; the charges for electrical energy supplied to be as follows:—1.2d. per unit for the first million units per quarter, 1.1d. per unit for the second million, .9d. per unit for any quantity in excess of two million units, subject to adjustment according to variations in fuel costs and calorific values.

After satisfactory trial runs, the new 8,000-kW Oerlikon turbo-alternator is in commission, and the Fraser & Chalmers 8,000-kW set is well in hand, and will probably be running by the end of the year.

The Borough Council is carrying out experiments with the object of improving the lighting of Oxford Street and Regent Street. The Council has declined a company's offer to fix illuminated advertising signs to the street lamps in Oxford Street. A rental of £2,000 was offered, plus 2½ per cent. of the gross receipts obtained from letting the signs.—*Evening News.*

LONDON'S ELECTRICITY SUPPLY.—The Special Committee of the London County Council on Electricity Supply has written to the Electricity Commissioners to emphasise the importance of the conditions to be attached to the consent of the Commissioners to the erection of a power station at Barking, by the County of London Electric Supply Co. In the opinion of the Committee safeguards should be provided for the interests of the public, and to preserve the position of the Joint Authority or other purchasing body. No action should be taken that would tie the hands of the Joint Authority with regard to the future electricity development of the London area. On the other hand, the Commissioners should have regard to the possibility of no Joint Authority having been formed by the time the purchase powers expire, and make provision for some other authority to have alternative rights of purchase.

The Committee has communicated with the Prime Minister and the Ministry of Transport, urging that the passage of the Electricity (Supply) Bill, which was introduced in April, 1921, would conduce to the development of electricity supply, and tend to increase employment.

HAMMERSMITH.—The Electricity Committee proposes to organise a Development Department, in connection with the electricity supply undertaking, for the purpose of investigating new electrical devices and methods and giving consumers advice. It is proposed to hold an electrical exhibition in the Town Hall in the near future, and to erect a permanent showroom.

Lytham.—**NEW PLANT.**—A new engine and dynamo have been installed to meet the increased demand for electricity. The new engine of 900 h.p., coupled to a 500-kW generator, will bring the capacity of the electricity works up to 1,800 kW.

Rhuddlan.—**ELECTRICITY EXTENSIONS.**—The Council has under consideration a scheme for the supply of electricity to the towns and villages situated in the Vale of Clwyd. The estimated cost of laying cable in the area, which includes Ruthin, Denbigh, St. Asaph, and Rhuddlan, is £2,500 per mile, and the promoters are prepared to go on with the scheme provided the places named guarantee between them a consumption of 320,000 units per annum for a term of years, which the promoters state they could supply at 1½d. per unit. The Council has decided to send representatives to a conference of the local authorities concerned which is being called.

Rathmines (Co. Dublin).—**PROPOSED LINKING-UP.**—Negotiations are proceeding between the Rathmines and Pembroke Urban District Councils regarding proposals which have been made for the linking-up of the electricity stations of the two Councils. The estimated cost of linking-up is £50,000.

Rugeley.—**ELECTRICITY SUPPLY.**—The Development Committee of the Urban Council has recommended that information be sought from the Wolverhampton Electricity Committee as to whether it will supply the district with electricity.

Southampton.—**EXTENSIONS.**—At a recent meeting of the Borough Council a recommendation from the Electricity Committee to carry out extensions of distribution at a cost of £21,670 was approved. The Council referred back to committee the question of £1,000 in purchasing apparatus for a hire-purchase system.

Southend.—**PLANNING NEW PLANT.**—The Electricity Committee reports that the electrical engineer has advised the Corporation of Southend to plan a new plant in order to meet the anticipated demand for the winter 1922-23; the

accommodation available in the sub-stations and the main generating station will permit of such installation without it being necessary to incur the expense of erecting new buildings. The operating costs of the Diesel engine plant at the Leigh sub-station for the six months ended September last as compared with the cost of steam plant at the main generating station for the same period per unit generated, including interest and sinking fund charges, were 1.85d. for the former, as compared with 3.29d. for the latter, and in view of the comparatively low capital expenditure, which would be incurred in installing low-speed Diesels, the committee favours the suggestion that this type should be installed in preference to steam plant, but before taking any action the reports are to be submitted to Mr. C. H. Wordingham, who has been retained to advise upon the present position and further extension of the undertaking.

Seaham Harbour.—**PROPOSED ELECTRICITY SUPPLY.**—A meeting of ratepayers, called by the Urban District Council, has approved, in principle, of an electricity supply for the town and district, and urged the Council to canvass all possible consumers with a view to the formulation of a scheme. The scheme at present suggested is to have a central distribution station to which power would be supplied from the mains of the Cleveland and Durham Electric Power Co. at 6,000 volts, and stepped down. The total estimated cost of the project is £16,670.

South Africa.—**KRUGERSDORP.**—The preliminary work in connection with the Krugersdorp electrical conversion scheme is now in hand. Prof. Buchanan and the engineers of the Victoria Falls Power Co. have arranged the route and the points of delivery of power.—*South African Mining and Engineering Journal.*

Ware.—**ELECTRICITY SUPPLY.**—At a recent meeting of the Urban Council, it was decided to approve the application of the North Metropolitan Electric Power Distribution Co., for an order to supply electricity in the Council's area.

Whitehaven.—**PRICE REDUCTIONS.**—The Borough Electrical Engineer (Mr. L. B. Hogarth, A.M.I.E.E.) informs us that the prices of electricity have been reduced as follows:—Lighting, from 7½d. to 7d. per unit; maximum demand, from 3½d. to 3d.; heating and cooking, from 1½d. to 1½d.; power, from 2.05d. to 1½d.; factory power, 60 per cent. increase reduced to 50 per cent.

Wolverhampton.—**PROPOSED PRICE REDUCTIONS.**—The Electricity Committee recommends to the consideration of the Corporation an early reduction in the price of electricity for lighting, power, and traction, and also in meter rents.

TRAMWAY AND RAILWAY NOTES.

Blackpool.—**ANNUAL REPORT.**—In his report upon the working during the year ended March 31st last, the general manager of the Corporation tramways states that the net profit of £144 fell far short of estimates, and it was necessary to apply for permission to temporarily increase fares until February, 1923; this was granted. Referring to the apparently poor results of the first year of municipal working of the Fleetwood tramway, he says that due allowance must be made for the difference between municipal and company financial arrangements. Whereas the £10,704 earned would have provided an ample dividend to shareholders in a company, owing to the necessity for setting aside £21,000 for sinking fund and interest payments, the line showed a loss to the municipality. It is stated that accumulated arrears of renewal and construction work since 1914 will entail heavy charges during the next three years; the amount is estimated at £254,343.

A short statement of financial results was given in our issue of June 10th last (p. 753).

L.B. & S.C. Railway.—**ELECTRIFICATION.**—A Bill has been deposited in Parliament by the London, Brighton & South Coast Railway Co., in which powers are sought to raise funds by means of debenture stock for the electrifying of suburban lines.

Liverpool.—**EXTENSIONS DEFERRED.**—The *Manchester Guardian* states that because there was no quorum it was impossible to hold a meeting of the Liverpool City Council, which had been convened on December 21st, for the purpose of considering recommendations for extensions of the Corporation electric tramways. Twenty minutes after the hour at which the meeting should have been commenced there were present only 80 members, whereas 99 constitute a quorum. The Lord Mayor announced that, in the absence of a quorum, and the meeting being a statutory one, nothing could be done. It is understood that the effect will be to defer the scheme for at least twelve months.

South Africa.—**RAILWAY ELECTRIFICATION.**—Work has been commenced upon the electrification of the Pietermaritzburg Glencoe line of the Government Railways. This is a most important section passing through the colliery district of Natal. Steep gradients are encountered by the line; in one part it

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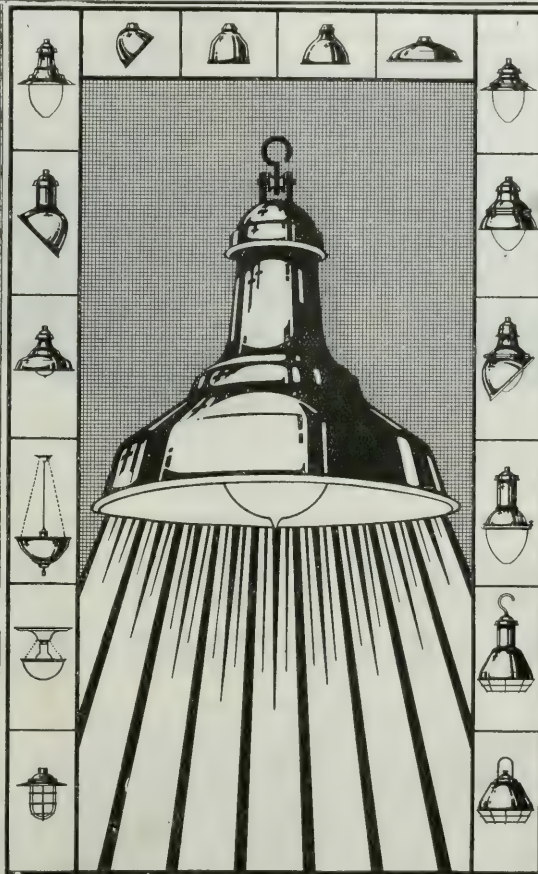
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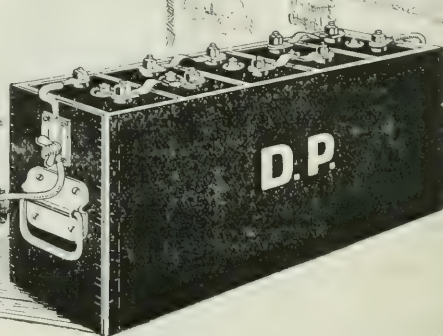
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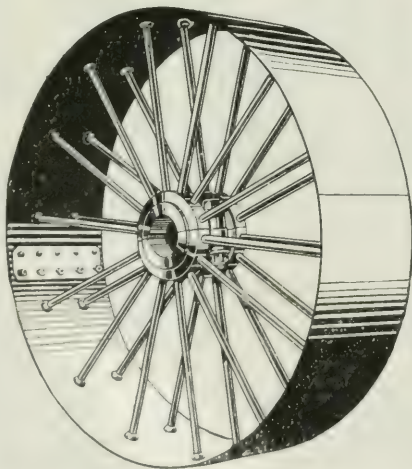
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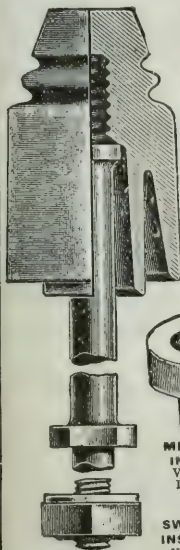
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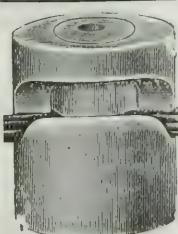


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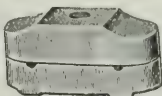
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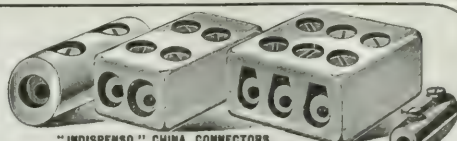


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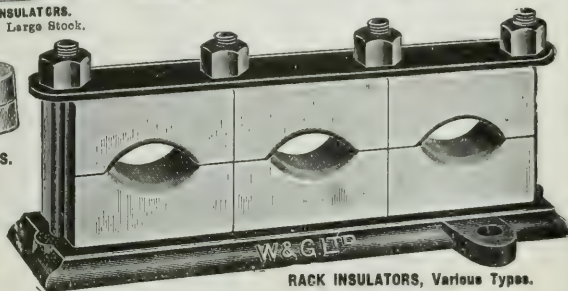
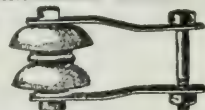
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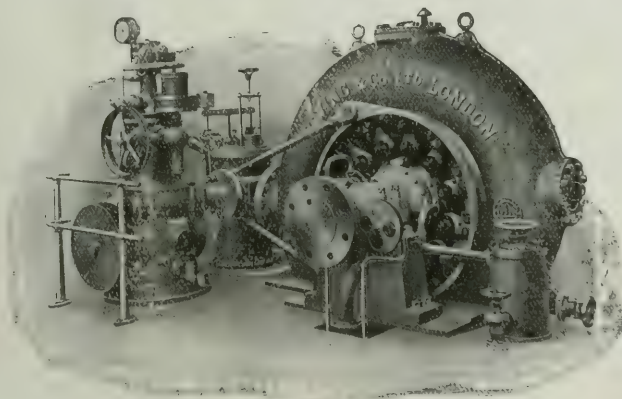
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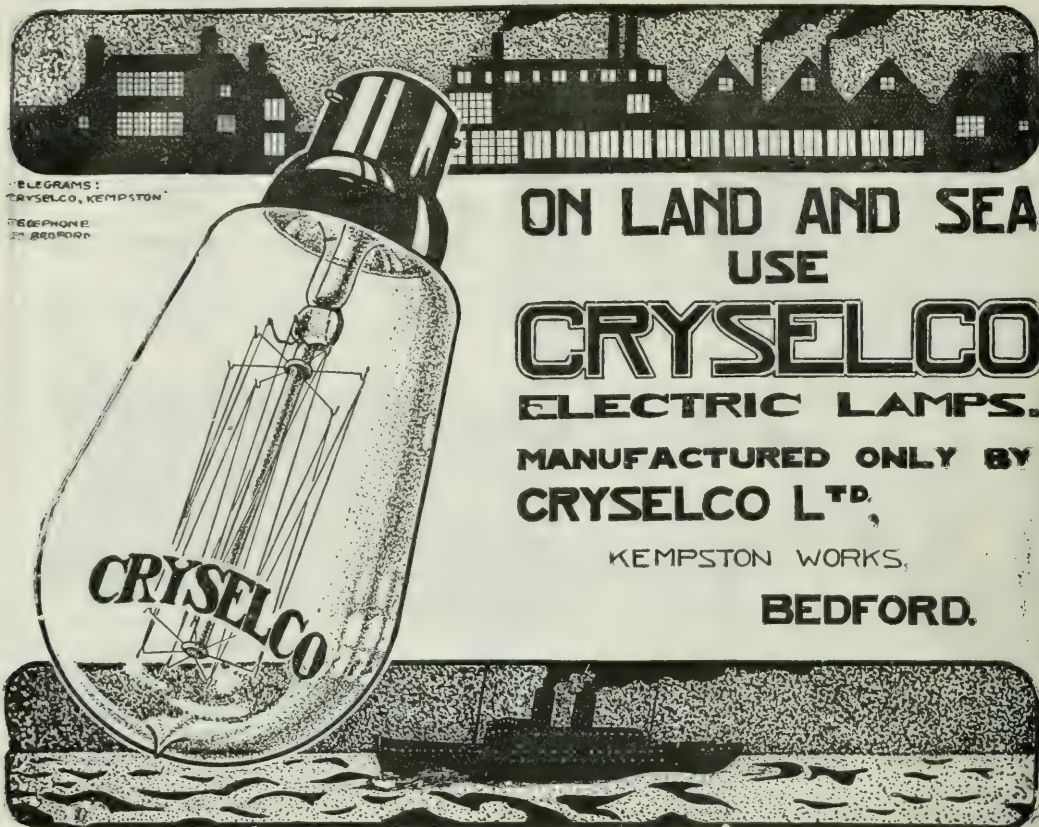
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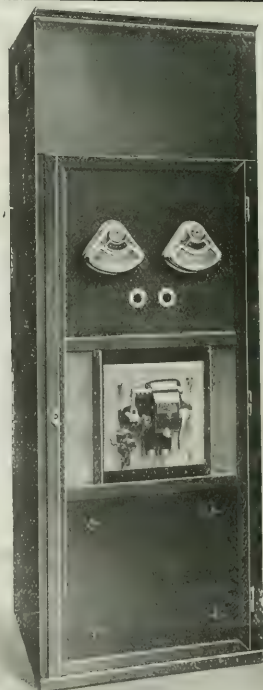
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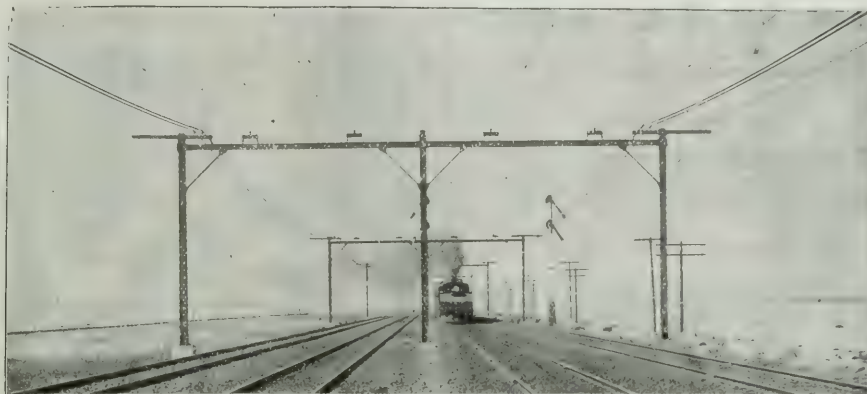
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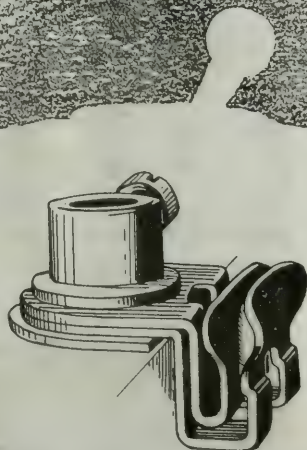


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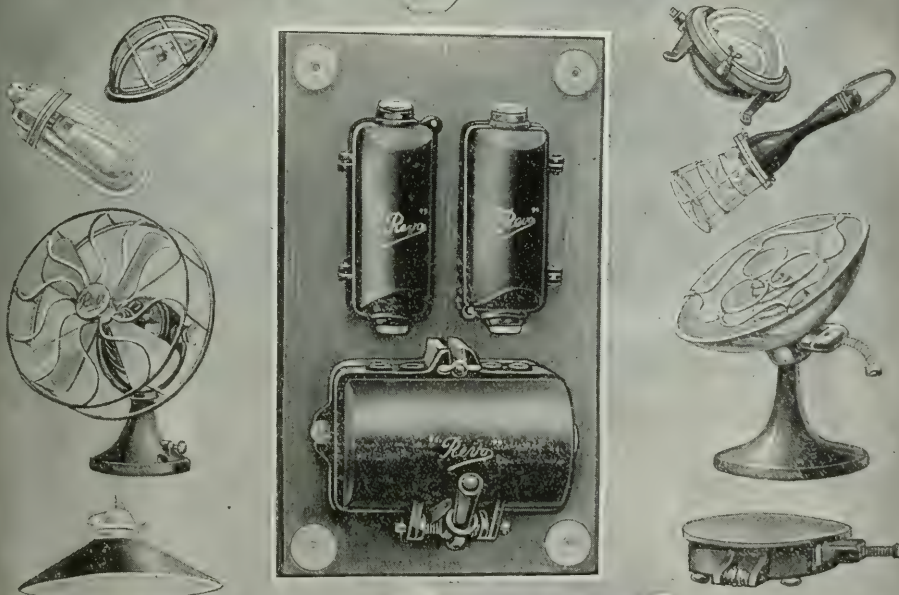
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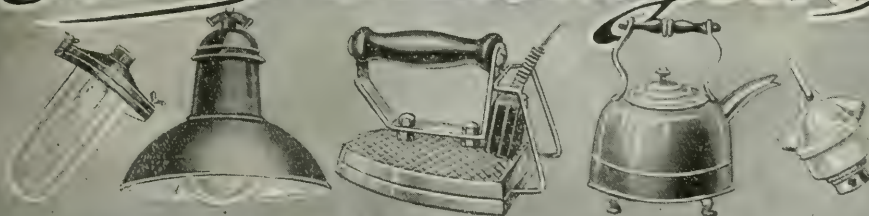
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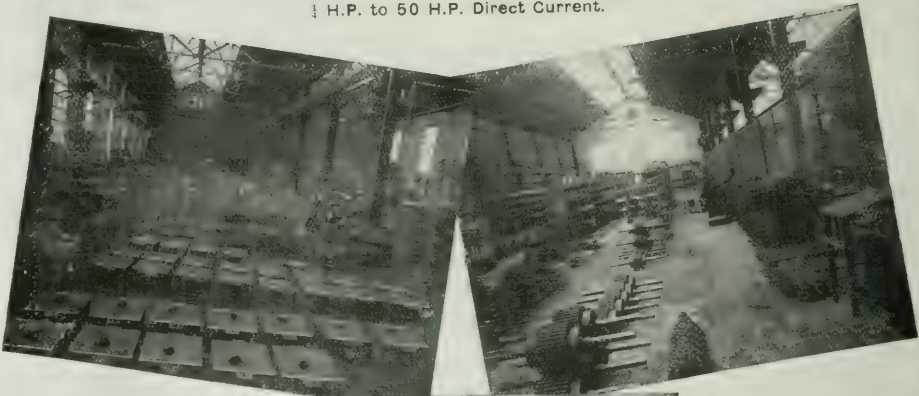
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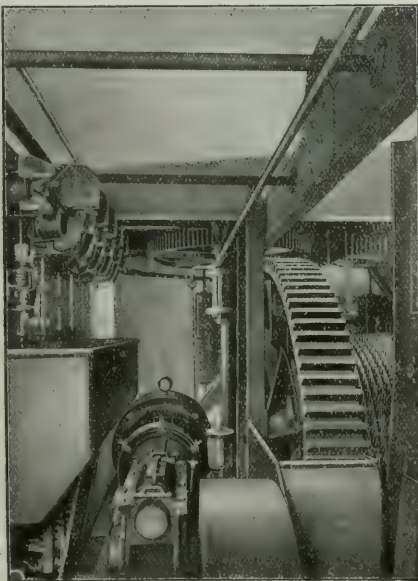
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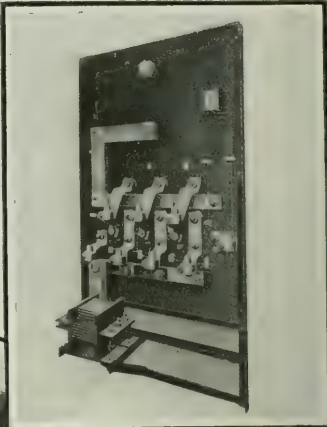
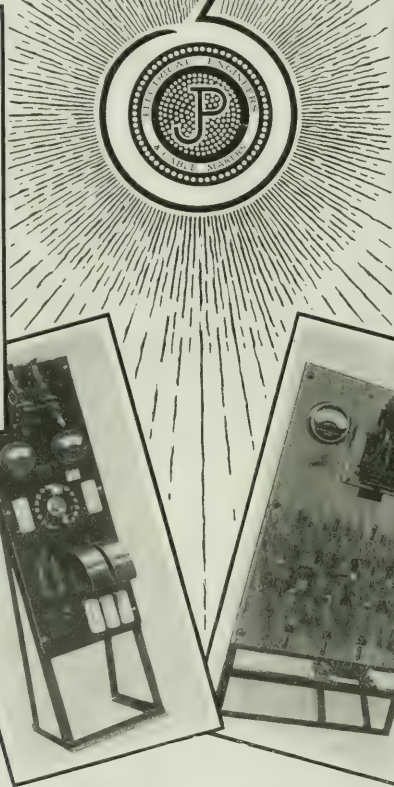
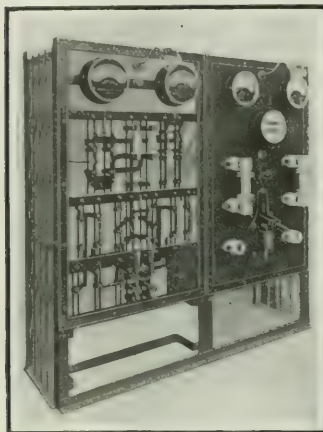
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The J & P Pages

What we are doing in Switchgear



WE give some further instances of the variety of conditions and circuits to which the flat-back type of switchboard can be adapted, although (as previously mentioned) its use in this country is considerably restricted by the Home Office Regulations.

Fig. 1 shows a Switchboard of the flat-back type having, however, a steel plate instead of a slate slab for one panel, and for the other, an arrangement of insulated steel bars on which are mounted the live parts of the gear. This board is for the control of the A.C. and D.C. circuits of a wireless installation on board a battleship, slate being dispensed with owing to its liability to fracture when firing is in progress. Although an oil switch is used on the machine panel, overload protection is given by fuses, as the frequency (500 cycles) is too high for the satisfactory operation of overload trip coils.

Fig. 2 shows a single panel for the control of the supply to an extra high tension precipitation transformer with rotary rectifier. Behind the panel is mounted an auto-transformer by means of which, in conjunction with the regulating switch on the front, it is possible to regulate the pressure applied to the terminals of the main step-up transformer.

Fig. 3 and Fig. 4 show the front and back views respectively of a D.C. Board arranged for the series parallel control of four 1,200 ampere 5 volt D.C. Generators for electro-plating work.

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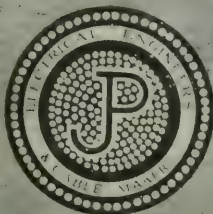
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THE SELECTION OF A MOTOR.

(Continued.)

The remaining point to be dealt with is Accessibility.

In a specially designed protected type Motor the Yoke is cast either complete with poles, or the poles are inserted separately, the ends are then closed by castings with openings for inspection and ventilation—that at the commutator end carrying the brush gear.

To inspect the windings of these machines without dismantling the end covers and bearings is an impossibility, and it is equally impossible to observe the interior of the machine while running.

It is desirable in many cases that dust accumulating in a Motor should be blown out at intervals; without dismantling this cannot be accomplished satisfactorily.

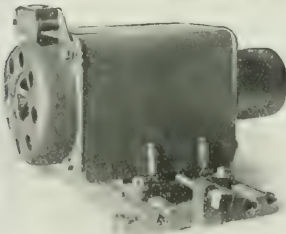
The L.W. Motor is completely accessible, the two covers which enclose the whole of the interior of the machine can be removed entirely without any tools. With the aid of only a screw-driver, the brush gear can be removed complete without disturbing the bearings. With the patent design of brush holders the whole of the commutator is visible under running condition.

The illustrations below show the protected type machine with and without covers; from these it will be appreciated that facilities are given for inspection under running conditions, which may often prevent breakdowns and thus save great expense in repairs.

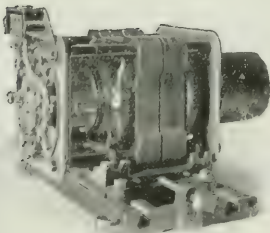
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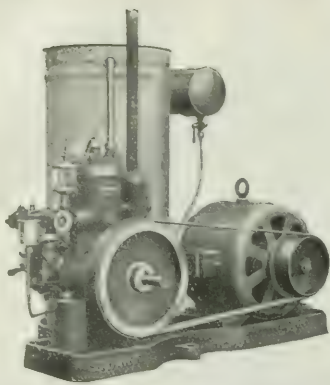
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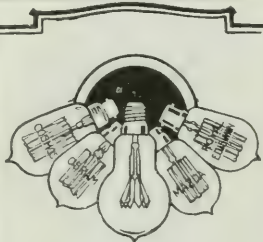
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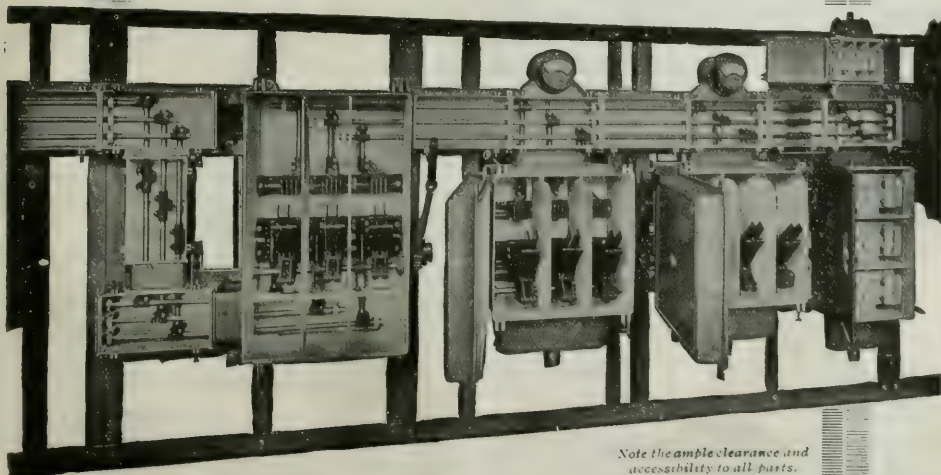
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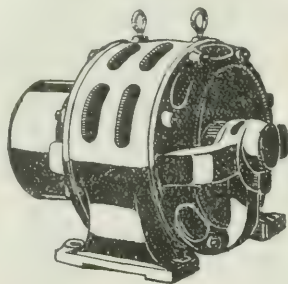


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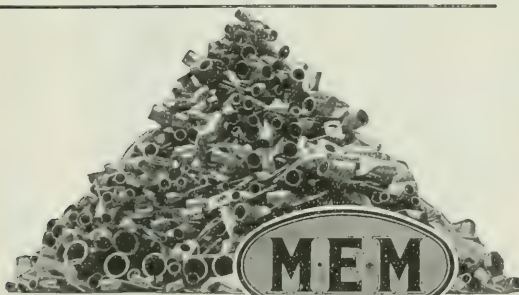
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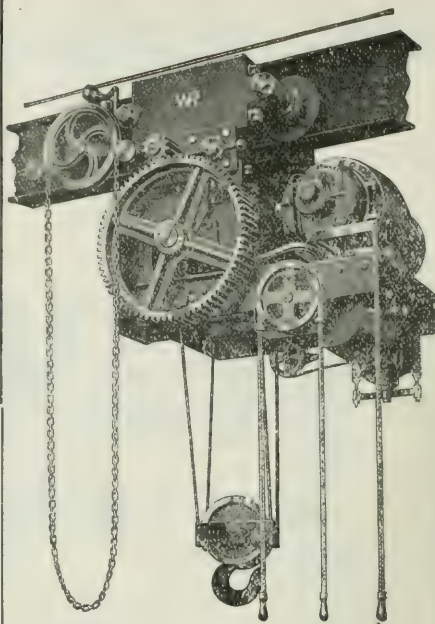
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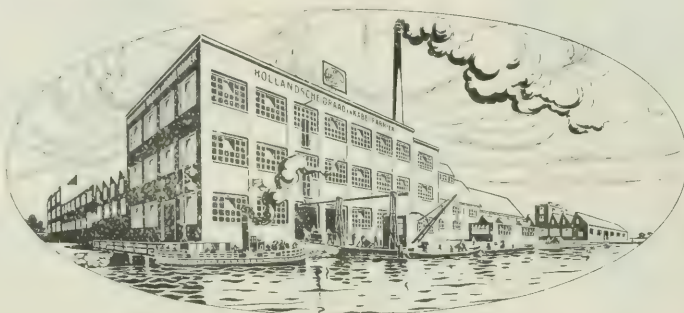
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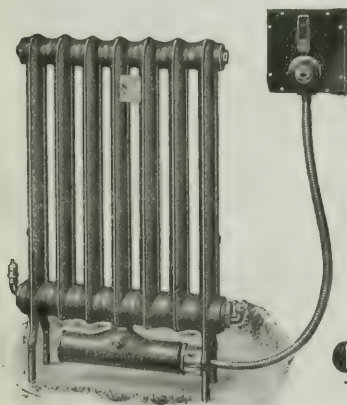
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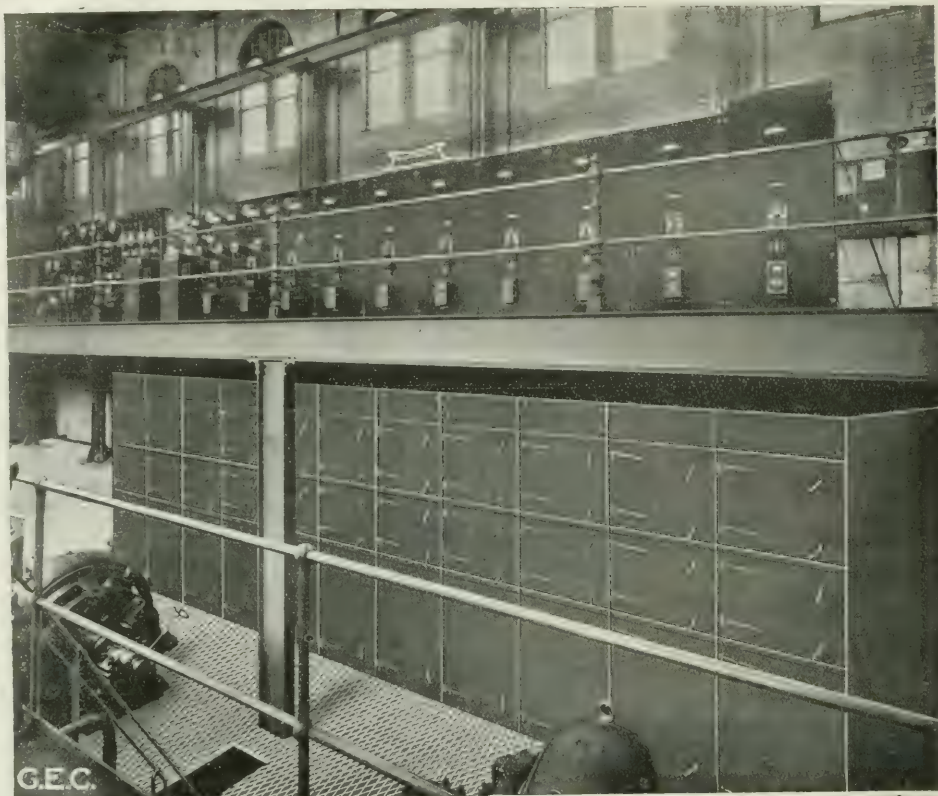
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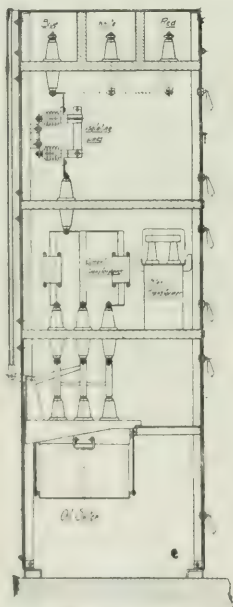
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COMPRISING two large Double Aeroplane Sheds, 170 ft. by 200 ft. by 25 ft., built in hollow terra cotta slabs with brick piers and timber roofs, covered with asbestos sheeting on each side of the large glazed skylights, each fitted with doors, windows, &c. One A.R.S. Shed of similar design, 170 ft. by 100 ft. by 25 ft. Technical Store, 120 ft. by 30 ft. by 10 ft., built in 44 in. brickwork with piers. Sixty other buildings built in brick and breeze slabs of various dimensions, including the large Regimental Institute, Barrack Blocks, Bath Houses, Pig Sties, &c. Heavy iron 4 in. Water Main. The large Iron Water Tank, approx. 32 ft. by 28 ft. by 8 ft., as fixed on steel joists. Two 70-h.p. Vertical Oil Engines, by Robey. Two open-type port. Dynamos, Main Switch Boards, &c. The fittings include a large quantity of roll-top Baths, white earthenware Lavatory Basins, Sinks, Flushing Cisterns, W.C.'s, and a number of miscellaneous effects.

Further particulars and full descriptive catalogues may be obtained from the auctioneers, Messrs.

BUCKELL, BALLARD & PENNINGTON,

8, Cornmarket Street, Oxford. Nat. Tel. 192. And at Market Square, Bicester; Tel. 11.

S123

To Electricians, Contractors, Factors, &c.

THE MART.

119/121, NEWINGTON CAUSEWAY, LONDON, S.E.1.

The ASSETS AUCTIONS CO., LTD.,

are instructed to SELL BY AUCTION, WITHOUT RESERVE.

On THURSDAY, JANUARY 5th, at 12.30 prompt,

18,500 VARIOUS WOOD BLOCKS, Electric Ships' Logs, Blowers, Drillers, Radiators, Toasters, Footwarmer, Sterilizer, Gyrometer, Recording Voltmeters, Meters, Fans, Suction CLEANER, Fuse and Switchboards, Conduit Fittings and Tubing, PLATING VAT, IRONCLAD SWITCHES up to 300 v. Panels, 500 and 300 Watt Lamps, Tape, Telephones various Cable, Magnetos, Outside Lamps, ALABASTER, SILK, &c., BOWL FITTINGS, Fuse Wire, 5,000 Galvanised Telephone Brackets, Electric Shades, Holders, Switches, Reflectors, Roses, Morse Tappers and Lamps, Striplite, $\frac{1}{2}$ and 2-h.p. Motors, various voltages, &c.

On view day previous and morning of sale. Catalogues upon application. Phone : Hop 3862.

S144

G. R.

BY DIRECTION OF THE DISPOSAL BOARD.

SALE BY AUCTION IN LOTS

of

PLANT, MACHINERY, ELECTRICAL EQUIPMENT, OFFICE FURNITURE, &c.,

At C.S. DEPOT 1208, QUEEN'S DRIVE, WALTON, LIVERPOOL,

C.S. DEPOT 40, BIRKENHEAD,

EAST AND WEST FLOAT DOCK ROAD, BIRKENHEAD,

H.M. FACTORY, ELLESMERE PORT, CHESHIRE, and at

THE PETROGRAD WAREHOUSE PORT OF MANCHESTER
WAREHOUSES, TRAFFORD PARK, MANCHESTER.

On JANUARY 9th and following days, at 11 a.m.
precisely each day. Including—

21 HAMMERHEAD Electric Cranes, complete with motors, by Royce. Two four-spindle Gridley Automatics, 30 Roller Dryers, by Bentley & Jackson, Ltd. Six Boiler Storage Tanks, Lancashire Boiler type, 30 ft. x 7 ft. Three M.S. Filters, pressure and vacuum, by Banks, Oldbury. Vertical Steam-driven "Edwards" Air Pump. Two Pressure Gas Producers, capacity 10 tons per 24 hours. Enclosed Steel Coal Elevator. Vertical Steam Engine, 7 in. x 18 in., by Robey, 150-kW, d.c., 250 volts Steam-driven Generating Sets, by J. Howden. Two Duplex Horizontal Air Pumps and Jet Condensers, by Pearn. Five-throw Hydraulic Pump. Hydraulic Accumulator. Hydraulic Intensifier. Six 3,000-h.p. Diesel Engines. Electrically-driven 3-throw Pump, direct coupled to 130 h.p., d.c., 500 volts Electric Motor. Two Electric Hoists, 1 ton. Two 500 h.p. Diesel Engines. Sensitive Drilling Machines. Power Hack Saw. Denbigh Milling Machine. Three Baling Presses. 20 124-in. Centre Lathes. Single-phase oil-immersed Transformers. 25 Electric Motors, a.c. and d.c., from 5 to 400 h.p., twin cylinder. Dryer Tip Wagons. Rotor Pumps. Thread Milling Machines. Vertical Fabric Testing Machines. Cloth Testing Machine. Acetylene Welding Plant. Motor Regulators. Reducing Sets. Pressure Gauges. Galvanised Iron Fresh Water Tanks. Wireless Material. 30-in. Band Saw, by Haigh & Co., Oldham. Circular Saw Bench, by T. & R. Lees, Manchester. 24 Batteries for Flame Protectors, without Air Bottles and Keys, by Ruston, Proctor & Co., Ltd. Plane Milling Machine, by Kendal & Gent (new). Copper-covered Cable. 11 drums (new). Friction Presses, by Taylor & Challen (new). Four tons Steam Hammer, by B. & S. Massey. Two Switch Panels (new). Generator for Diesel Oil Engine. 16 Receiver Splining Machines, by Pratt & Whitney. Six Generating Sets, by Allen, Sons & Co., Ltd. Two Phoenix Motors, and numerous other effects. Office Furniture, consisting of Collapsible Tables, Lined Top Tables, Stationery Cupboards, Card Index Cabinets, 118 Hardwood Chairs, 11 Arm Chairs, 28 Deal Forms, Double Desk, 5 ft. x 5 ft., &c.

Order of Sale: C.S. Depot 1,208, Walton, January 9th, 1922. C.S. Depot 40, Birkenhead, January 10th and 11th. H.M. Factory, Ellesmere Port, January 12th. Port of Manchester, Warehouse, Trafford Park, January 13th.

On view January 2nd and following days from 9 till 4 each day.

Admission by Catalogue only. price 1s each

For further particulars and catalogues apply to the Auctioneers, Messrs.

J. HINDLE & SON, F.A.I.,

27, London Street, Southport (Tel. 290), 17a, South Castle Street, Liverpool; and Duke Street, Formby. 8098

HILLIER, PARKER, MAY & ROWDEN, 27, Maddox Street, LONDON, W.

By AUCTION, at the GRAND HOTEL, BROAD ST., BRISTOL, on
THURSDAY, JAN. 12th, 1922, at 3 o'clock.

FREEHOLD WITH POSSESSION

FACTORY PREMISES, MIVART STREET, EASTVILLE, BRISTOL.

Ground floor, basement and two upper floors. Frontage to MIVART STREET about 209 ft., and to CATO STREET about 113 ft. Total floor area about 42,000 sq. ft. together with building suitable for garage: large yard and loading dock.

In conjunction with Messrs. ED. T. PARKER & CO., St. Stephen Street, Bristol.

Solicitors: Messrs. Wells & Hind, Fletcher Gate, Nottingham.

Full particulars of the Auctioneers, Messrs.

HILLIER, PARKER, MAY & ROWDEN, 27, Maddox Street, LONDON, W.

Telegrams: "Wunputt, Reg., London." 8132

RADIATOR TUBES, LTD., 11½, Great Dover Street, Borough, S.E.

Metal Plating and Depositing Plant and Radiator Tube Machinery.

Comprising Air Compressors and Receivers, 16 PINE and LEAD-LINED PLATING & DEPOSITING VATS, 38 Tube Rolling Machines, Polishing Heads, Shafting, Pulleys, Belting, Drilling Machines, 3½" Centre Lathe, 5 cwt. Platform Weighing Machine, Laboratory Fittings, one 300-AMP., 4-VOLT GENERATING SET, three 2,000-AMP., 6-VOLT PLATING DYNAMOS, three 20-H.P. SLOW-SPEED ELECTRIC MOTORS, eight ELECTRIC MOTORS, D.C. 460 VOLTS VERTICAL BOILER, ACID-RESISTING PUMPS, &c. Also OFFICE FURNITURE, including: Safe by Cooper, Remington and Monarch Typewriters, Mahogany and other Writing Tables and other Miscellaneous Items.

LEOPOLD FARMER & SONS

will SELL the above by AUCTION early in JANUARY, 1922.

Catalogues of the Auctioneers, 46, Gresham Street, Bank, E.C. 2, and Kilburn, N.W. 8140

SITUATIONS VACANT.

Latest Time for receiving, 5 p.m. Wednesday.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them nor can the names of Advertisers using a number in any way be disclosed.

Original Testimonials should never be sent.

ASSOCIATED MUNICIPAL ELECTRICAL ENGINEERS. (GREAT BRITAIN AND IRELAND.)

BOROUGH OF SWINDON.

APPOINTMENT OF ELECTRICAL AND MECHANICAL ENGINEER.

INTENDING applicants for the above vacancy who are members of this Association are requested not to state a salary less than that provided in the Schedule of Salaries agreed between the Incorporated Municipal Electrical Association and this Association, viz., £740 per annum.

(Signed) A. NICHOLS MOORE,
J. E. TAPPER,

Hon. Secretaries.

December 20th, 1921.

8139

SEVENOAKS & DISTRICT ELECTRICITY CO., LTD.

Male Clerk-Typist Wanted.

FOR stock-keeping, costing, and records, and shorthand-typing.

Good opening for young man with some experience, who is energetic and keen, and has capacity for expansion. Must be expert shorthand-typist. No "duds" need apply. Salary to commence about £3 per week, according to qualifications. —Apply, enclosing photograph and references to C. F. Mounsdon, resident engineer and manager, Electricity Works, Sundridge, Nr. Sevenoaks. 8146

SITUATIONS VACANT.—Continued.

BRITISH GUIANA.

TELEPHONE Inspector required by the Government of British Guiana for a period of 18 months, with possible permanency. Salary £350 per annum. Free passages. Candidates, age 25 to 35, must be thoroughly conversant with magneto and common battery telephone exchange systems, and subscribers instruments, and have had good experience in overhead cable and pole line construction and maintenance work.

Apply at once, by letter, stating age and experience, and whether married or single, to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/10857, and mentioning this paper. 8122

BOROUGH OF HEYWOOD.

Electricity Department.

THE Corporation of Heywood invite applications for the position of Manager of their electricity undertaking. Candidates must have had experience in electricity undertakings, extra-high-tension bulk supply plant, and e.h.t. mains, and have a sound knowledge of the commercial management of electricity supply and distribution (nearly the whole of the supply is received in bulk from a neighbouring local authority) and will be required to take the supervision of the tramways, which are worked by neighbouring authorities under agreement.

Applications, endorsed "Manager," stating salary required, age, and qualifications, accompanied by copies of two recent testimonials, must be received by the undersigned not later than Saturday, January 7th, 1922.

By Order,

GEO. G. BOUCHIER,

Town Clerk.

Town Clerk's Office,

Heywood,

December 23rd, 1921.

8135

ROYAL AIR FORCE.

RECRUITS for the following trades required:—Power Station Engineers, Shift Engineers, Engine Drivers and Dynamo and Switchboard Attendants, for four years' service. Ages:—Ex-Service men, 18 to 35 years; civilians, 18 to 28. Marriage allowance paid to married men of 26 years of age and over.—For particulars, write stating age, or call, Inspector of Recruiting, R.A.F., 4, Henrietta Street, Covent-Garden, W.C.2; or R.A.F. Recruiting Depot, 298, Bath Street, Glasgow. 7194

PLUMBER-JOINTER WANTED.

WANTED temporarily, a capable and experienced Plumber-Jointer, accustomed to e.h.t. and l.t. paper-insulated l.c. cables and all-round work.

Standard district schedule rate of wages.

Apply, stating age and experience, with copies of testimonials, to Engineer and Manager, Electricity Offices, Water Street, Colne. 8134

BRITISH GUIANA.

ASSISTANT Telegraph Engineer required by the Government of British Guiana for three years' service in the Posts and Telegraphs Department, with prospect of extension. Salary £450 per annum, rising by annual increments of £25 to £500 per annum, payable locally in dollars at a fixed rate of 4s. 2d. to the dollar. Free passages. Quarters not provided.

Candidates, age 25-35, preferably single, must have had a good technical education, be thoroughly qualified telegraph and telephone engineers, and possess a practical knowledge of wireless telegraphy and telephony.—Apply at once, in writing, giving age and brief details of experience to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/B.G. 11254. 8125

BOROUGH OF NELSON.

THE Nelson Corporation require at once a good Charge Engineer. Applicants must be possessed of sound technical and mechanical knowledge, and thoroughly experienced in modern power station practice, e.h.t. 3-phase rotary converters, and d.c. 3-wire. Preference will be given to one accustomed to Brush Ljungstrom turbos.

Salary in accordance with National Joint Board Schedule.

Applications to be addressed to G. F. Naylor, Electricity Works, Nelson, Lancs. 8130

SITUATIONS VACANT.—Continued.**METROPOLITAN BOROUGH OF HACKNEY.****APPOINTMENT OF GENERAL CLERK, ELECTRICITY DEPARTMENT.**

THE Borough Council are prepared to receive applications for the above-named appointment, which, under the Council's scale, is a Class 5 position, at a commencing salary of £182 per annum, with two annual increments of £15 expedited in order to bring the salary up to not less than £4 per week.

The maximum salary of the class is £250 per annum. The salary will be payable monthly, and be subject to review as the Board of Trade index figure of the cost of living falls below 100 per cent. above pre-war level. The salary is also subject to a percentage deduction in accordance with the provisions of the Council's Superannuation Act, 1908.

Applicants for the position must have reached the age of 21 years, and have had previous experience in an electricity undertaking or upon analogous work with a manufacturing or contracting firm; be quick and accurate at figures (including elementary mathematics); and possess a knowledge of the preparation of wages. Experience in shorthand and type-writing will be considered an advantage.

The appointment will be held during the pleasure of the Council, subject to one month's notice on either side.

The person appointed will be required to pass satisfactorily a medical examination within 14 days of appointment, and before entering upon the duties.

Applications must be made on printed forms, to be obtained from the undersigned on receipt of a stamped addressed (foolscap) envelope, and be accompanied by copies of not more than three recent testimonials.

Applications must be endorsed "General Clerk, Electricity Department," and delivered to the undersigned not later than 5 o'clock p.m. on Monday, January 16th, 1922.

Canvassing members of the Council, directly or indirectly, is strictly prohibited, and will be deemed a disqualification.

R. H. R. TEE,
Town Clerk.

Town Hall, Hackney, E.8.
December 23rd, 1921.

8143

CITY OF BRADFORD.**TECHNICAL COLLEGE.**

APPPLICATIONS are invited for a Lectureship in Electrical Engineering in the College.

A salary up to £550 per annum will be paid to a candidate of suitable qualifications and experience. Candidates must possess a first-class Honours degree or its equivalent, and have special qualifications in high-frequency, high-tension, and thermionic work.

Full particulars of the appointment, and forms of application, may be obtained from the Principal of the College.

Applications to be returned so as to reach me as soon as possible.

N. L. FLEMING, Town Clerk.

Town Hall, Bradford.
December 21st, 1921.

8142

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 15s.). Three consecutive insertions for the price of two, if ordered and prepaid with first insertion.

Box Number and Electrical Review address count as seven words.

DRAUGHTSMAN wanted to take control of tool and plant drawing office. Up-to-date experience of jigs and tools for production of electrical motors and generators of medium and large sizes.—Apply by letter, stating experience, age and salary required, to Metropolitan-Vickers Electrical Co., Ltd., River Don Works, Sheffield. 8118

DRAUGHTSMAN for electric motor control apparatus.—Write full details of experience, age, and salary, Box 1314, Sells, Fleet Street, E.C.4. 4400

ELECTRICAL Fitter wanted, thoroughly qualified and experienced in installation and repairs to motors and generators, a.c. and d.c., up to 250 h.p. Practical experience on manufacture, testing, and repairs of plant essential. Good at bench work.—8128, Electrical Review, 4, Ludgate Hill, London.

FOREMAN wanted by firm of a.c. motor manufacturers, Leeds district. Must be able to do all testing, erecting, &c. Only men who have held similar posts need apply.—State salary, references, 4382, Electrical Review, 4, Ludgate Hill, London.

LONDON Traveller for electric tools and installation work.—State salary required, 8136, Electrical Review, 4, Ludgate Hill, London.

REPRESENTATIVE required (London), by a leading manufacturer of electric incandescent lamps. Salary and expenses only.—All applications, which will be treated in confidence, must state age, experience, and salary required, 8150, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS VACANT.—Continued.

SALES Engineer wanted to follow up tender for dynamos, motors, &c., d.c. and a.c.; Manchester district.—State fully experience, age and wages expected, 8119, Electrical Review, 4, Ludgate Hill, London.

WANTED for electrical repair works in South Wales, competent Shop Foreman. Must have expert knowledge of a.c. and d.c. windings; also mechanical work. Able to control men.—State experience and salary required, 4374, Electrical Review, 4, Ludgate Hill, London.

WANTED, Experienced Man to repair and test d.c. meters for supply company in London area. Required to read meters at quarter ends and assist with slot meter collection. Hours, 41 per week.—Applicants please give previous experience and wages required, 4406, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS WANTED.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 15s.). Three consecutive insertions for the price of two, if ordered and prepaid with first insertion.

Box Number and Electrical Review address count as seven words.

A. A.—Capable Engineer and Commercial Man (34), requires a post with supply undertaking, consultants, or commercial engineers. Experienced in power station, transmission (e.h.t.), lighting, power, tramways, drawing office, and administration at home and abroad; also country house and factory plants; good correspondent and draughtsman; fluent Portuguese.—4354, Electrical Review, 4, Ludgate Hill, London.

A CAPABLE Electrician (young and energetic) requires a post as Foreman. Experienced in lift erection and wiring for all controls; lighting and power in all its branches; estimating; good organiser; excellent references.—4412, Electrical Review, 4, Ludgate Hill, London.

A GOOD industrious worker seeks Subordinate or Charge position; experienced in lighting, power, private plants, domestic appliances, with electrical machine repairs.—4405, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER seeks situation in any of the following capacities: d.c. dynamo and motor design, assembling, armature and transformer winding, transformer erection.—H., 14, Montague Road, Wimbeldon. 4364

ADVERTISER (38), over 20 years' experience public supply undertakings, shift charge engineer, &c., experience with turbines, H.S. steam, gas and Diesel engines, a.c. and d.c. systems, repairs and maintenance, seeks change; country house, works power plant, or public supply.—W., 7, Cambridge Road, Horsham. 4345

ADVERTISER seeks engagement as Supervisor or Foreman Electrician. Thoroughly competent in laying out, supervising, all lighting, telephone, and power installations. Life experience.—4415, Electrical Review, 4, Ludgate Hill, London.

APPARATUS Draughtsman, Chief Electrical, is open for re-engagement at new year. Speciality, design of telephone or kindred apparatus. Sound production experience, including the design of press tools and jigs, &c. Sound technical experience. Honours City and Guilds of London telephony and higher mathematics.—4384, Electrical Review, 4, Ludgate Hill, London.

CABLE Joiner (42), non plumb., seeks situation. 22 years' experience, lead and bitumen mains, services, testing, and meters. Best references.—French, 11, Heron Road, St. Margaret's, Middlesex. 4333

CLERK (30), consumers' accounts, ledgers, meter and unit registers, wages, invoices, wiring accounts. Showroom experience.—4392, Electrical Review, 4, Ludgate Hill, London.

CHARGE Hand; lighting, heating, telephones, motors, plant and battery erection.—W. Bright, 29, Gloucester Road, Cirencester, Glos. 4394

ELECTRIC Welder's Grinder; used to surface welded tram rails.—4315, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Fitter wants job on maintenance of factory installation or with contractor. Good estimator and charge hand.—G., 171, Malmesbury Road, Bow, E.3. 4331

ELECTRICAL Engineer (23), A.O.G.I. Three years' technical college (Finsbury), desires start at anything. Experience chief consideration.—4317, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN (26), single, would like position on electricity supply; pre-war experience of supply company, knowledge of a.c., d.c. mains, wirings, &c., and conversant with I.E.E. rules and regulations.—4363, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS WANTED.—Continued.

ELECTRICIAN, 12 years' experience in installation and maintenance; good mechanic; distance no object; disengaged.—"A," 74, Westville Road, Shepherd's Bush W.12. 4395

ELECTRICIAN; experienced and reliable; good references.—H. F. A. T. Sutton Street, Chelsea. 4403

ENERGETIC man (married), with good connection with motor engineers and contractors, wants position with manufacturers as Traveller, or Indoor Position; quick at figures.—4143, Electrical Review, 4, Ludgate Hill, London.

FIRST-CLASS Armature Winder (23), requires situation, 8 years' experience (with leading firm), excellent testimonials.—4328, Electrical Review, 4, Ludgate Hill, London.

GENERAL Electrician, experienced in both a.c. and d.c. work. Complete country house lighting.—4389, Electrical Review, 4, Ludgate Hill, London.

JOINTER-Plumber, services or charge outside work. Testing and faults.—4409, Electrical Review, 4, Ludgate Hill, London.

LINESMAN, fully experienced in e.h.t., overhead construction work, desires work at once. Able to erect and take charge; good references.—4373, Electrical Review, 4, Ludgate Hill, London.

WIREMAN, quick, reliable; all systems, accurate estimator; 18 years' experience; disengaged.—4311, Electrical Review, 4, Ludgate Hill, London.

WIREMAN or Charge Hand; good references.—H. Payne, 56, Crowndale Road, St. Pancras. 4386

WIREMAN-Electrician, 23 years' experience, and boy (15) want work, anywhere.—Jones, 52, Ilminster Gardens, Clapham Junction. 4359

WIREMAN, good and quick; power, light and 'phones (pre-war), town or country.—Wireman, 23, Chatham Street, Battersea. 4393

WIREMAN (disengaged) wants Job; lighting, motors, casing, barrel.—E., 135, Blackstock Road. 4407

MINISTRY OF LABOUR.

The Proprietors of the ELECTRICAL REVIEW have placed this space at the disposal of the District Director, Ministry of Labour, 3 and 4, Clement's Inn, Strand, W.C.1, to whom all replies should be addressed, quoting number of advertisement, the date on which it appeared, and the name of this paper.

DRAUGHTSMAN Designer. Age 22, single. Two years' assistant draughtsman, 1 year draughtsman. 2 years chief draughtsman; Royal Air Force 1 year 11 months as draughtsman-designer; electrical engineer student at Regent Street Poly.; good practical law knowledge; good all-round draughtsman-designer, electrical and wireless. (4066/21)

ELECTRICAL Engineer. Age 24, married. Knowledge of French. Experience as railway engineer, supervising, accumulators on charge. Own business general electrical engineer. Inspector and repairing vehicles, batteries. Qualified wireless lecturer. C.D. wire system, e.h.t., 3-phase working, dynamos and motors. (4688/21)

ELECTRICAL Engineer. Major, age 35, single, A.M.I.E.E. Ten years as assistant engineer steam-driven plant; 3-wire, d.c.; 18 months as chief electrical engineer i/c steam-driven plant; 750 kW, 3-phase, a.c., 3,000 volts d.c. plant; substations; rotary converters; overhead transmission; all lighting and power equipment for workshops and camps; thorough knowledge electrical supply work. (98947)

ELECTRICAL Engineer. Captain, age 38, married, A.M.I.E.E.; fully trained in operating side of electric power supply; large modern stations, a.c. and d.c.; expert knowledge of application of electricity to industrial operation; lighting, power and heating; good commercial experience; control of labour; conversant with American electrical works; good knowledge chemistry. (95004)

ELECTRICAL and Mechanical Engineer. Lieut., age 42, married; A.M.I.E.E. and A.M.I.C.E.; 4 years' apprenticeship loco. works; 8 years' experience erecting engineer i/c of erection of sub-stations for electric underground railways; also i/c of various other plants at gas works; 5 years' resident engineer; 160 h.p. gas engines, 320 h.p. Diesel engine; alternators, switchboard, outside wiring, and h.p. pumps. (3489/21)

ELECTRICAL and Internal Combustion Engineer. Lieut., age 38, married. 4 years' apprenticeship dynamo and motor construction; 10 years' electrical and general engineering; 3 years at sea in charge of electrical plant; aero engine repair specialist; ground engineer's certificate, Air Ministry; rotary and air-cooled engines. (4292)

ELECTRICAL and Mechanical Engineer. Captain, age 29, single; A.M.I.E.E.; 4 years assistant engineer; experience electrical power supply, distribution, &c.; cable laying l.t., h.t. and h.h.t.; underground cotton and sugar machinery; hydro-electric plant (small). (5657/21)

SITUATIONS WANTED.—Continued.

ELECTRICAL Engineer. Age 34, widower. Lieut. German and French; 3 years' apprenticeship; 9 years at St. Pancras Borough Council as charge shift engineer; assistant engineer to Westminster Electrical Supply Corporation; in all, 20 years' experience in running and erection of large plants. (1236/21)

ELECTRICAL Engineer. Age 33, married. 2nd Lieut. A.M.I.C.E., A.M.I.E.E.; fluent French, Portuguese and Danish; 3 years as pupil to Cable Co., going through all shops; 5 years' experience as outside superintendent cables and overhead work; 10 months' experience erection of machinery and construction of works, and starting production of light railway tracks. (97016)

TRAINING Vacancy required in Electrical Engineering. Age 25. C.S.M. Had 12 months' training Sterling Telephone & Elec. Co., and four months' theoretical Training Science School, Dublin. Desires to complete. (70403)

FOR SALE.

Advertisements are inserted under this heading at 14s. per inch.

THIS WEEK'S PHOENIX BARGAINS.

TWO 200-h.p., 500-volt, 220 r.p.m., compound-wound, 2-bearing Motors, £350 each.

Four 350-h.p., 500/550-volt, 575 r.p.m., 3-phase, 50-cycle, slip-ring Motors, £400 each.

Two 60-h.p., 500-volt, 450 r.p.m., enclosed shunt-wound Motors, by Dick, Kerr & Co., £160 each.

Two 35/40-h.p., 500-volt, 50-cycle, 3-phase, slip-ring Motors, by Sandycroft, 1917, £95 each.

One 90-h.p., 500-volt, 50-cycle, 3-phase, 575 r.p.m., slip-ring Motor by Bruce Peebles & Co., £220.

Three 50-h.p., 220-volt, 450 r.p.m., shunt-wound Motors, £160 each.

One 140-kW, 220-volt, Belliss-Westinghouse Steam Set, £800.

Two 200-kW, 220-volt, Allen-Westinghouse Steam Sets, new 1915, £1,100 each.

One 1,000-kW, 6,600-volt, Turbo-Alternator, with Surface Condensing Plant, £3,500.

One 150-kW, 500-volt, Belliss Steam Set, £800.

One 200-kW, 500-volt, Belliss Steam Set, £1,000.

Many other bargains. Now is the time to buy.

The Phoenix Electrical Co., Ltd., 32-36, Broomielaw, Glasgow. 8145

SPECIAL PLANT—UNIQUE OPPORTUNITY.

Excellent Condition.

250-KW CONVERTER.

250 kW La Cour Converter, 6,000/6,600 volts, 50-cycles, 3-phase, to 500 volts d.c., shunt.

500-KW D.C. MOTOR-GENERATOR.

500 kW Crompton Set, practically new, on combined bed-plate, 230/240 volts, 460/470, complete with starters for starting either side.

450-KW D.C. STEAM SET.

450 kW Belliss-Crompton, 440 volts, d.c., shunt, 190 lbs. pressure.

100 H.P. D.C. MOTOR.

100 h.p. Mather & Platt, 460 volt, shunt, 390 revs., complete with pulley, rails and starter.

BRITISH CENTRAL ELECTRICAL CO., LTD.,

6 and 8, Rosebery Avenue, E.C.1.

Telegrams: "Briticent, London." Phone: Holborn 5848. 8154

FOR SALE.

750 KW Generating Set, Browett, triple Engine, coupled to Lancashire dynamo, 500/550 volts, d.c., 320 r.p.m. 18,000 lb. Surface Condenser and Pumps, by Mirreles, Watson and Co., all ex Corporation station, and in first-class condition. A bargain. Apply—

R. WALKER, 2, Oswald Street, Glasgow. 9029

FOR SALE.

No.	H.P.	R.P.M.	VOLTS.
1	100	480	110 d.o.
2	55	570	110 d.c.
6	40	520	110 d.c.
5	30	850	110 d.c.
11	24	810	110 d.c.
1	15	940	110 d.c.

All above motors are shunt wound, open protected type, with end shield bearings, complete with open type starting switches with no-volt release, shunt rheostats, and overload circuit-breakers.—Tweedales & Smalley (1920), Ltd., Ossington, near Manchester. 7971

FOR SALE.—Continued.**MOTORS FOR SALE. (Extract.)**

COMPLETE LIST SENT UPON REQUEST.

(Comprising Steam, Diesel and Gas Sets, Turbines, Motors, &c.)

New and Second-hand in Good Condition.

A.C. MOTORS, THREE-PHASE.						
Ref. No.	Make.	H.P.	Volts.	Cycles.	Revs.	Type.
306	Lahmeyer	450	210	50	230	S.R.
820	Clayton	40	400	50	360	S.C.
808	Westinghouse	60 (2 of)	400	25	480	S.R.
854	Metro-Vickers	10	400	50	725	S.C.
854	Mather & Platt	10 (2 of)	400	50	725	S.C.
854	Do.	10 (2 of)	400	50	970/725	S.C. bk-g geared.
854	Metro-Vickers	15	400	50	725	S.C.
854	Mather & Platt	20 (2 of)	400	50	725	S.C.
854	Bruce Peebles	20	400	50	725	S.R.
854	Mather & Platt	25 (2 of)	400	50	725/190	S.C. bk-g geared.
854	Metro-Vickers	30	400	50	725	S.C.
854	Do.	40	400	50	725	S.C.
854	Bruce Peebles	40	400	50	725	S.R.
872	Westinghouse	20	440	50	735	S.R.
617	Do.	40 (2 of)	440	50	710	S.C.
1012	Brush Elec.	50	440	40	580	S.R.
210	Westinghouse	50 (6 of)	440	25	475	S.C.
804	Bruce Peebles	207	440	27	314	S.R.
924	Lancs. Dyn'mo	500	440	50	1450	S.R.
917	Crompton	25	500	25	750	S.R.
917	Lancs. Dynamo	90	500	25	725	S.R.
917	Harland	100	500	25	725	S.C.
917	Gr'nw'd. Batley	150	500	25	720	S.R.
840	Mavor & Olson	300	500	50	750	S.R.
840	Crompton	300	500	50	575	S.R.

D.C. MOTORS.

Ref. No.	Make.	H.P.	Volts.	Revs.	Type.
808	Rees-Rotobro	19	220	1350/1580	S.
656	G.E.C.	25	220	2000	C.
808	Dick, Kerr	40	220	640	S.
808	G.E.C.	40	220	450	S.
1008	B.T.H.	64	220	335	C.
480	Siemens	12½	250	405	C.
910	Westinghouse	50 (2 of)	400	600	S.
910	Mather & Platt	55	400	700	S.
679	G.E.C.	50	440	370	S.
615	Lancs. Dynamo	75	440	1500	C.
915	G.E.C.	50	460	720	—
915	B.T.H.	16	460	490/1350	—
944	Lancs. Dynamo	110	460	650	C.
1021	Mather & Platt	100	460	390	S.
1021	Do.	155	460	380	S.
910	Crompton	100	460/500	500/550	S.
307	Union Electric	85	500	1000	S.
910	G.E.C.	40	500	835	S.
910	Mather & Platt	50	500	275	S.
910	Westinghouse	60 (2 of)	500	600	S.
910	B.T.H.	80	500	600	S.

BRITISH CENTRAL ELECTRICAL CO., LTD.,

6 & 8, Rosebery Avenue, London, E.C. 1. 8155

Phone.: Holborn 5848. Grams.: "Briticent, Holborn, London."

THIS WEEK'S BARGAINS.**MOTOR GENERATORS FROM 3 TO 30 kW.**

VERY Low Prices.—Glasgow Electrical Engineering Co., Ltd., 45-47, Pitt Street, Glasgow. Stock list of motors and accessories post free. 7648

MOTORS—REDUCED PRICES.

75-h.p., 3-phase, 415 volts, 50 cycles, 575 r.p.m., slip ring.
 25-h.p., 3-phase, 440 volts, 50 cycles, 720 r.p.m., squirrel cage.
 40-h.p., d.c., 440 volts, 850 r.p.m.
 15-h.p., d.c., 440 volts, 930 r.p.m.
 12-h.p., d.c., 440 volts, 900/900 r.p.m., with Brookhirst panel.
 5-h.p., d.c., 230 volts, 600 r.p.m., with Brookhirst panel.
 74-h.p., d.c., 220 volts, 750 r.p.m.
 5-h.p., d.c., 200 volts, 1,400 r.p.m.
 3-h.p., d.c., 230 volts, 1,500 r.p.m., totally enclosed.
 24-h.p., d.c., 230 volts, 1,280 r.p.m. 6254
 HIRST, IBBERTSON & TAYLOR, 37, Water Street, Manchester.

NEW MOTORS. SPECIAL PRICES.

MAKER'S Guarantee—stock replaced as sold.

SQUIRREL CAGE. **SLIP RING.**
 1, 2, 3 and 4 h.p. SINGLE 5, 6, 7½, 10 and 15 h.p.
 950 and 1,440 r.p.m. PHASE. 950 and 1,440 r.p.m.
 1, 3½, 5, 6, 7½ & 10 h.p. THREE 3½, 5, 5½, 7½, 10 and 15 h.p.
 750 and 1,440 r.p.m. PHASE. 750, 950 and 1,440 r.p.m.

Several good S.H. Motors at attractive prices. 6126

ELECTRICAL INSTALLATIONS, LTD., 27, Martin Lane, E.C.4.

FOR SALE.—Continued.**THE WELL-KNOWN "CONZ."****Single Phase and D.C. Motors.**IN STOCK. NEW.—With a full guarantee.
And prices are right.**SINGLE PHASE, SQUIRREL CAGE, 50 CYCLES.**

½ h.p., 220 V, 1,500 r.p.m.
 1 h.p., 110 V, 1,500 r.p.m.
 1 h.p., 220 V, 1,500 r.p.m.
 2 h.p., 220 V, 1,500 r.p.m.
 2 h.p., 400 V, 1,500 r.p.m.
 3 h.p., 400-470 V, 1,500 r.p.m.

SINGLE PHASE, SLIP RING, 50 CYCLES

3 h.p., 400-470 V, 1,500 r.p.m.
 4 h.p., 400-470 V, 1,500 r.p.m.

DIRECT CURRENT.

200 VOLTS.	400-470 VOLTS.
½ h.p., 1,500 r.p.m.	2 h.p., 1,700 r.p.m.
2 h.p., 1,700 r.p.m.	2 h.p., 1,400 r.p.m.
1 h.p., 1,300 r.p.m.	2½ h.p., 1,700 r.p.m.
1 h.p., 1,600 r.p.m.	3 h.p., 1,600 r.p.m.
1½ h.p., 1,700 r.p.m.	3 h.p., 1,300 r.p.m.
1½ h.p., 1,300 r.p.m.	4 h.p., 1,200 r.p.m.
2 h.p., 1,700 r.p.m.	5½ h.p., 1,500 r.p.m.
2 h.p., 1,400 r.p.m.	

THE RENSHAW ENGINEERING WORKS, LTD., Mitcham, Surrey.

500-kW ROTARY CONVERTER, 460-500 VOLTS, D.C.

ONE 500-kW Westinghouse Self-synchronising, 6-ring compound interpole, 50 cycles, complete with transformer; also h.p. and l.p. switchgear, modern machine; condition as new. Immediate delivery. Low price to clear.

One 200-h.p. Motor by Messrs. Vickers, Ltd., 440 volts, 435 r.p.m., compound interpole, open type, with starting gear; new condition.

Three 500-kW Transformers, 10,750/415 volts, 3-phase, 50 cycles.

One 600-kVA Westinghouse Transformer, 6,600/440 volts, three-phase, 50 cycles; brand new.

One 50 kW, oil-cooled Johnson & Phillips Transformer, 400/110 volts, 3-phase, 25 cycles.

Dynamometers and Motors, various sizes, 110, 220 and 440 volts, both a.c. and d.c.

MIDLAND COUNTIES ELECTRICAL ENGINEERING CO., LTD.,

136, Sandon Road, Birmingham.

Telegrams: Rheostat, Birmingham. 7979

DYNAMOS.

SIX 3½ kW, 110 volt, compound, 1,430 revs., by G.E.C.; new, with shunt regulators; £28 each. 17 kW, 110 volt, compound, 510 revs., by Holmes, 3-bearing, complete, as new, £115.

Midland Counties Electrical Engineering Co., Ltd.,

136, Sandon Road, Birmingham.

Telegrams: Rheostat, Birmingham. 7980

MOTORS, PETROL-ELECTRIC SETS, DRILLS, &c.

ELECTRIC Klaxons for factory and Fire Hooters, with 200-volt Transformer, £6 10s.

Small Alternators, ½ kW to 2 kW, 100 to 500 cycles.

Witton-Kramer Motors, 50 periods, 220/240 volts s.p., on small wheeled trolley. Complete with dex. shaft for grinding or drilling, £9.

½-h.p. ventilated a.c. Motors, with 3 in. pulley, £10.

Wilson Wolf double-ended Electric Grinder, 1 h.p., 220 volt a.c. Motor on heavy pedestal, fitted two emery wheels and twist drill grinder, motor totally enclosed, wheels shrouded.

Rotax d.c. 200/220 volt Motors, ½ and 1-6 h.p., totally enclosed ball bearings, 1-speed pulley, £5 10s.

Lyon & Wrench Petrol Electric Sets, 1½ kW, 50 volts and 200 volts, £40. Switchboards, £5.

Proof Tape, 1 in. wide, 1s. per lb.

100 amp. D. & S. Distributor Fuse Handles, Tubular Hand grip, 4ss. dozen.

Inspection Handlamps, to Admiralty specification. All metal body, with switch and 2-volt accumulator, 6-8 hours' continual light, 25s.

Hand Electric Drills, weight 14 lb., d.c. only, 200/250 volts capacity up to 1 in. clearance, £7. Bench type, weight 160 lbs. capacity, 4 in. clearance, £15.

7,000 Electric Heating Units, 1½ amps and 3 amps, nichrome and mica clad metal clad, 12s. dozen.

Cell Milking Dynamometers, 10 amps., 0.15 volts, £8 10s. Switch-board for ditto, £1 10s.

Mahogany Boxes for 100 volt Dry Batteries, six plug sockets, 2 wander plugs for h.p. wireless or portable testing, 5s.

3 Valve Amplifiers, £5.

Jointless Rubber Gloves, leather palms, 15s. pair

LESLIE DIXON & CO. (Dept. E.),

9, Colonial Avenue, Minorities, E.I.

8099

FOR SALE.—Continued.**ELECTRIC MOTORS AT CUT PRICES.****All Machines Guaranteed.**

ONLY best makes. Many new, thoroughly overhauled and tested before despatched.

TWO-PHASE, 50 PERIODS, 200 VOLTS (4-WIRE).

- One 10 h.p., 1,440 r.p.m., squirrel cage.
- One 15 h.p., 710 r.p.m., squirrel cage.
- One 16 h.p., 715 r.p.m., slip ring.
- One 20 h.p., 720 r.p.m., slip ring.
- One 40 h.p., 720 r.p.m., slip ring.

THREE-PHASE, 25 PERIODS, 400/440 VOLTS.

- Eight 7½ h.p., 1,440 r.p.m., squirrel cage.

THREE-PHASE, 40 PERIODS, 400/440 VOLTS.

- One 44 h.p., 760 r.p.m., slip ring.
- Two 72 h.p., 760 r.p.m., slip ring.
- One 88 h.p., 580 r.p.m., slip ring.

THREE-PHASE, 50 PERIODS, 400/440 VOLTS.

- Eighteen 4 h.p., 1,440 r.p.m., squirrel cage.
- Thirteen 6 h.p., 1,460 r.p.m., squirrel cage.
- Twelve 7½ h.p., 1,440 r.p.m., slip ring.
- One 7½ h.p., 1,435 r.p.m., squirrel cage.
- Two 60 h.p., 930 r.p.m., slip ring.

We always hold a large stock of machines, both squirrel cage and slip ring, ranging from 1 h.p. to 97 h.p.

- One 100 h.p., 480 r.p.m., squirrel cage, 3 bearings.
- One 130 h.p., 242 r.p.m., slip ring, 3 bearings.
- One 250 h.p., 365 r.p.m., slip ring, 3 bearings.

THREE-PHASE, 50 PERIODS, 500/550 VOLTS.

- One 55 h.p., 950 r.p.m., slip ring.
- Two 90 h.p., 950 r.p.m., slip ring.
- One 110 h.p., 720 r.p.m., slip ring.

THREE-PHASE, 50 PERIODS, 3,000/3,300 VOLTS.

- One 300 h.p., 320 r.p.m., slip ring.

DIRECT CURRENT, 220/240 VOLTS.

- One 9 h.p., 450 r.p.m., shunt wound.
- One 16 h.p., 1,440/1,650 r.p.m., shunt wound.
- One 18.3 h.p., 1,450 revs., shunt wound.
- One 29 h.p., 620 revs., compound wound, P.V.
- One 31 h.p., 780 revs., shunt wound, protected.
- One 35 h.p., 300/720 revs., shunt wound, protected.
- One 45 h.p., 650 revs., shunt wound, semi-enclosed.
- One 45 h.p., 850 revs., shunt wound, totally enclosed.

DIRECT CURRENT, 440/500 VOLTS.

- Two 6 h.p., 1,080 revs., shunt wound, E.V., 440 volts.
- One 22.5 h.p., 960/1,445 r.p.m., shunt wound, E.V., 440 volts.
- One 25 h.p., 800 r.p.m., shunt wound, protected, 440 volts.
- One 40 h.p., 200 r.p.m., compound wound, open, 440 volts.
- One 60 h.p., 1,080 revs., shunt wound, protected, 500 volts.
- One 80 h.p., 300 revs., compound wound, open, 440 volts.
- One 250 h.p., 485 r.p.m., compound wound, open, 500 volts.
- One 400 h.p., 310 r.p.m., compound wound, open, 500 volts.

CRANE-RATED MOTORS.

Thirteen 220 and 440 volts, series wound, totally enclosed crane-rated motors, 13 to 50 h.p.

Suitable control gear, slide rails and pulleys are always available for the above machines.

MYLAN & SMITH (ENGINEERS), LTD.,

10, East Parade, Sheffield.

Also at 10, Park Row, Nottingham.

'Phone: 760 Central, Sheffield.

'Grams: "Topical," Sheffield.

Electrical Stores: Bamford, Derbyshire, Midland Railway.

7259

FOR SALE.

New Transformers, by B.E.T. Co., Ltd.

THREE-PHASE, 50 CYCLES.

Three 575 kVA, 10,250-11,000/415-440 volts, £250 each.

One 600 kVA, 6,600/440 volts, £275.

Two 1,675 kVA, 6,600/440 volts, £1,300 each.

THE FOUNTAIN ELECTRICAL CO., LTD., 32-36, Broomfield-lane, Croydon.

7606

THROUGH COMPANY IN LIQUIDATION.

NEARLY New 70-h.p. Motor, by Crompton, No. 109,316; 440 volt, 175 amp., 775 r.p.m., compound wound, continuous current, 14 in. by 14 in. pulley and slide rails, with Patent Ratchet Starter No. 16,233, by Bray, Markham and Reiss, fitted with no-volt and overload release, ammeter, No. 3 double-pole switch box. Price £175.—4396, Electrical Review, 1, Ludgate Hill, London.

FOR SALE.—Continued.**ELECTRICAL ACCESSORY BARGAINS.****Still Further Reductions.**

SUPERLAMP, Ltd., 111, Great Eastern Street, London, E.C.2., offer the following exceptional bargains:—

Ceiling Roses.

- Quality A. 2s. 9d. per dozen.
- B. 6s. per dozen.

Switches, 5 amp. tumbler.

- Quality A. 8s. 9d. per dozen.
- B. 11s. 6d. per dozen.

Lamp Holders.

- C.G.S.C., 7s. per dozen.
- Batten, 7s. 9d. per dozen.
- E.S., 8s. per dozen.
- Keyswitch, 17s. 6d. per dozen.

Cut Outs.

- 5 amp. bow, 6s. per dozen.
- 5 amp. oblong, 7s. 9d. per dozen.
- 10 amp. bow, 7s. 6d. per dozen.
- 10 amp. oblong, 10s. 6d. per dozen.

Counterweight and pulley, 18s. per dozen.

Cable, v.i.r., 600 megohms.

- 1/18, 10s. 6d. per coil.
- 3/22, 11s. 6d. per coil.
- 3/20, 16s. per coil.
- 7/22, 24s. 6d. per coil.
- 7/20, 35s. per coil.

Conduit, 5/8 C.J., 7s. per 100 ft.

Black Tape, 2s. per lb.

Wood Blocks, I.W., W.E.

- ¾ by 1, 1s. 6d.; 1s. 9d. per dozen.
- 6½ by ¾, 4s.; 5s. per dozen.

Coupled Switches.

- 5 amp., d.p., unmounted, 2s. 9d. each.
- 5 amp., d.p., mounted, 3s. 3d. each.
- 10 amp., d.p., unmounted, 5s. each.
- 10 amp., d.p., mounted, 6s. each.

Fuseboards Oak Cases.

- 5-way, 11s. per board.
- 4-way, 10s. per board.
- 3-way, 9s. 1d. per board.
- 2-way, 7s. per board.

Flex, 14/36.

- Cotton, 22s. 6d. per gross yards.
- Workshop, 25s. 6d. per gross yards.

Wall Plugs (all China), 17s. 6d. per dozen.

Hardwood Base, 22s. 6d. per dozen.

Shades, 10 in. Enam. Iron, 7s. 9d. per dozen.

9 in. Opals, 5s. 6d. per dozen gross lots.

Bell wire, 3s. 6d. per coil.

Electric Lamps.

Drawn Wire, low volt, 1s. 4d. each.

- High volt, 1s. 6d. each.
- Helical (half-watt pattern), 100 watts, 3s. 3d. each.
- 60 watts, 2s. 3d. each.
- 40 watts, 2s. each.

Every lamp guaranteed good and sound. Average tested life over 1,000 hours. We replace faulty or broken lamps. Carriage paid on 24 or more.

Terms subject 5 per cent. discount cash with order. Carriage paid on orders over £12 in value. No samples sent unless cash sent plus cost of carriage. Conduit sent carriage forward. China and glass at buyers risk.

Send for our new January, 1922, price list. Send us your enquiries.

SUPERLAMP, LTD.,

"The Electrical Bargain House,"

111, Great Eastern Street, London, E.C.2.

(Nr. Old Street Tube Station and City Road.)

Telephone: Clerkenwell, 1497.

8115

FOR SALE.—Continued.**PETROL AND PARAFFIN ELECTRIC GENERATING SETS.**

Guaranteed in First-Class Running Order.

No. in Stock.	Output.	Volts.		Make.
1	500 watts	50	Direct coupled	F. W. Petters.
44	1 kW	25/37	Belt	F. W. Petters.
4	3½	50/75	Direct coupled	F. W. Petters.
4	4	65	"	Austin.
1	8	80	"	Simplex.
1	10	100/110	"	"
2	10	60	"	"
1	10	105	"	Barlow.
1	10	220	"	Aster.
1	10	220	"	Gardner.
4	12	60	"	Simplex.
5	12	60	"	Gardner.
4	14	80	"	"
4	16	80	"	Simplex.
2	18	60	"	Vickers.
2	21	100/145	"	Keighley.
2	24	80	"	Aster.
1	50	220/540	"	"
		3 phase.	"	"
		50 cycles.	"	"

DYNAMOS.

No. in Stock.	Output.	Volts.	r.p.m.	Make.
6	24 kW	80	Compound	Holmes.
4	3½	50/75	1300	Lyon & Wrench.
3	4	65	Compound	1400
1	10	110	Shunt	1100 E.C.C.

MOTOR GENERATOR.

One 220/240-volt supply. 11 kW. 50/110-volt. complete with switchgear.

One 440-volt Converter, by Crypto, output 60 volt. 50 amps. 1750 r.p.m., complete with switchgear.

MOTORS.

15 h.p., 440-volt, E.C.C., 645 r.p.m.

20 h.p., 440-volt, Mawdsley, 800 r.p.m.

Both machines complete with slide rails, pulley and starter.

Large Stock of Engines and Dynamos which can be coupled up within seven days.

FYFE, WILSON & Co., LTD.,

31, Budge Row, Cannon Street, E.C. 4.

'Phone: City 2602. 'Grams: "Ductility, Phone, London."

8151

FOR SALE.

DIESEL Engines, six cylinder, two and four stroke, 850, 1,000, 1,200 h.p., excellent condition. Dynamos for above, 250 or 500 volts d.c. Immediate delivery and low price.

Also two 500-kW Parsons Turbine Sets, 250 or 500 volts, d.c., with Condenser and spare armature.

Electrically-driven Air Compressors, 250 volts, d.c., pressures 1,500 to 3,000 lb. per sq. in.

JENNINGS, West Walls, Newcastle-on-Tyne. 6243

INERT BELL CELLS, 1.5 VOLT.**Exceptional Offers.**

SURPLUS Government stock (German Reparation), best make, large stocks, well packed in strong cases, each of 100 cells, price 40s. per case; 5-case lots, 37s. 6d. per case, including cases and packing. Carriage forward ex London warehouse. For sample half dozen, post free, send postal order value 4s. Size of cells (exclusive of terminals), 2½ in. by 2½ in. by ½ in. high.—British & Allied Electrical Agency, Ltd., 13, Charterhouse Street, London, E.C.1. 8126

HIRE OR SALE.

ELECTRIC Motors and Dynamos.—Machines always available. ARMATURES and FIELD COILS rewound or repaired without delay.

'Phone: MACDONALD, SYER & CO., LTD., Museum 5080. 295, Gray's Inn Road, W.C.1. 6246

SURPLUS PLANT FOR SALE IN FRANCE.

LARGE stock of Turbo-Alternators, Diesel and Steam Engines, Transformers, Rotary Converters, Motors and Generators. Very low prices owing to rate of exchange.

Special Bargains:—

Two 1,000-kW British Westinghouse Rotary Converters.

One 940-kVA British Thomson Turbo-Alternator.

One 500-kW British Westinghouse Turbo-Alternator.

One 400-h.p. British Thomson 25-cycle Motor.

ALEX LEFEBVRE, 9, Rue Arsène Houssaye, Paris. VIII. 6421

FOR SALE.—Continued.**ELECTRICAL PLANT FOR SALE. (Extract.)**

(Comprising Steam and Diesel Sets, Turbines, &c.).

COMPLETE LIST SENT UPON REQUEST.

New and Second-Hand, in Good Condition.**DYNAMOS.**

Ref. No.	Make.	kW.	Volts.	Revs.	Winding.
818	Westinghouse	135	220	300	C.
226	Peebles	495	220	300	S.
315	Holmes	150	450/550	425	S.
441	Elec. Co.	200	480	350	C.
860	Scott, Mountain	150	500	350	C.

ALTERNATORS.

Ref. No.	Make.	kW.	Phases.	Volts.	Revs.	Cycles.
845	Westinghouse	80 (2 of)	3	200	250	50
1004	Hall	95	3	400	750	50
414	G.E.C.	70	3	570	500	25
830	Westinghouse	300	3	3300	375	50

D.C. STEAM SETS.

Ref. No.	Make.	kW.	Volts.	Winding.	Steam lbs.
494	Browett-Jackson	15	100	S.	80
1010	Willans-Peebles	55	110	S.	160
412	Belliss-B.T.H.	50	115	S.	160
830	Browett-Royce	250	210	C.	125
831	Do.	250	210	C.	125
971	Belliss-E.C.C.	100	220	C.	120
971	Do.	200	220	C.	120
1062	Allen-Westinghouse	200	220	S.	150
1062	Do.	375	220	S.	150
998	Willans-Lancs.	350	240	C.	130
74	Belliss-Westinghouse	140	250	C.	200
822	Parker-Mather	100	440	C.	130
830	Mather & Platt	132	440	S.	190
926	Belliss-Crompton	450	440	S.	160
925	Belliss-Dick, Kerr	260	440/550	C.	200
665	Willans-Mather	224	450/550	S.	160
1071	Reavell-G.E.C.	100	460	C.	140
463	Belliss-Siemens	500	460	S.	150
504	Willans-Mather	150 (2 of)	460/500	S.	125
847	Belliss-Crompton	250	460/520	S.	155
309	Belliss-Holmes	180	500	S.	150
236	Willans-E.C.C.	375	500	S.	180

A.C. STEAM SETS.

Ref. No.	Make.	kW.	Phases.	Volts.	Cycles.	Steam lbs.
1011	Belliss-Boveri	75	3	250	50	160
1011	Do.	180	3	250	50	160
414	Sisson-G.E.C.	70	3	570	25	100
414	Do.	135	3	570	25	100

A.C. STEAM TURBINES.

Ref. No.	Make.	kW.	Phases.	Volts.	Cycles.	Steam lbs.
452	B.T.H.	125	3	440	50	120
859	Parsons-E.C.C.	500	3	500	50	150
859	Parsons	1000	3	500	50	180
80	Parsons-E.C.C.	300	2	2200	50	170
1044	Westinghouse	1000	3	3300	50	180
645	Willans-Dick, Kerr	2000 (2 of)	3	6600	50	175
852	Willans-W'house	1000	3	11000	40	200

D.C. DIESEL SETS.

Ref. No.	kW.	Volts.
1077	75	220
1077	150 (3 of)	220

BRITISH CENTRAL ELECTRICAL CO., LTD.,

6 & 8, Rosebery Avenue, London, E.C. 1.

Telegrams: "Briticent, London." 'Phone: Holborn 5848. 8156

FOR SALE.

50 H.P., 44-V, 3-phase, 40 cycle Peabees Motors, 760 revs., with Ellison starter. 3, 6, and 10-h.p., 110-volt Motors.

22-kW, 230-volt, compound Dynamo and Motors, 4/30 h.p. 10, 15, 20 and 30-h.p., 440/460 volt, Siemens shunt protected Motors, almost new.

DUNMOND & Co., Middlesbrough. 6236

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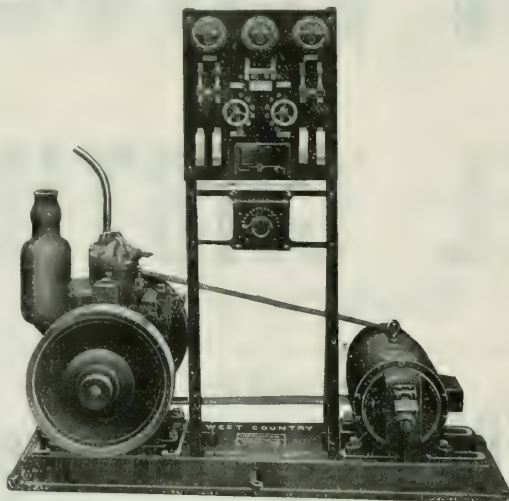
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was pronounced unanimously in favour of the Patent, thereby reversing the judgments given in the Courts below.

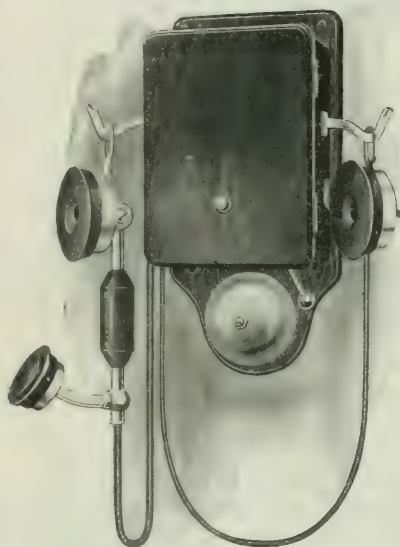
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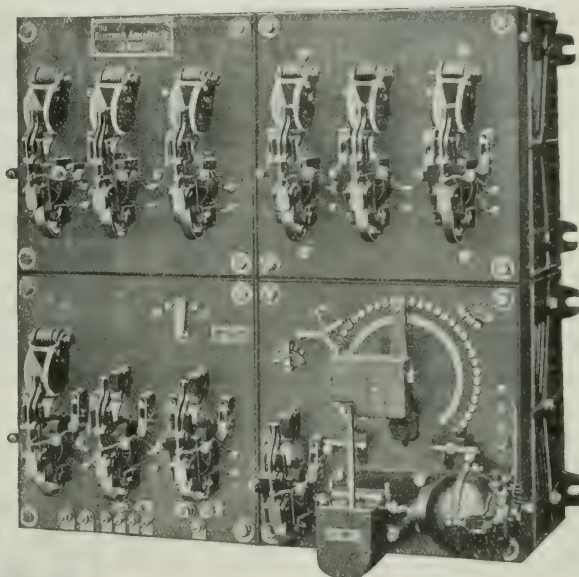
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OFFICIAL NOTICES.**Latest Time for receiving, 5 p.m. Wednesday.****COMMONWEALTH OF AUSTRALIA.****Telephone Apparatus and Parts.****SCHEDULE 54A.**

THE Commonwealth of Australia invites tenders for above, returnable in Australia by 15th February, 1922.

SCHEDULE V.3.

Thirty tons approx. Wheatstone Tape Paper, White. Tenders invited up to February 14th, 1922, for supply and delivery in Australia. For tender forms and all particulars apply Supply Officer, Australia House, Strand, London, W.C.2.

7928

COUNTY BOROUGH OF EAST HAM.**Extension of Generating Plant.**

TENDERS are invited for the supply and delivery of the following:—

EXTENSION No. 4, SECTION "A," CONVERTING PLANT.

One 1,500 kW Converter, either rotary or motor type, for converting 3-phase, 50-period, 6,600 volts, to d.c. 450-500 volts.

EXTENSION No. 4, SECTION "A."

The necessary e.h.t. and low-tension Switchgear and Connections for the above.

Specifications and conditions may be obtained on application to the engineer and manager (Mr. W. C. Ullmann), Nelson Street, East Ham, E.6. Sealed tenders, endorsed "Tenders for Extension of Generating Plant," to be delivered addressed to His Worship the Mayor, Town Hall, East Ham, E.6, not later than 12 o'clock noon of Thursday, January 12th, 1922.

The Corporation do not bind themselves to accept the lowest or any tender.

(By Order).

C. EUSTACE WILSON,
Town Clerk.

Town Hall, East Ham, E.6.
December 16th, 1921.

8109

CITY OF LEEDS.**Electricity Department.****ALTERNATING CURRENT SINGLE-PHASE WATT-METERS.**

TENDERS are invited for the supply of Single-phase Wattmeters required during the year ending December 31st, 1922, the minimum number to be called for being 2,000.

Conditions of contract and forms of tender may be obtained from the undersigned.

Tenders are to reach Sir Robert E. Fox, Town Clerk, 26, Great George Street, Leeds, on or before January 12th, 1922, at 10 a.m., in sealed envelopes endorsed "Electricity—Tender for Meters."

The Corporation do not bind themselves to accept the lowest or any of the tenders sent in.

C. NELSON HEFFORD,
Manager.

Electricity Department, 1, Whitehall Road, Leeds.
December 19th, 1921.

8119

*In the High Court of Justice,
Chancery Division.*

1921 F. No. 688.

Mr. Justice Russell.

IN THE MATTER OF FULLER'S UNITED ELECTRIC WORKS,
LIMITED, AND REDUCED, and

IN THE MATTER OF THE COMPANIES' (CONSOLIDATION) ACT,
1908.

NOTICE is hereby given that a petition presented to the High Court of Justice, Chancery Division, on the sixth day of December, 1921, for confirming the proposed reduction of the capital of the above-named company from £500,000 to £378,794 8s. by cancelling capital which has been lost or is unrepresented by available assets, directed to be heard before Mr. Justice Russell on Tuesday, the 17th day of January, 1922. Any creditor or shareholder desiring to oppose the making of an order for reduction of the capital of the said company under the above Act may appear at the time of hearing in person or by Counsel for that purpose. Such person is required to give three clear days' notice in writing of his intention to appear with the grounds of his objections, to the undersigned, the clerks of the court. A copy of the petition will be handed to any such person requiring the same by the undersigned on payment of the regulated charge for the same.

Tested this 20th day of December, 1921.

CLIFFORD TURNER & HOPTON,
81-7, Gresham Street, E.C.2.
Solicitors for the above-named company.

8121

OFFICIAL NOTICES.—Continued.**CORPORATION OF MADRAS.****Electrical Department.****NOTICE.**

TENDERS for the supply of the following Electric Cables will be received by the Commissioner, Corporation of Madras, in his office at or before 12 noon on Monday, February 20th, 1922.

Low-Tension Cables.

Forty-two miles of twin 7/0.44 S.W.G.
Thirteen miles of twin 7/0.64 S.W.G.

paper-insulated, lead-covered and steel tape armoured cables for 225 volt a.c. circuits.

High-Tension Cables.

Two miles of three-core 7/0.44 S.W.G.
Five miles of three-core 7/0.64 S.W.G.

paper-insulated, lead-covered and steel tape armoured cables for 5,000 volts a.c. circuits with neutral point not earthed.

Printed forms of tender, agreement and specification can be had from the Publisher, "The Electrical Review," 4, Ludgate Hill, London, E.C.4, on payment of 4s. per set, which will not be returned. Only tenders in such forms and complying with the conditions therein will be considered.

C. V. K. CHETTY.

Electrical Engineer.

Ripon Buildings,
Madras, India.
December 1st, 1921.

8149

NOTICES RELATING TO PATENTS.**PATENTS, TRADE MARKS & DESIGNS**
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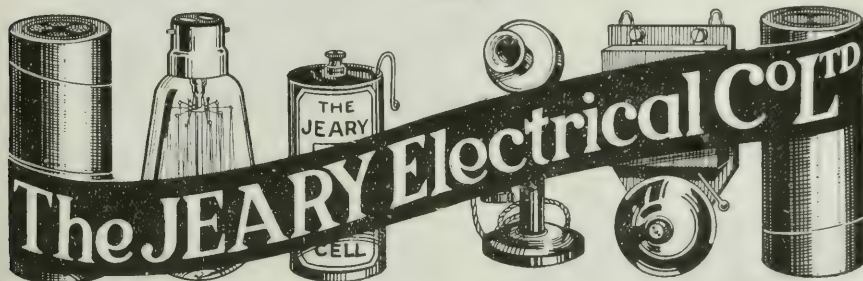
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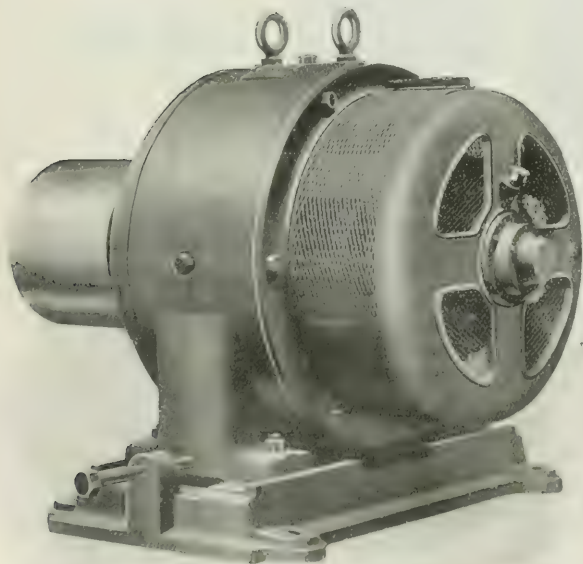
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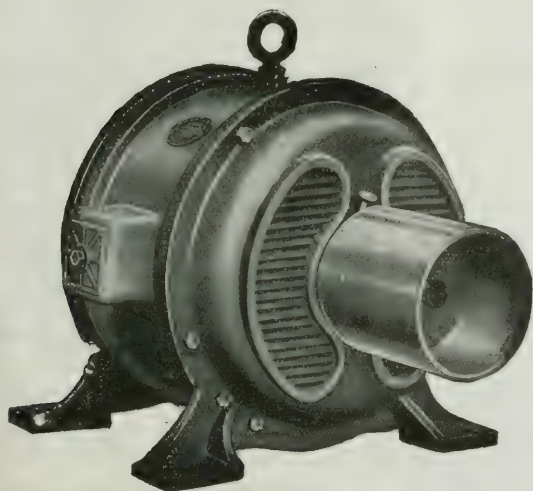
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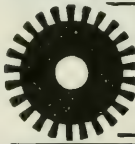
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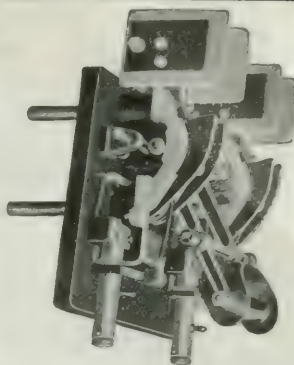
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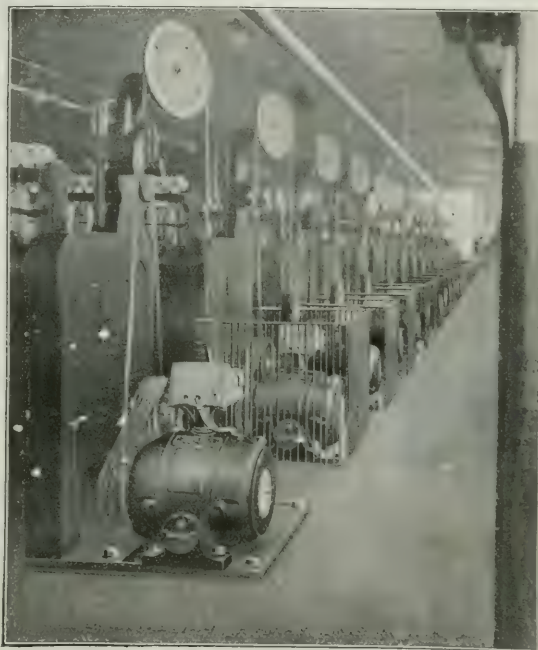
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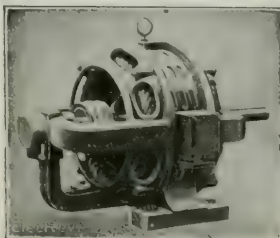
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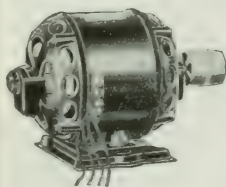
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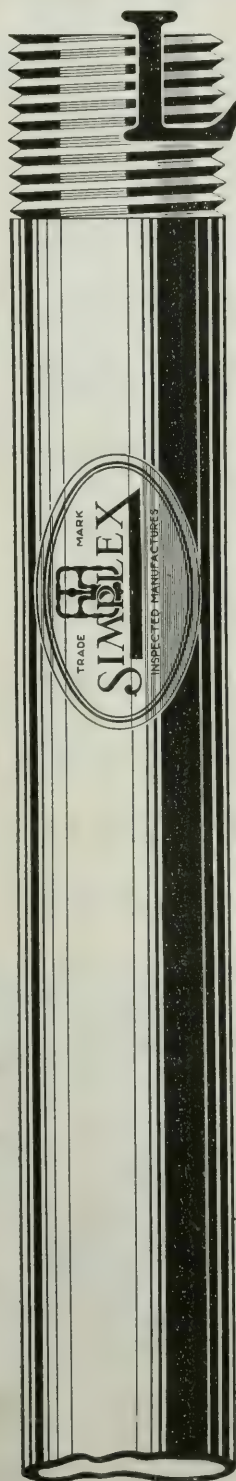
FORK SEPARATORS,
PERFORATED and RIBBED SEPARATORS
FOR ACCUMULATORS.

HIGHTENSITE, LTD.,
NORMANDY WORKS, NORMANDY ST.,
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Phos. J. 1151
Tel. 1151 HICK CLINTON

METAL PUMPS,
CHEMICAL VESSELS, &c.,
LINED WITH EBONITE.

SEND US YOUR ENQUIRIES



LOOK FOR THE TRADE MARK ON EVERY LENGTH OF SIMPLEX CONDUIT



WARNING: In numerous instances, imported and inferior grades of conduit are being supplied by certain unscrupulous vendors against requisitions for Simplex conduit. It should, therefore, be noted that the sale of other makes of conduit where "Simplex" is specified is illegal—judgment to this effect having been given in the Courts.

PROTECTION: In order to effect a safeguard for your interests in this direction every length of genuine Simplex conduit will now bear a reproduction in transfer form of the Company's trade-mark to act essentially as a guarantee of "Simplex" origin.

GARANTEE: When ordering conduit, therefore, order Simplex conduit and see that every length bears the little red label; it is YOUR GUARANTEE that the conduit supplied is Simplex conduit—conduit that is efficient to the utmost limit of efficiency.

ADVANTAGES: Besides its guaranteeing the source of origin, the label also indicates that the conduit is manufactured from only the highest grade of steel, and that each length is specially inspected and tested for smoothness of bore and accuracy of internal and external diameters. A special process of stoving after enamelling gives the conduit a protective covering of exceptional durability, which is at once elastic and tenacious, and possesses good insulating properties. The threads are well cut AFTER enamelling, and are protected by cardboard caps against damage during delivery.

SOLD THROUGHOUT THE
SIMPLEX
ORGANISATION

STOCKED AT 14 BRANCHES IN THE U.K. AND
OBTAINABLE ALL OVER THE WORLD.

Advt. of Simplex Conduits, Limited, Garrison Lane, Birmingham.



A Happy and Prosperous New Year to all our Agents! Congratulations on the fine showing you made during 1921, and cordial Good Wishes for still greater successes in 1922! In handling Lalley Light you have—as you know—the best thing of its kind, bar none. Here's wishing you good business in all your departments.



STUDEBAKER, Ltd.

(Lighting Plant Dept.).

117-123, Great Portland Street,
London, W. 1.

Grams "Studebaker, Wexdo, London."

Phone . . . Longham 1210 (4 lines)

Safe Crane Control with Unskilled Operators

Potentiometer Control ensures perfect safety with the least skilled operator.

One only, of several control schemes for hoist motions employed with Allenwest Drum Controllers, it has many important features. The speed is always proportional to the position of the controller handle, whatever the load. The maximum speed is fixed at a safe value and complete control of the load is ensured when lowering. A loaded hook is automatically retarded and a light hook driven down, the speed in both cases being at its maximum safe value. Weston or similar brakes are unnecessary.

Allenwest Drum Controllers are constructed to give uninterrupted service, and there is a design for every requirement.

Write for Leaflet E. 20/1.

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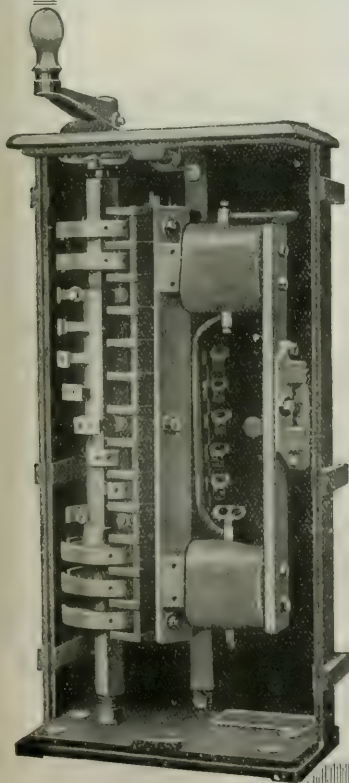
*Birmingham, Cardiff, Glasgow,
London, Manchester, Newcastle,
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It is with great pleasure that we announce an arrangement we have made with the
STELLA LAMP WORKS, LIMITED,

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for that firm in future to supply CONDOR Half-Watt and Argon filled Lamps.

CONDOR Lamps are still being sold OPENLY and STRAIGHTFORWARDLY and our INDEMNITY is STILL GOOD. Our FRIENDS can rely on us in spite of any statements to the CONTRARY.

Not one order placed with us for Half-Watt Lamps has been cancelled.

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YOU CANNOT BUY A BETTER LAMP.

Legal action will be taken against any person or persons
claiming to be directly or indirectly importing Condor Lamps.



NOTICE
regarding the
COST
of
ELECTRIC CONTROL GEAR

In anticipation of the
fall in costs of materials which will
be caused by the discontinuance
of the Ministry of Munitions bonus,

GEORGE ELLISON,
Maker of **ELECTRIC CONTROL GEAR,**
has decided to

REDUCE SELLING PRICES

10%

This reduction will take effect on
JANUARY 1st, 1922, and will

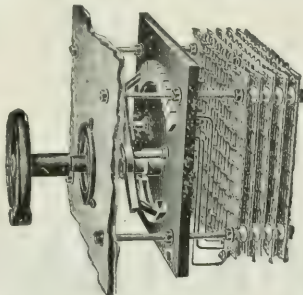
STABILISE PRICES
for **ELLISON CONTROL GEAR.**

George Ellison, December 30th, 1921.





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This type of regulator is specially intended for building into switchboards, and is made in any size or capacity.

The main features are
ABSOLUTE RELIABILITY, NEAT AND COMPACT EASILY ACCESSIBLE, EXTREMELY SIMPLE DESIGN, MINIMUM COST OF FIXING, MADE TO SUIT **YOUR OWN EXACT REQUIREMENTS**, AND AT A MODERATE COST.

Pre-eminently suitable for—
Battery Charging Panels, Projection Lamp Switchboards, Shunt Regulation, etc., etc.

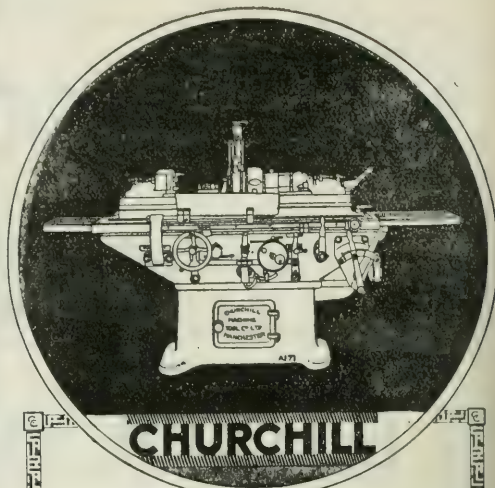
We supply these resistances COMPLETE with Hand Wheel and Dial-Plate, all ready for fixing to the switchboard. They can also be supplied with sprocket and chain control.

Please address your enquiries to—

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CHURCHILL GRINDERS

You can obtain accurate results very rapidly on Churchill Grinders. This means cheapness in production.

There is no cheaper process for accurately producing finished surfaces, either cylindrical or flat.

The reason Churchill Grinders are so uniformly successful is that they are capable of continuous maximum production.

Whatever grinding work you may have we can give you the right machine.

Tell us what you want. It will cost you nothing and may save you much.

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We are in a position
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MANCHESTER GRADE FLEX.

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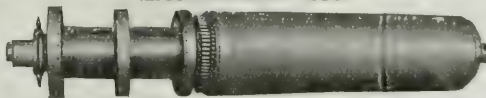
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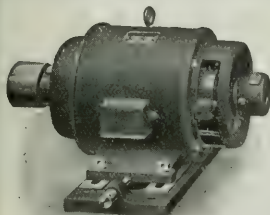
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REPAIRAny Mechanical and Electrical
Defect to**DYNAMOS, MOTORS,
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and REWINDAnd Reconstruct any size.
Commutators ground up in position.
New Commutators supplied.

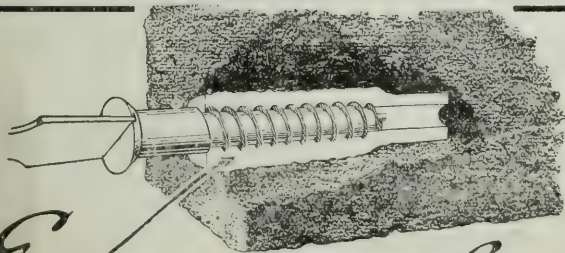
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YOU LOSTTHAT LAST ORDER FOR MOTOR INSTALLATION
WHY??? PRICE TOO HIGH!!!

TRY US.

OUR PRICES AND QUALITY WILL ENABLE
YOU to WIN every time.**The SMALL POWER DYNAMO & MOTOR Co., Ltd.,**
OLD LANE, OPENSRAW, MANCHESTER.*Expansion means Grip!*

Look at this illustration and you will see how it is that Rawlplugs provide the only satisfactory method by which screws can be made to hold all kinds of fixtures permanently in any material.

By the old method either you jammed a nail desperately into the plaster, where it worked loose, crumbled the plaster and ruined the wall—or you cut a hole with the cold chisel in the brick beyond, made a wood plug to fit and wedged the plug into position. In either case your fixture was practically bound to work loose and fall sooner or later, because the nail or wood plug merely rested in the wall. It did not grip inside the wall. But Rawlplugs do.

You make a small neat hole with the Rawlplug tool—smaller than the head of the screw—and press the Rawlplug into it. The Rawlplug is a little fibre tube, and when you turn a screw into it, it expands, the screw forms a perfect thread in the Rawlplug, grips the wall like a vice and your fixture becomes part of the wall itself.

Do you Realise all the Possibilities of Rawlplugs?

Whether you drive a nail between the courses or chip the brick away and insert an unsightly wood block, the result after your fixture is up is always the same—trouble and dissatisfaction. With Rawlplugs you simply make a small hole in the brick wherever it is required to fix the screw, insert a Rawlplug, and turn the screw home. A simple, permanent and satisfactory job.

Plaster is always difficult to fix anything to. Nails are useless. Wood plugs break away the face of the wall and make ugly holes which have to be made good by plastering. Only Rawlplugs will hold satisfactorily in plaster. They expand inside the wall with a vice-like grip and become as it were part of the wall.

Wood plugs won't hold in stone. For fixing name plates to outside walls, for lightning conductors, for outside wiring always use Rawlplugs. There are no maintenance charges with Rawlplugs because once up they never need attention.

The only satisfactory method of making a fixture with tiles is by means of Rawlplugs, because the tile can be pierced by the Rawlplug Tool without "starring" or damage to the tile and without the necessity of plastering or cementing into position.

Rawlplugs need no skilled handling. They are available in position and cannot damage the walls. They have been used in houses all over the country for fixing coat hooks, brackets, and all kinds of fixtures to brick, plaster, tiles, concrete, marble, stone, etc.

Sample Outfit.Containing 100 Rawlplugs
and supply of Screws,
special Rawlplug
Tool and 2 Bits **5/6**Write for special list and trade terms. If you
have any points of doubt or difficulty let us advise.**Complete Outfit.**All sizes of
Rawlplugs and **£2**
Tools, Nos. 3-14**THE RAWLPLUG COMPANY, LTD., Gloucester House, Cromwell Road, London, S.W. 7.**

We Manufacture

1, 2 & 3 PHASE MOTORS

 $\frac{1}{4}$ to 35 H.P., Fully Guaranteed.

Slip Ring and Squirrel Cage, with indestructible rotors and very good starting torque.

Delivery from Stock.

COMPETITIVE PRICES

HOWELLS & CO., 105, York St., Hanley,
STOKE-ON-TRENT.

YOUR SALES CAN BE INCREASED



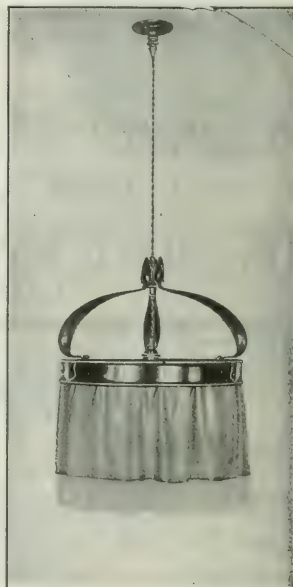
Series "L," 23/- complete.

and, incidentally, your Showroom made more attractive by displaying

BETTERWAY SHADES.

The six standard colours—
Light Red—Dark Red—
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—meet the tastes of a large
body of customers, and the
Bead Trimming and beauti-
fully Embroidered White
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of superiority only obtained
in good class articles.

*We invite you to send
for our Illustrated List.*



An effective Attachment, which can be fixed in a
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Series "F," 20/-

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Bakelite Insulation.

We carry Large Stocks, as follows:—

0'5, 0'8, 1'5, 3'0, 5'0, 6'4, 10'0, 12'8 m/m Sheets.

Small Tubes from 10 to 28 m/m internal
diameter \times 2 and 3 m/m wall.Large Tubes from 143 to 356 m/m internal
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Guaranteed Quality.

Low Prices.

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CONDUIT SADDLES

(JAPANNED STEEL).



E 127.

STOCK SIZES: $\frac{1}{2}$ ", $\frac{3}{8}$ ", $\frac{3}{4}$ ", 1", $1\frac{1}{4}$ ", $1\frac{1}{2}$ ", 2".**E. SHOWELL & SONS, LTD.,**

Stirchley,

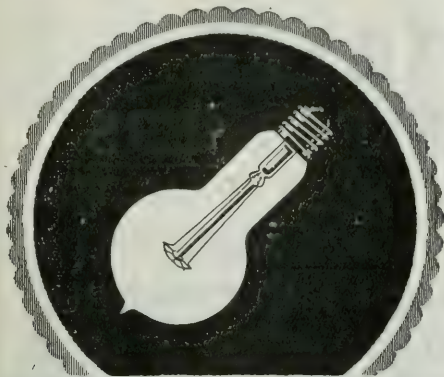
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LIONEL ROBINSON,

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METAL-FILAMENT
LAMPS.**

THE STONEBRIDGE ELECTRICAL CO., LTD.,
WINDMILL ROAD,
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Telephone:
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PRICES DOWN
of
LOWKE 50-volt Direct-coupled SET

DESIGNED FOR FIFTY 20-C.P. LAMPS, AND WORKS-TESTED
FOR A HUNDRED LAMPS. IT COMPRISES

ENGINE of 2 H.P., giving such complete combustion that exhaust is
smokeless and odourless. Its detachable head reduces engine cleaning to a
ten-minute job.

CARBURETTOR (automatic) changes from petrol to paraffin without
adjustment.

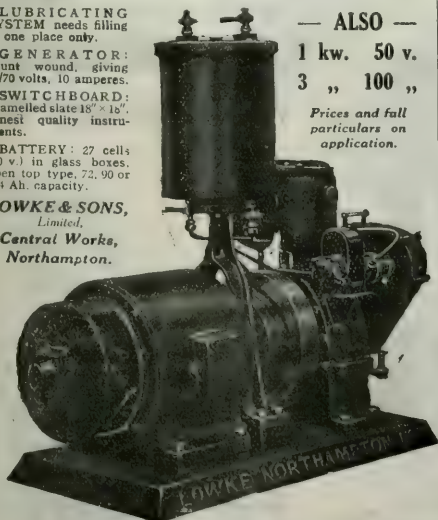
LUBRICATING
SYSTEM needs filling
in one place only.

GENERATOR:
shunt wound, giving
50/70 volts, 10 amperes.

SWITCHBOARD:
enamelled slate 18" x 12".
Finest quality instru-
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BATTERY: 27 cells
(50 v.) in glass boxes,
open top type, 72, 90 or
144 Ah. capacity.

LOWKE & SONS,
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**POWER AND LIGHT
WITH
THE QUIET KNIGHT
ON PARAFFIN.**

*USE WILLYS LIGHT AND POWER
SET WITH ITS LARGE
CAPACITY BATTERY, 3-H.P
Air Cooled Engine, 1½ KW. Generator,
225. ampere hours Battery at 22-30
volts.*

RETAIL PRICES.

OLD PRICE £225

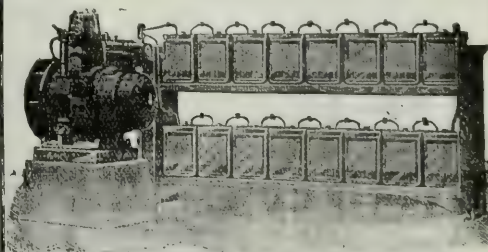
NEW PRICE £195

REDUCTION OF £30

Operative Dec. 9th.

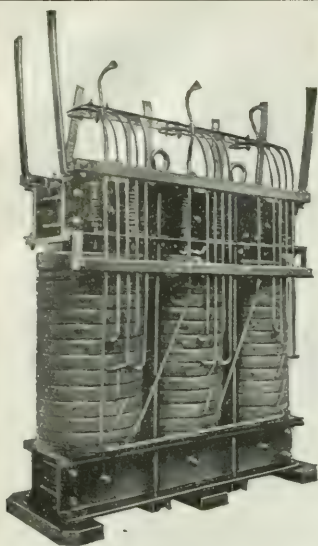
**ENGINE & GENERATOR ONLY.
NEW PRICE - £125.**

At the reduced price the Willys
Light Electric Set is the greatest value
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HAVE 20 YEARS' PRACTICAL
A.C. EXPERIENCE EMBODIED IN
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OTHER MAKES.

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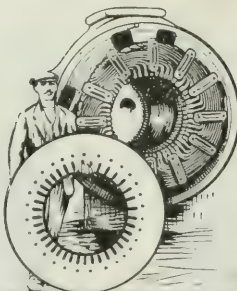
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HARRIS
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FOR ELECTRICAL TRADES

**95,
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"WESTMINSTER" ARC LAMPS.

Electric
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2500
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Telegrams:
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Detectors
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Earthing
Devices
Castings
in
Brass, Bronze
other Alloys.

"Westminster"
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over 20000
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Motor Generators
&
Machines of special Design.

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Telegrams:
"DYNAMO,"
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Telephone:
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AND

DYNAMOS

FOR

**Direct or
Alternating
Current**

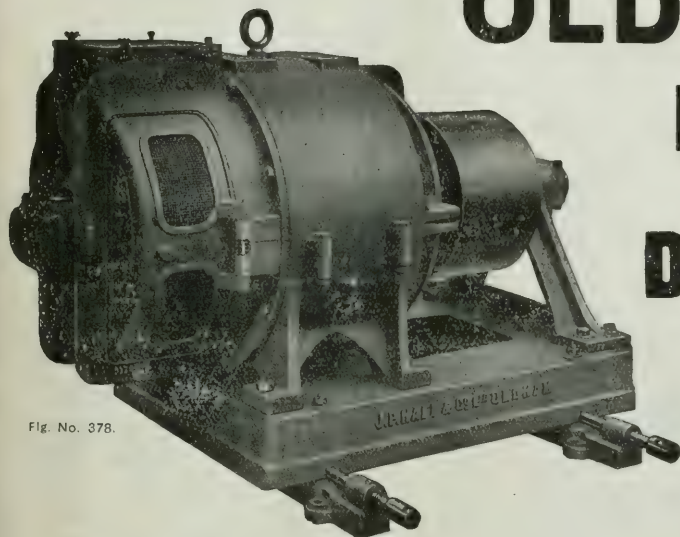
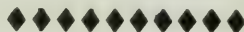
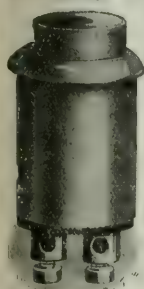


Fig. No. 378.

50-H.P. D.C. MOTOR WITH BEDPLATE AND OUTER BEARING.

FLUSH TYPE BARREL BELL PUSHES (PROV. PAT.)

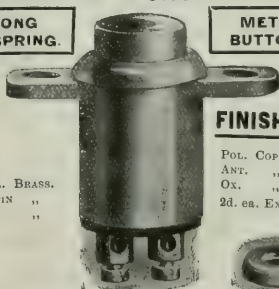
ENGLISH MANUFACTURE — MASS PRODUCTION — COMPETITIVE PRICE.
STRONG MECHANICAL CONSTRUCTION — SOUND ELECTRICAL INSULATION.



**STRONG
SPRING.**

POL. BRASS.
SATIN " "
OX. " "

No. 61. PRICE 2/3 ea.



**METAL
BUTTONS.**

FINISHES

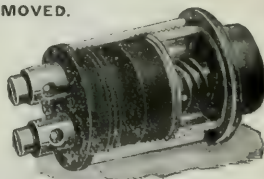
POL. COPPER.
ANT. " "
OX. " "
2d. ea. Extra.

No. 71. PRICE 2/6 ea.



POL. SILVER.
ANT. " "
OX. " "
4d. ea. Extra.

No. 81. PRICE 2/9 ea.



No. 61 WITH PART OF
BRASSWORK
REMOVED.

CONTACT FITTED IN
MOULDED INSULATION
WORKING ON BALL JOINT

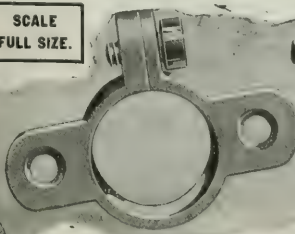
**ADJUSTABLE TYPE for RECESSED PLATES or where
DEPTH of PLASTER UNCERTAIN.**



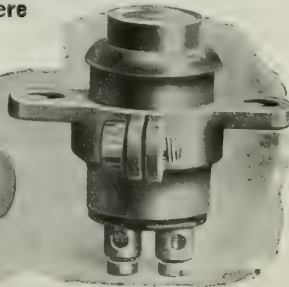
No. 61/91.
PRICE 3/3 ea.



No. 91. PRICE 1/- ea.



No. 101. PRICE 9d. ea.



No. 61/101. PRICE 3/- ea.

MANUFACTURED BY:-

GATH ELECTRICAL ENGINEERING CO., HALIFAX, ENG.

Not lamps alone for light

Modern installations are usually equipped with gas-filled lamps, but the high intrinsic brilliancy of these lamps needs controlling to get the best results. In "Sunlite" P.E. Reflectors and fittings, there are embodied all



those features which experience has shown necessary. Not only are the reflecting surfaces correctly designed to

send the light just where it is required, but ventilation and other details have been carefully dealt with.

"SUNLITE" REFLECTORS

The complete range is illustrated in our Booklet **"High Efficiency Lighting"**



There you will find just the information you require to get the very best results in illuminating large areas whether inside or outside. We

shall be glad to send you a copy, or to advise you on any special lighting equipment.



There are so
many reasons
why you should
buy your
LAMPS
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STEARN-EDISWAN-FOSTER
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The sale of Lamps should be a considerable part of your business. If you supply only the really reliable lamps made by E.L.M.A. members. The lamps which your customers naturally ask for, because they know they are good and because they are well advertised. These are the lamps you get at the Sun—from stock in any quantity. A stock of a quarter of a million lamps means that your orders are instantly executed. The terms are the best you can get anywhere. The service is excellent—Sunco Everything Electrical Service—the lamps can be included with many other items—saving you buying and carriage expense.

Send to-day for Particulars and prices of lamps, List No. 346, and anything else electrical—Sunco lists will help you to more business.



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LONDON W.C.2.

BIRMINGHAM: 30, Paradise Street.
NEWCASTLE-ON-TYNE: Milburn House.
BELFAST: Gibson's Bldgs., Mill St.

Telephone: Gerard 221 lines.

Telegrams: "Secabilis, Ox London."

ries about 1,500 ft. in twelve miles and throughout the section there is little level running. Power will be provided by a generating station which is being erected at Glencoe.

Taunton.—ORDER CANCELLED.—The Ministry of Transport has informed the Town Council that an Order has been made abrogating as from December 6th the powers of the Taunton Electric Traction Co., Ltd., in respect of the tramways authorised by the Taunton Tramways Order, 1900, and the Taunton Tramways (Extension) Order, 1907.

TELEGRAPH AND TELEPHONE NOTES.

France.—TELEPHONE SERVICE.—That the Government's monopoly of the telephone service has been a failure is suggested by *The Times* in announcing a bold plan submitted by M. Deschamps, former Minister of Posts, Telegraphs, and Telephones, to industrialise the telephone. His idea is that the State should make over its monopoly to a company, which would take over not only the telephone system and apparatus, but also the personnel now employed by the State. The weak and impracticable side of his scheme is that the personnel should be "part-owned" and "part-paid" by the State. As against this proposal a Bill has been laid before the Chamber by the present Minister, M. Paul Lafont, which is an earnest attempt to remedy the defects of the existing system, while retaining the monopoly. Instead of yearly doles, M. Lafont asks for a lump credit of 1,600,000,000 fr. (£31,000,000), spread over a period of eight years. This would enable him to attain continuity in carrying out his plans. The financial programme counts on the voluntary assistance of the Chambers of Commerce, public and private establishments, municipalities, &c., in the shape of loans without interest. This last idea is already in operation at Lyons, Bordeaux, Lille, Roubaix, and other towns. M. Lafont proposes not only to speed up and improve the telephone service generally, but he means to modernise it in the technical sense of the word. Whereas the Parisian now pays 1.750 fr. (£35) annual subscription fee, M. Lafont intends to charge 350 fr. (£7) "tout compris."

Imperial Wireless Chain.—The presentation to the Cabinet of the report of the Wireless Telegraphy Commission has afforded Dr. W. H. Eccles (vice-chairman) a suitable occasion to place before readers of *The Times* a broad statement covering the preparatory work that has been accomplished towards the improvement of Imperial communication. After referring to the unanimous report of the Wireless Telegraphy Committee that was published in June, 1920, Dr. Eccles points out, *inter alia*, that the establishment of intermediate relay stations shortened the average link of the chain to 2,320 statute miles. But even across 2,000 miles, especially in tropical regions, it would not be easy to guarantee an uninterrupted service, and when atmospheric conditions were unfavourable the most powerful of existing stations would often be asked to repeat messages. The Committee, therefore, had to find a method of generating electric waves which should be capable of adaptation at will to ranges varying from 2,000 to 11,000 miles, and capable of easy variation in strength from moderate to very intense, according to the atmospheric conditions. The most promising combination of flexibility and the other desirable qualities was found in the method utilising the thermionic valve, as yet untried on a large scale. In its report, the Committee recommended that the Imperial stations should be equipped with thermionic valve plant able to deliver at least 120 kilowatts of power to an efficient antenna and capable of extension to 240 kilowatts at a later date as desired. The principal stations in England, South Africa and India would communicate direct during the hours of each day known to be most favourable for the respective pairs of stations. When atmospheric disturbances at the receiving stations were slight, the messages might be in code or otherwise, and would be sent at high speed. When the atmospheric conditions were not quite suitable for coded and commercial messages, a considerable volume of news traffic could be conveyed. Later, when the atmospheric conditions became still more difficult, the intermediate relay stations would be called upon to take down messages for retransmission. The intermediate stations would doubtless have a certain volume of local traffic, and would be of strategical importance.

To plan the stations in detail the Wireless Telegraphy Commission was appointed by the Cabinet in December, 1920; its report has just been presented to the Cabinet, and is to be published shortly. In respect of thermionic valve plant, the Commission has drawn most of its practical and proved information from the staff of the Admiralty's station at Horsea, Portsmouth, and from the Marconi Co. Approximate estimates point to an average capital cost per station of not more than £160,000, including the transmitting and receiving sides of a duplex station, but exclusive of staff quarters, which may have to be provided at some of the sites.

After reference to the Press and propaganda aspects of the possibilities of an Imperial chain of wireless stations, Dr. Eccles concludes that the universal wireless progress during the eighteen months which have elapsed since the Imperial

Wireless Telegraphy Committee formulated its scheme has tended to confirm its conclusions that an Empire wireless service can be made continuous and trustworthy at reasonable cost by the aid of intermediate relay stations, and that only in this way can we escape the partial and erratic service which must accompany attempts at direct communication across the immense distances separating the great centres of the Empire.

Italy.—NEW WIRELESS STATION.—The Italian Ministry of Posts and Telegraphs is to grant a concession for the installation and working of a wireless station on the Island of Rhodes, to a private firm. The station is intended to establish a regular service of messages between Italy and Asia Minor.

Norway.—STORM DAMAGE.—A violent gale raged through Norway on December 17th. Great dislocation of the telegraph and telephone services was caused and communication with Denmark and Germany was broken. On December 20th communication was good with England, but the wires were overburdened. There was no connection with Germany, and with Denmark the connection was bad. Telegrams from Paris despatched on December 17th arrived by train from Copenhagen on the night of December 19th.—*Reuter's Trade Service* (Christiania).

Russian-Swedish Telegraph Service.—A complete official telegraph service between Sweden and Soviet Russia was established as from December 17th, a formal agreement having been concluded between the two countries based on the Swedish proposal regarding fees.—*Reuter's Trade Service* (Stockholm).

Wireless Telephony.—AMATEUR TESTS.—From midnight until 6 a.m. on December 8th, and at the same time on the following nine days, wireless amateurs of the U.S.A., organised by the Radio Relay League of America, attempted to communicate with amateurs in this country. A similar, but unsuccessful, attempt was made last February. This year, however, messages are said to have been accurately received from 43 amateur stations throughout the U.S.A. and Canada.

Mr. Paul F. Godley, who was sent over to this country by the American Radio Relay League, to act as official observer in the Transatlantic tests, selected Ardrossan, on the West Coast, as the most suitable site for a receiving station. Arrangements were made for messages to be sent each night, and Mr. Godley has been successful in receiving the messages. The most powerful station heard was that of an amateur at Toronto, and the most distant station that of an amateur at Atlanta, Georgia, 3,600 miles from Ardrossan. This is the first time that Transatlantic communication had been achieved with the low-power installations to which amateurs are restricted.

Wireless Telephony.—LONDON-AMSTERDAM CONVERSATIONS.—Speech by means of combined wire and wireless telephony was carried on between London and Amsterdam on December 18th, ordinary office telephones being used for the purpose. There is at present no direct trunk line communication between London and Amsterdam, and the demonstration, which took place at Marconi House, was made possible by means of a wireless link connecting trunk lines between the two countries. The General Post Office had placed the trunk line between London and Southwold at the disposal of the Marconi Co., which has erected a special wireless station at Southwold for the transmission across the sea. From Southwold the conversation was conveyed by wireless to Zandvoort, where another wireless station has been built. From there an ordinary trunk line conveyed the message to Amsterdam.

The circuits enabled conversation to be carried on in the ordinary way, one speaker breaking in and interrupting another as in ordinary conversation. This was achieved by working to Holland on a slightly different wave length to that used for the return conversation, and by separating the transmitting and receiving stations at either end. The wireless transmission was on an unusually short wave length, which is not in general use, and was relatively immune from atmospheric disturbance.

RAILWAY COMMUNICATION.—The hope that wireless telephony can be applied to avoid railway accidents is supported by experiments that have taken place between Paris and Creil, on the Nord Railway system. Wireless antennae were fixed on a carriage, and one compartment was arranged as a receiving and transmitting post. Between two telegraph posts skirting the line another horizontal aerial was established at a given point, thus permitting the use by induction of the ordinary telegraph wires. The experiments, which began in November, were continued in December, and perfect results are said to have been obtained. From the time the train left Paris wireless conversation went on between the Gare du Nord and the special compartment of the train, and was kept up until Creil was reached. Experiments are to be attempted between Paris and Calais and on the Nord system.—*Daily Telegraph*.

MORRIS POLICE EQUIPMENT.—The Paris Prefect of Police is providing his force with motor-cars equipped with wireless telephone apparatus, from which it will be possible to telephone to headquarters or to one another. In police operations requiring great rapidity much time otherwise lost in using the ordinary public telephone offices will be saved and the

chances of success increased. The only point remaining to be settled is the wave length to be used, regarding which the Prince of Wales Prefecture is in communication with the Post and Telegraph authorities. *Daily Mail.*

Wireless Telegraphy on Ships.—At the recent International Shipping Conference in London, a discussion took place on the regulations controlling the installation of wireless telegraph apparatus on board merchant vessels. It was argued that a free market for apparatus should be maintained, and that shipowners should have a free hand in dealing with the matter. An automatic alarm device should be sanctioned to avoid the necessity of human watchers for life-saving signals, and members of the crew should be trained sufficiently to be able to perform the duties involved, instead of carrying special wireless operators for the purpose. A committee is to be formed of representatives of shipowners to report upon desirable modifications of the Convention of London, and to secure their adoption by the Governments concerned.

Some details of the progress that has been made in the use of automatic devices for recording signals received from vessels in distress were recently given in *The Times*, according to which 25 vessels representing as many shipping companies are being equipped with the new "Four-second Alarm" of the Marconi Co. in order that it may be thoroughly tested in actual sea-going circumstances. The equipment of 30 of the ships is complete.

It is understood that whereas the North Foreland station will be fitted with the actual alarm, the Niton wireless station on the Isle of Wight will also co-operate by sending out experimental "Four-second" signals. The chief characteristic of the alarm is that it is wholly immune from interference due to general wireless communication and atmospheric disturbances, and unlike automatic devices intended to respond to the S.O.S. signals, it is not actuated by signal combinations having the same sequence as those appearing in S.O.S. With the present form of wireless distress signal (S.O.S.) there will probably be great difficulty in devising automatic apparatus for registering the receipt of the signal which will be sufficiently reliable to permit of its use on board ship in place of a watcher, as contemplated in section 9 of the Merchant Shipping (Wireless Telegraphy) Rules, 1920.

The distress signal cannot be altered without international agreement; but it has been suggested that, in order to avoid the difficulties resulting from jamming by atmospheric disturbances, the distress signal proper should be preceded by an "alarm signal" capable of actuating automatic apparatus without fail.

The alarm signal at present under consideration consists of a prolonged dash of four seconds followed by a space of one second, the alternation of dash and space being continued for one minute; and the automatic apparatus should respond to the alarm signal after the reception of any three consecutive dashes.

Copies of reports obtained at regular intervals from the masters of ships equipped with the device will be sent direct to the Secretary, General Post Office, for examination.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared.)

OPEN.

Australia.—MELBOURNE.—February 1st. Victorian Government Railways. Four motor-driven grinding machines, with accessories.*

February 15th. 100 track relays; 50 line relays (cont. 34,739); 100 3-position line relays (cont. 34,740). February 22nd. 100 electric signal mechanisms (cont. 34,736); electro-mechanical interlocking apparatus (cont. 34,822). March 1st. 50 miles insulated copper wire (cont. 34,824).*

Bulgaria.—February 6th. Department of Posts, Telegraphs, and Telephones. 30 terminal boxes; 1,000 combined lightning arresters and 1-amp. fuses; 500 ditto, different type; 300 transformers; 700 condensers; 30 junction boxes.*

Chile.—February 4th. State Railways. Twelve wind-mills, complete; one electric compressor; one air-storage drum and d.c. motor; 1,300 metal-filament lamps for lighting locomotives; 38 wall telephones.*

East Ham.—January 12th. Electricity Department. One 1,500-kW converter, either rotary or motor type; e.h.p. and l.p. switchgear and connectors. (December 23rd.)

India.—MADRAS.—February 20th. Corporation. L.p. cables:—42 miles of twin 7/0.44 S.W.G. and 13 miles of twin 7/0.64 S.W.G. paper-insulated lead-covered and steel-tape armoured cables for 225-V. a.c. circuits. H.p. cables:—Two miles of 3-core 7/0.44 S.W.G. and 5 miles of 3-core 7/0.64 S.W.G. paper-insulated lead-covered and steel-tape armoured cables for 5,000-V. a.c. circuits with neutral point not earthed. Specifications and forms of tender (4s. per set) from the Publisher, ELECTRICAL REVIEW. (See this issue.)

Leeds.—January 12th. Electricity Department. Single-phase wattmeters for 12 months (minimum 2,000). (See this issue.)

London.—L.C.C.—January 12th. One electric passenger lift, capacity 11½ cwt., with full automatic push-button control, to be completed within two months, at Geoffrey House, Tabard Garden Estate, Bermondsey, S.E. (December 16th.)

Maldens and Coombe.—January 10th. Urban District Council. Two 10-h.p. horizontal electric motors, starting gear, &c. Also electric lighting installation at Blakes Lane pumping station. Mr. R. H. Jellies, engineer and surveyor, Municipal Offices, New Malden.

Manchester. January 5th. Corporation. For Barton power station. Standard gauge railway, 2-way turntables (two of 20 tons and two of 40 tons capacity). Specifications, &c., from Mr. F. E. Hughes, secretary, Electricity Dept., Town Hall. Deposit £1 is. (returnable.)

New Zealand.—WELLINGTON.—January 17th. Post and Telegraph Department, 25,000 dry cells for telephone work.*

Peterborough.—January 12th. Electricity Department. One 3,000-kW turbo-alternator with condensing plant, two 750-kW rotary converters, two 100-kW motor generators, e.h.p. and l.p. switchgear, steam, water, and drain pipes, foundations for the above plant, and structural alterations to existing buildings. (December 16th.)

South Africa.—JOHANNESBURG.—January 4th. Municipal Council. Two 2,000-kW converters, with switchgear and spares.*

Pretoria.—February 1st. Public Works Department. Conduit and conduit fittings. Electrical Engineer, Public Works Department, Pretoria.

Port Elizabeth.—January 31st. Municipal Council. Tenders for electrical plant.*

Durban.—January 18th. 372 consumers' watt-hour meters, including 37 d.c. meters, 275 single-phase, 50-cycle induction type meters, and 60 3-phase, 50-cycle induction type a.c. meters for unbalanced leads.*

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Government Contracts.—The following Government contracts were placed during November, 1921:—

ADMIRALY (CONTRACT AND PURCHASE DEPARTMENT)

Accommodations—London Battery and Cable Co., Ltd.
Cables and boxes, Fulkers' Limited Electric Works, Ltd.
Cables, travelling blocks—H. Morris & Co., Ltd.
Electrically-driven capstans—Sir W. Arrol & Co., Ltd.
Electric travelling crane—H. Morris, Ltd.
Electric light and power cable systems—Johnson & Phillips, Ltd.
Electric travellers—Sir W. Arrol & Co., Ltd.
Electric hoists—W. Wadsworth & Sons
Electric cable—Johnson & Phillips, Ltd.
Insulating materials—Attwater & Sons; Connollys (Blackley), Ltd.; Iso Rubber and Waterproofing Co., Ltd.; Mica Manufacturing Co., Ltd.; Micanite and Insulators, Ltd.
Motor and control gear—Laurence, Scott & Co., Ltd.; English Electric Co., Ltd.
Rotary converter—English Electric Co., Ltd.

WAR OFFICE.

Electric cables—Enfield Edison Cable Works, Ltd.
Electric batteries—C. A. Vandervell & Co., Ltd.
Electrical equipment—A. Lyon & Co., Park Royal Engineering Works, Ltd.; Small Electric Motors, Ltd.
Electric fans—General Electric Co., Ltd.
Electric generators—G. Kent, Ltd.

AIR MINISTRY.

Electric storage battery—Hart Accumulator, Ltd.; Chloride Electrical Storage Co., Ltd.
Booster pumps, Rues Rotabro Manufacturing Co., Ltd.
Magnets, British Thomson-Houston Co., Ltd.
Wireless valves, General Electric Co., Ltd.

POST OFFICE.

Testing, protective apparatus, &c. Brit. E. M. Friesson Manufacturing Co., Ltd.

Telegraph and telephone cable, Enfield Edison Cable Works, Ltd.; British General Cable Works, Ltd.; Union Cable Co., Ltd.
Joint line castings—United Steel Companies, Ltd. (J. Butlin & Co. branch).

Cords for telephones—British Insulated & Heatsh Cable, Ltd.; Siemens Bros. & Co., Ltd.

Ducts—Albion Clay Co., Ltd.; Donington Sanitary Pipe & Fibrebrick Co., Ltd.; Doulton & Co., Ltd.; J. Oakes & Co., Ltd.

Laying conduits—Stanningley, Stafford, Smeethwick, King's Norton; Hodges Bros. (Contractors), Ltd.; Pontypool, Shirley, and Selly Oak; Poplin & Holland, Ltd.; Colver, S. Jovett & Sons; Ilington (Barnes Road); W. Griffiths & Co., Ltd.; City of London, Sloane Ex. area and Elm Elm, S.W.; Catton and Dereham, West Brompton, S.W.; Tottenham (Lansdowne Road); J. Mowlem & Co., Ltd.; Wilmshew; E. Jovett; Stratford (Romford Road), Castleford, Preston-Blackburn-Burnley (Sections I, IV, & V); J. A. Ewart, Ltd.; Harrow (Peterborough and Bessborough Roads), and Kensal Rise; G. J. Anderson; East Hove; Martin & Element, Ltd.; Newport-Pontypool; H. Smith; Low Moor (Bradford), Cleckheaton, Greig & Matthews; Presham and Romey; Hardy & Co.; Wrexham and Wrexham-Rushton, Northwich, Newquay, Liskeard, Chalfont St. Giles, Hanley (Ettruria Road, Crownhill); G. P. Trenham, Ltd.; Farnham Common (Bucks); G. E. Taylor & Co.; Aberdeen; R. Thorburn & Son; Colney Hatch Lane, Bath (Lansdown), Stoney, &c.; O. C. Summers; Hristol (Central South (Section II) and Queen Square); J. F. Hodge and Co.; Manchester (High Street (Section III)); W. Turner (Ardwick), Ltd.; Preston-Blackburn-Burnley (Section III); R. & J. Howarth; Edinburg (Newington); W. Deane & Ashton-Hyde Junction, Farnworth (Lancs.); Kendal; W. Pollett & Co., Ltd.; Eastbourne; H. Farrow, Ltd.; Halesowen-Cleckheaton; A. Blair, Lyell and Co., Ltd.

Manufacture, supply, drawing-in, and jointing of cable. London-Docking (London district): W. T. Henley's Telegraph Works Co., Ltd.; (London) Court Staines Light-house: W. T. Henley's Telegraph Works Co., Ltd.; Aldershot, High-Avenue: W. T. Henley's Telegraph Works Co., Ltd.; Haslemere-Dorking: British Insulated and Helsby Cables, Ltd.

Telephone exchange equipment: London, Siemens Bros. & Co., Ltd.; Aldershot, Siemens Bros. & Co., Ltd.; sub-contractors—Tudor Accumulator Co., Ltd., for batteries; English Electric Co., Ltd., for charging machines; Dunfermline: Peel-Connor Telephone Works, Ltd.; sub-contractors—Tudor Accumulator Co., Ltd., for batteries; Crompton & Co., Ltd., for charging machines; Broughty Ferry: Peel-Connor Telephone Works, sub-contractors—Chloride Electrical Storage Co., Ltd., for batteries; Crompton & Co., Ltd., for charging machines.

CROWN VENDORS FOR THE COLONIES.

Switchgear—Ferguson, Pullin, Ltd.; Telegraph line material—Bulfinch, Ltd.; Siemens Bros. & Co., Ltd.; Track counting material, Westinghouse Brake & Saxby Signal Co., Ltd.; Transformers—Metropolitan-Vickers Electrical Export Co., Ltd.; Copper wire, etc.—British Insulated and Helsby Cables, Ltd.

HIGH COMMISSIONER FOR INDIA.

X-ray apparatus—X-Rays, Ltd.; Cables—Faller's United Electric Works, Ltd.; Tudor Accumulator Co., Ltd.; Electric fans—J. Stone & Co., Ltd.; Switchboard—Erskine, Heap & Co., Ltd.; Copper wire—Elliott's Metal Co., Ltd.; Wireless telegraph stores—Marconi's Wireless Telegraph Co., Ltd.

H.M. OFFICE OF WORKS.

Electric lift—Ethells, Congdon & Muir, Ltd.

LONDON.—HAMMERSMITH.—Electricity Committee.

Additional feeder equipment, etc., for the sub-station supply to Ealing Borough Council.

Two stonework coils, brass bars, and isolators, £335.—Ferguson, Pullin, Ltd., Recommended.

ST. MARVULBORNE. Electric Supply Committee.—The Committee has received a claim from the Metropolitan-Vickers Electrical Co., Ltd., for £2,692, extras on account of the contract accepted on December 18th, 1919, for three 1,500-kW rotary-converters with transformers, starting and regulating switchgear, at £20,436, owing to increased cost of labour, materials and freight charges. After full consideration the Committee recommends that £2,000 be paid to the Metropolitan-Vickers Electrical Co., Ltd., in full settlement.

Paraguay.—According to the *Review of the River Plate* of November 25th, for the installation and working of a telephone system in the city of Asunción and district only one tender was presented—by Engineer Dowlin, who is stated to have the financial support of the International Western Electric Co., Incorporated. The firms of Siemens-Schuckert (Buenos Aires) and Ericsson (Stockholm), it is stated, abstained from presenting tenders owing to the very severe conditions imposed, and because materials were specified which neither of them manufactured.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, December 30th. At Caxton Hall, Westminster. At 8 p.m. Questions and general discussion.

Friday, January 6th. At 8 p.m. Lecture, "Stone and Marble-working Machinery," by Mr. A. E. Bingham.

Royal Institution of Great Britain.—Christmas Lectures. "Electric Waves and Wireless Telegraphy," by Prof. J. A. Fleming, F.R.S., At Albemarle Street, W., at 3 p.m.

Lecture II.—Saturday, December 31st. Waves in Air.

III.—Tuesday, January 3rd. The Telephone.

IV.—Thursday, January 5th. Electric Oscillations.

V.—Thursday, January 5th. Electric Oscillations.

V.—Saturday, January 7th. Electric Waves.

Nottingham Society of Engineers.—Wednesday, January 4th. At the Welbeck Hotel. Paper on "Modern Foundry Plant," by Mr. E. Stevenson.

Institute of Cost and Works Accountants.—Wednesday, January 4th. At the Institute of Patent Agents, Staple Inn Buildings, W.C. At 7 p.m. Lecture on "Financial Planning," by Mr. H. G. Jenkins.

Physical Society of London and the Optical Society.—Annual Exhibition. Wednesday and Thursday, January 4th and 5th. At the Imperial College of Science, South Kensington. From 3 to 6 p.m. and from 7 to 10 p.m.

Wednesday, January 4th, at 4 p.m., and Thursday, January 5th, at 8 p.m. Lecture on "The Johnson-Rabek Electrostatic Telephone and its Predecessors," by Mr. A. A. Campbell Swinton, F.R.S.

Thursday, January 5th. At 8 p.m. Lecture on "Radium," by Mr. F. Harrison Glegg.

Institution of Electrical Engineers.—Thursday, January 5th. At the Institution, Victoria Embankment. At 6 p.m. Paper on "Single and 3-phase Commutator Motors with Shunt and Series Characteristics," by Dr. S. P. Smith.

(Wireless Section).—Wednesday, January 4th. At the Institution, Victoria Embankment. At 6 p.m. Paper on "High-speed Wireless Telegraphy," by Lt.-Col. A. G. T. Cousins.

(East Midland Sub-Centre).—Tuesday, January 3rd. At the Loughborough College. At 6.45 p.m. Address by Mr. R. A. Chattock.

NOTES.

The Compliments of the Season.—The ELECTRICAL REVIEW wishes all of its readers "A Happy and Prosperous New Year."

A Height Recorder.—Apparatus for finding the height of the clouds for the information of night-flying airmen is to be tried at the London Air Station, Croydon. It consists of a 500,000 candle-power searchlight throwing a vertical beam upon the clouds, and a specially designed theodolite through

which to observe the point where the beam touches the cloud. The angle obtained and the distance of the theodolite from the searchlight enable the observer to find the height of the cloud. *Daily Mail*

Cost of Living in Cuba.—A correspondent seeks information as to the cost of living and generally any particulars regarding climate or other conditions, which would have to be taken into account by a returned Englishman in Cuba. It was hoped could supply the required information, he should be much obliged.

Service Notes.—A uniform for wireless operators of the Mercantile Marine has just been approved of and confirmed in the *London Gazette*. The uniform, or plain clothes, must be worn whether on ship, in port, or on shore, thus putting an end to semi-uniform. Warant Electrician E. D. Hines has been posted to Greenwich for duty. Captain J. B. Birch, A.M.Inst.C.E., London Electrical Engineers, has been transferred to the general list of the Reserve of Officers of the Territorial Army; Lieutenant A. W. Mawby, O.B.E., from the London Electrical Engineers, has been promoted major in the Territorial Reserve of Officers, and Lieutenant A.C. Stacey, from the London Electrical Engineers, has been transferred to the Territorial Reserve of Officers.

Appointments Vacant.—Assistant telegraph engineer (£450), for the Government of British Guiana Post and Telegraph Department; charge engineer, for Nelson Corporation Electricity Department; plumber-jointer, for Colne Electricity and Tramways Department; manager, for the Heywood Corporation electricity undertaking; telephone inspector (£350), for the Government of British Guiana; general clerk (£250), for the Hackney Borough Council electricity department; lectureship in electrical engineering (£500), for the Bradford Technical College; male clerk-typist (£3), for the Sevenoaks and District Electricity Co., Ltd. (See our advertisement pages to-day.)

A.E.G. Activities in Russia.—The *Manchester Guardian Commercial* quotes from the *Frankfurter Zeitung* a message from Riga relating to the activities of the A.E.G. in Russia: "The Soviet Government is now negotiating with the A.E.G. in Berlin with regard to the transfer of tramway concessions. The tramway systems in all the more important towns of Russia were previously in the hands of Belgians. The Soviet Government desires to reserve to itself 50 per cent. of the net profits, and it also stipulates that the company is to assume responsibility for the maintenance of its staff and workers."

This subject is also referred to in our "Business Notes" to-day.

Modern Conceptions of Corrosion.—In a paper on this subject read to the Liverpool Engineering Society, Mr. W. Ramsay, F.I.C., M.Inst.Met., points out that for the most part the term is confined to metals and alloys, although corrosion of non-metallic material is by no means uncommon. Such cases are, as a rule, simple chemical problems.

Again, it is necessary to discriminate between corrosion and erosion, or the loss of material by mechanical agencies, such as fluid or solid friction. Actually it is not always easy to distinguish between the two actions, which at times resemble each other very much, and may even proceed side by side in the same piece of metal.

Attempts to defeat or limit corrosion in metals must have been made at a very early date. Air and waterproof coatings find application under certain circumstances at the present time, but they are often applied to metal work in a very unintelligent manner. Metallic coatings are so well known that they require but brief comment. So-called "galvanising" is probably the best protective of this class, and zinc being strongly electro-positive to the iron, it remains effective even when part of the iron is exposed by wear or accident. The use of a more electro-positive metal, to provide a counter electro-motive force, sufficient to establish an electrolytic balance, is widely adopted in engineering practice, and zinc, being cheap and highly electro-positive to most engineering metals, finds a large application for this purpose. The efficiency of Hannay's "electro-gene" was not very great, and it was abandoned. The idea that a relatively small area of zinc can prevent ionisation of a large area of less electro-positive metal is possibly correct in theory but fails in practice.

The first attempt to overcome corrosion by a counter electro-motive force supplied from an outside source probably originated from Hannay. Boilers were fitted with plate anodes connected by insulated plugs through the shell of the boiler to the positive pole of an electric generator, the shell being connected up to the negative pole, the idea being to establish an electrolytic balance. Cumberland has improved the method by framing the anodes in such a manner that the current density is distributed more evenly over the whole interior of the boiler.

In conclusion, corrosion is to be regarded as a natural function of metals and alloys, and it appears to be established that it is always electrolytic in character. The few doubtful cases in which the action seems to be of the nature of a chemical solution require closer investigation, and in such cases there are features which indicate that the action is electrolytic though possibly obscured by other circumstances.

Transmitting Aerial Resistances.—The paper by Mr. T. L. Eadsbury, D.A., I.E.S., that was read in December before the Wireless Section of the Institution of Electrical Engineers deals with the subject of the resistance of transmitting aërials. It describes an attempt which has been made to reduce to a minimum the energy losses in the neighbourhood of such aërials. These are known to be very inefficient, and shows that the above results are obtained by interposing a screen of wires between the aerial and earth, using this screen as a condenser earth instead of the usual buried earth. The losses in such a system are analysed, and it is shown that a large fraction of the earth losses is eliminated when such a screen is used. Formulae are devised for predetermining the resistance of screened aërials, in terms of the conductivity of the earth and the surface dielectric loss.

Such aërials have the drawback that the wires of the screen itself may form an oscillating system, and under certain conditions oscillations are set up in this system which waste energy. Methods of dealing with and eliminating these losses are discussed, and, finally, screening is compared with Alexanderson's multiple-earth system, and it is concluded that a combination of the two methods should give the best results.

The investigation has a very general bearing on wireless practice. We may, in fact, ask ourselves how far we may go on reducing the losses. The lines along which further reductions in earth loss may be effected are indicated by the theory, which shows that a simultaneous broadening of the screen and aerial has the desired effect. Again, the dielectric loss may be reduced by spacing the wires more closely or by using a complete radial screen in which the edge effect is reduced to a minimum.

Screens have been employed successfully at large power stations, and it now requires only one-sixth of the power to produce signals equal to those formerly produced by the spark station. It is evident, therefore, that the practice of long-distance wireless telegraphy may be very considerably modified by these results.

The practical point is this: It is much cheaper to erect an aerial of 400 ft., say, with 40 jars' capacity, than an 800-ft. aerial with 20 jars' capacity, and even cheaper still to use a 200-ft. aerial with 80 jars' capacity. The height rather than the area is the difficulty. If sufficient care is paid to the improvement of the resistance, the height of the aerial can be reduced without increasing the power required to produce a given range, and in the limiting case a closed directive aerial might be used to minimise jamming and to increase the effective radiation in the direction required, with a plate condenser which would effectively control the maximum voltage.

This condition of affairs is not possible when the dead-loss resistance is large compared with the radiation resistance for, when this is so, every decrease in height requires a commensurate increase in power. Although perfect radiation efficiency can never be obtained in practice, the reduction of the dead-loss resistance will always mean: (a) an economy in power required; (b) an economy in initial expense on aërials by enabling a lower aerial to do the work of a higher one.

In the case of certain existing aërials it is preferable to reduce the resistance by the Alexanderson method, especially in the case of long, narrow aërials. The screening of such an aerial may not reduce the resistance sufficiently, and it is a matter of great practical difficulty to widen an existing aerial and reduce the resistance in this way. The only alternative is to make use of Alexanderson feeders and to put the various sections of the aerial in parallel instead of in series, which is, in effect, equivalent to a simultaneous widening and shortening of the aerial. But to get the best results from this method a suitably designed screen should be used to intercept the lines of force from the aerial and to reduce, consequently, the surface dielectric loss.

The National Association of Supervising Electricians.—This Association, which was formed in 1914 primarily for educational purposes, lectures, &c., has made good progress, and has benefited not only its own members but also many electrical workers outside its ranks; whilst it was found necessary to register it as a trade union in order to enable it to protect the economic interests of its members, it has not relaxed its efforts towards education and efficiency, and by a strict scrutiny of the qualifications of candidates it has maintained a standard of membership which commands respect. As the result of negotiations with the employers, the Association has secured recognition, and an agreement between the National Federated Electrical Association and the N.A.S.E. was concluded in June last, which settled the status and privileges, working hours, holidays, &c., of staff foremen and supervising engineers respectively; this agreement remains in force until terminated by either side on giving three months' notice, to expire on February 28th in any year.

With a view to further development, the Association has now appointed Mr. A. Brammer as full-time general secretary, and steps are being taken to form district branches in Manchester, Birmingham, Middlesbrough and Portsmouth to begin with. In view of the difficult position of a foreman or supervisor who belongs to a manual workers' trade union, the need for such an association as the N.A.S.E. is obvious, and judging by its excellent record up to the present, it may look forward to a prosperous and useful future. Lecture meetings are held each month at St. Bride's Institute, Bride Lane, Ludgate Circus, the next being on Tuesday, January 10th; and the

annual dinner will take place on January 28th. Other advantages of membership are the use of a technical library and the services of an employment bureau and a legal department. Particulars regarding membership can be obtained from the general secretary at the offices of the Association, 29, Metropolitan Buildings, 65, Queen Victoria Street, E.C.4.

The Electrification of Industry in the United States.—Mr. Fall, the secretary of the Department of the Interior, recently submitted to President Harding the analysis made by the Geological Survey of a comprehensive system for generating and distributing electricity to transportation lines and industries in the North Atlantic coast region, between Boston and Washington. The survey was authorised by Congress, and has been described in our columns.

The engineers who made the survey reported that 970 miles of 220,000-volt lines, and five times that mileage of 110,000-volt lines would be needed. The 1,200 miles of wire now carrying 33,000 volts and over would be operated as distribution lines for local industries. This transmission network with its sub-stations would require 104,000,000 dollars by 1930, the report said, in which year the total investment would be 1,109,564,000 dollars. Electrification of the Boston-Washington area, according to the report, would save 50,000,000 tons of coal annually by 1930, or 190,000,000 dollars in fuel expenditure.

The question of railroad electrification, continues the report, must be decided according to density of traffic, and so it is that, of the 36,000 miles of main line, yards, and sidings, in this super-power zone, only about 19,000 miles could be profitably electrified. This electrification would cost nearly 500,000,000 dollars, but it would save from 11 to 19 per cent. on the investment, or an average of 14 per cent. Electrification is the next step in railroad expansion absolutely necessary to increase both capacity and the efficiency of the transportation system. Incidentally, the annual saving of 9,000,000 tons of coal by the railroads would greatly increase the available car supply.—*Reuter's Trade Service* (Washington).

A Domestic Labour-saving Competition.—The Women's Engineering Society is organising a labour-saving competition divided into three sections:—(a) engineering devices suitable for mechanical, electrical, automobile work, &c.; (b) structural improvements; and (c) any other labour-saving appliance for the home. Full details may be obtained from the Secretary, 26, George Street, Hanover Square, W.1.

The competition will not be confined to members of the Society, all women are eligible to enter.

The contest should be productive of good results as only a woman intimately acquainted with the needs of the home can properly understand the business of lightening domestic labour. Mere men often fail to understand that "Woman's work is never done."

A Power Station's Future.—It is proposed to utilise the McDonald Road electric power station, Edinburgh, for an exhibition hall, when it is superseded by the completion of the Corporation electric power station at Portobello.

INSTITUTION NOTES.

Institution of Electrical Engineers.—EAST MIDLAND SUB-CENTRE.—A meeting will be held at The College, Loughborough, on January 3rd, and a paper will be read by Mr. R. A. Chattock on "The Electrical Development of Outlying Districts."

SCOTTISH CENTRE.—The annual dinner of the Scottish Centre of the Institution is to be held on February 28th, 1922.

Institute of Engineers (India).—The Institute of Engineers (India) has entered upon its second year, and is expected to become a very powerful body contributing greatly to engineering progress in that country. The Institute has local branches in Bengal, Bombay, Madras, and the United Provinces, while branches in the Native States, such as Mysore, will soon begin their activities. The membership is increasing rapidly.—*Reuter's Trade Service* (Bombay).

The Physical Society of London.—The Physical Society's and Optical Society's annual exhibition is to be held on January 4th and 5th, 1922 (not 5th and 6th, as stated last week), at the Imperial College of Science, South Kensington, and will be open in the afternoon (from 3 to 6 p.m.) and in the evening (from 7 to 10 p.m.). Mr. A. A. Campbell Swinton, M.Inst.C.E., F.R.S., will lecture on "The Johnson-Rubik Electrostatic Telephone and its Precursors" at 4 p.m. on January 4th, and at 8 p.m. on January 5th. Mr. F. Harrison Glew will lecture on "Radium: its Application in Peace and War," at 8 p.m. on January 4th. All the lectures will be illustrated with experiments. Other discourses are being arranged, over 50 firms are exhibiting scientific apparatus, and a number of experimental demonstrations have been arranged.

Chelmsford Engineering Society.—On December 16th Mr. E. A. Evans, of Messrs. C. C. Wakefield & Co., Ltd., gave an illustrated lecture on "Petroleum and its Lubricating Properties." After dealing briefly with the early history of petroleum, the development of oil wells, and the various refin-

ing processes, the lecturer gave a full account of the theory of lubrication and the latest discoveries regarding the molecular construction and properties of oils. The theory of lubrication based upon the molecular attraction of the oil and metal surface was discussed at some length. Although the radius of attraction of the molecule is only about 10⁻⁷ centimetres, yet it was shown how this force, operating over such a small radius, can be very great and is sufficiently great to maintain an oil film on the surface, and that the rupture force of the oil film is measured by the attractive force of the molecules. The dimensions of the molecules were also shown to be of value in lubrication problems.

Society of Engineers.—At the annual general meeting, held on December 12th, the following premiums for papers read during 1921 were awarded, amongst others: Bessemer premium (value £5 5s.) to Mr. R. W. A. Brewer, for his paper on "Some Modern Engineering Practice in America." Nurey premium (value £3 3s.) to Mr. Alfred S. E. Ackermann, for his paper on "The Physical Properties of Clay" (3rd paper).

Institution of Civil Engineers.—The Council of the Institution of Civil Engineers has made the following awards, among others, for papers printed without discussion in the *Proceedings* for the Sessions 1918-1919 and 1919-1920:—*Session 1918-1919*.—A Telford Medal to Professor E. G. Coker, F.R.S. (London); and a Telford Premium to Mr. Rollo Appleyard, O.B.E. (London). *Session 1919-1920*.—A Crampton Prize to Professor F. C. Lea, O.B.E. (Birmingham).

Greenock Association of Electrical Engineers.—At a meeting held on December 21st, Mr. R. F. McConnell read a paper on "Electric Cranes." Various modern types of cranes were illustrated by lantern slides, and prominence was given to rheostatic control systems and to the Scott-Bentley load discriminator. A keen discussion on brakes and limit switches followed the paper.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

In view of the prominence of SIR VINCENT RAVEN in railway engineering, and the importance of the paper which he read recently before the North-East Coast Institution of Engineers and Shipbuilders (which is abstracted elsewhere in this issue,

Sir Vincent L. Raven, the son of the late Rev. Vincent Raven, Rector of Great Framingham, Norfolk, was a pupil, under the late Mr. Fletcher, of the North-Eastern Railway, and after passing through various positions in the chief mechanical engineer's department of that railway company, including that of principal assistant to the chief mechanical engineer, was appointed head of that department on the resignation of Mr. Wilson Worsdell in 1910.

In August, 1915, Sir Vincent Raven (then Mr. Raven), at the request of Mr. Lloyd George, took charge as chief superintendent at Woolwich Arsenal, in the place of Sir Frederick Donaldson, which position he held until May, 1917. At that time the number of employes had risen to something over 73,000 hands, and an enormous output of every kind of war material was being delivered from the Arsenal.

He received a Knighthood in February, 1917, and was made a Knight of the British Empire in August, 1917.

In May, 1917, Sir Vincent was appointed by Sir Eric Geddes, then Controller at the Admiralty, as his deputy for the production of naval armaments, which included guns, mountings, shells, torpedoes, mines, &c., and also took charge of the torpedo factory at Greenock, the Gun Factory at West Houghton, the Cordite Factory at Holton Heath, and the Lighter-than-Air Section of Aircraft. This post he held until the end of 1918, and at the beginning of 1919 he resumed the position of chief mechanical engineer to the North-Eastern Railway Company.

Sir Vincent Raven is a member of the Institution of Civil Engineers, a vice-president of the Institution of Mechanical Engineers, and is also on the Advisory Committee to the Government for the Kensington Science and Art Museum; Sir Vincent was also on the Committee appointed by the Ministry of Transport under the chairmanship of Colonel Pringle, C.B., for the Revision of Railway Requirements.

Mr. W. E. CHAPPEL, who has been connected with the Staveley Coal & Iron Co. and allied interests in the position of electrical engineer and consultant for the past 12 years, is severing his connection with the firm, as from December 31st, and is opening an office at St. Marie's Chambers, 6, Norfolk Row, Sheffield, as a consulting electrical engineer, specialising in the application of electricity to mining work.

The *Melbourne Age* reported on October 25th that the chief works manager of the Federal General Electric Co., Ltd., Melbourne (Mr. J. Durst), was leaving on a business visit to Europe and the United States. He is to inspect factories and plant with the view of obtaining the latest data for the company's equipment, and expects to return next March. The company was registered in Melbourne in September with an authorised capital of £750,000.

Obituary.—MR. JACOB ATHERTON.—We regret to record the death, which occurred at Torquay on December 20th, of Mr. Jacob Atherton, of Huyton. Mr. Atherton, who was in his 69th year, had been in failing health for some months, and he went to Torquay in search of recovery. The *Liverpool Daily Post and Mercury*, in referring to the matter (Mr. Atherton being a native of Liverpool) gives the following particulars of the deceased gentleman's career: Mr. Atherton was associated with his elder and better-known brother, Mr. J. B. Atherton, in many important commercial development schemes. When his brother in 1890 returned from the United States with the patent rights in paper-insulated cables, Mr. Jacob Atherton joined him in the formation of the British Insulated Wire Co., and in the erection in 1890 of the extensive works at Prescott, which now bears the name of the British Insulated & Helsby Cables, Ltd., the business of the Helsby Cable Co. having been taken over more recently. The two brothers established a number of lighting concerns, including the Midland Power Co., the Blackheath and Greenwich Electric Light Co., and the South London Electric Supply Corporation, all of which Mr. Jacob Atherton was a director up to his death. From electric cables and power the two brothers turned their attention to tramways, and promoted in Parliament the Bill which authorised the laying down of the South Lancashire tramways system, which ultimately linked up Liverpool by tram track with Manchester. They also secured a Light Railway Order for a tramway between Aigburth and Garston, which paved the way for the extension of the municipal tramway service in the south end of the city. Mr. Jacob Atherton was associated with tramway construction schemes in Australia. Some thirty or forty years ago he purchased an extensive estate at Huyton, a portion of which has since been developed by the Huyton Golf Club.

MR. JOHN MILTON.—We regret to record the death, after a short illness of Mr. John Milton, chief assistant engineer to the Wycombe (Borough) Electric Light & Power Co., Ltd., for over thirteen years. Mr. Milton was in his 43rd year. He served a pupilage with the Northampton Electric Supply Co., and after being on its staff as a test engineer, he became a shift engineer at Buxton, mains engineer and chief assistant engineer at Southend, and shift engineer at Battersea, which place he left to proceed to Wycombe in 1908. While Mr. W. E. Brandreth, the resident engineer and manager at High Wycombe, was on service in the Army, Mr. Milton, for four years, managed the station. He was an A.M.I.E.E.

Will.—The late SIR DOUGLAS FOX left £45,766 gross and £44,988 net.



SIR VINCENT L. RAVEN.
Chief Mechanical Engineer to the North-Eastern Railway.

and on which we comment in our leading columns to-day), we have pleasure in reproducing his portrait as that of an engineer whose name will rank high amongst those of the pioneers of main-line railway electrification in this country.

NEW COMPANIES REGISTERED.

Supra Electrical Co., Ltd. (178,452).—Private company. Registered December 20th, 1921. Capital, £12,000 in £1 shares. To carry on the business of electrical engineering, including the supply, installation, and maintenance of electrical machinery, and the construction of electrical apparatus. The subscribers each with £100. The directors are: H. H. R. Jones, 64, Levens, Ross, Ebor., W. H. B. Jones, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100. The first directors are not named. Solicitors: Chamberlayne, Hocking & Co., 83, Pall Mall.

Carndonagh Electric Supply, Ltd.—Registered in Dublin, Ireland. Capital, £3,000 in £1 shares. To carry on business as electricians, mechanical engineers, and manufacturers of and dealers in electrical machinery, power, and light. The subscribers are: H. Doherty (junr.), Bridge Street, Carndonagh, builder, 200 shares; D. McCloskey, Chapel Street, Carndonagh, auctioneer, 25 shares; P. McLaughlin, Diamond, Carndonagh, provision merchant, 50 shares; P. J. Doherty, Carndonagh, draper and spirit merchant, 40 shares; G. Doherty, Carndonagh, spirit merchant, 50 shares; W. J. Crosson, Carndonagh, spirit merchant, 50 shares; R. Moore, Churchtown, Carndonagh, Clerk of Union, 50 shares; total, 465 shares. The first directors are—H. Doherty (junr.), W. J. Crosson, R. Moore, J. Reid, and J. White. Secretary: J. J. Doherty (electrical engineer). Registered office: Bridge Street, Carndonagh.

British Engineering Units, Ltd. (178,516).—Private company. Registered December 20th, 1921. Capital, £1,000 in £1 shares. To carry on the business of manufacturing and electrical machinery, manufacturers of and dealers in machinery, &c. The subscribers (each with one share) are: H. Megainey, 17, Shaftesbury Road, Earlsdon, Coventry, secretary; H. N. Gillitt, 15, Manor Road, Coventry, articles clerk. The first directors are: A. Green and S. A. Bailey. Solicitor: R. C. Rotherham & Co., 38, Bailey Lane, Coventry.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Western Electric Distributing Corporation, Ltd. (79,057). Return dated September 3rd, 1921. Capital at date of return, £43,000 in £1 shares (15,000 cum. preference, 3,000 preferred ordinary, and 25,000 ordinary). 12,790 cum. preference, 2,875 preferred ordinary, and 24,328 ordinary shares taken up. £39,428 paid. £365 remains in arrears. Mortgages and charges nil. Capital increased to £30,000 by the creation of a further 2,000 cum. preferred and 3,000 ordinary shares of £1 each.

Stentophone Motor Accessories (1921), Ltd.—Particulars of £25,000 debentures authorised December 5th, 1921. Whole amount issued. Charged on the company's undertaking and property, present and future, including uncalled capital.

Robert Bowran & Co., Ltd.—Satisfaction in full on December 7th, 1921, of mortgage dated May 1st, 1918, securing £2,000.

South Western Engineering Co., Ltd.—A. W. Watts, of 364, Camden Road, N., as receiver, on December 9th, 1921, under powers contained in debentures issued September 9th, 1920.

CITY NOTES.

Cordova Light, Power & Traction Co., Ltd. Sir G. A. Touche, Bart. (chairman), presiding over the annual general meeting on December 20th, said that although the company had been free from direct labour troubles, strikes at the port of Buenos Aires had held up supplies and greatly hindered maintenance work. The Provincial Government had sanctioned a large expenditure on raising and strengthening the San Roque Lake dam from which the company derived its water power, and had accepted a tender for the work. The Light & Power Co., through increased operating costs, had shown a loss of £2,007. The Tramways Co. had, however, shown improvements; the passengers carried had increased by nearly 5,000,000 and net receipts by £14,291. In conclusion, Sir G. A. Touche said that the working of the subsidiaries for the first six months of the current year showed an increase of £11,000 as compared with the first half of the year under review.

The annual general meeting was held **Vickers, Limited**, on December 22nd at Sheffield. Mr. Douglas Vickers, M.P. (chairman), who presided, after dealing with the accounts of the company, spoke at some length about the subsidiary companies. The directors in Subsidiary and Connected Companies "showed an increase of about £840,000, partly due to a transfer from 'marketable securities' of certain shares in Sir William Arrol & Co., Ltd., and the South Metropolitan Electric Light and Power Co., Ltd. The Metropolitan Carriage, Wagon, and Finance Co., Ltd., stood in the accounts as representing £12,954,000, being 99.9 per cent. of the capital of that company. Through the Carriage, Wagon, and Finance Co., Vickers, Ltd., held shares in Electrical Holdings, Ltd., and the Metropolitan-Vickers Electrical Co., Ltd., and through the Holdings Co. in Brown, Boveri & Co. The company also owned about 50 per cent. of the capital of the Metropolitan-Vickers Electrical Co., Ltd., representing in the accounts £2,070,000. The shares of the subsidiary business of Walsley Motors, Ltd., worth £700,000, were also held. Two companies formed to provide housing accommodation stood at £334,000 and £45,000. The company's subsidiary in W. Beardmore & Co., Ltd., amounted to £484,500. They had also invested £114,000

in five syndicates formed for the development of hydro-electric concessions abroad, and their armament interests in Spain, Italy, and Japan amounted to £176,000, £84,000, and £343,000 respectively. The whole of the capital of James Booth & Co., Ltd., the manufacturers of "Duriumin," was held by the company. Their interest in Vickers-Peters, Ltd., was of the value of £137,000. The total investments of the company were therefore about £17,389,000. In addition to this, Vickers, Ltd., held 85 per cent. of the ordinary shares of Canadian Vickers, Ltd. There was an uncertainty about the settlement of the company's claims on the Government in respect of contracts and taxation, but it was hoped that most of them would be agreed before many months had passed. Regarding the year just ending, Mr. Vickers said that the adverse influences mentioned in the report for 1920 continued into this year. The fall in shipping freights had embarrassed owners and reflected on ship construction. The price of coal remained at too high a level and exchange difficulties, the high cost of labour and low output had all had their effect, and nobody could expect the year's results to be good. As far as armaments were concerned, some relief had been evident through an order from the Japanese Government. The effects of the Washington Conference were still uncertain, but they would prove another justification of the policy which led the company to the acquisition of the Carriage, Wagon & Finance Co. The great engineering schemes of the future were certain to centre round electric power, traction and transportation, and in no other field did it seem possible to find work in this country for the steel works and engineering plants erected for war purposes.

The directors report a net profit for the **Ferranti, Ltd.** year ended June 30th last amounting to £36,263, which compares with £36,622 for the preceding twelve months and £18,251 for the year to June 30th, 1919. Adding £89,461 brought in, the sum now available is £125,730. The *Manchester Daily Dispatch* states that it is proposed to transfer to general reserve £100,000, and to pay a dividend of 18 per cent., less tax (being three years' arrears) on the preference shares, leaving arrears of 54 per cent. A similar distribution was made for the two years ended June, 1920. With the above allocation the general reserve will amount to £172,000, and out of this it has been decided to write down the value of goodwill and patent rights, £69,370, to the nominal value of £1, leaving a balance in the reserve of £102,630. The submission of a definite scheme for the reorganisation of the company's capital has been postponed until conditions are more stable. Referring to the past year's results, the directors say that the trading has been satisfactory, but there has been a serious falling off in orders from the beginning of 1921, which will materially affect the results of the next financial year.

Mr. C. A. Vandervell (chairman and joint managing director), presiding at the annual meeting on December 20th, said that the loss on the year's working was £251,280. The adverse result was due to the fact that although at the beginning of the year contracts to the value of £600,000 were in hand, these were practically all either suspended or cancelled. He admitted that, in the circumstances, the directors were wrong in declaring a dividend in December last, but it was thought that the serious depression could not last very long. It was anticipated that a percentage of the bad debts, for which a very large sum had been reserved, would be recovered in the future. Among the activities of the firm during the year had been the acquisition of the patent rights of the Willard rubber separator for accumulators (in the chairman's own name); the concentration of the dynamo and electrical business in the Warple Way works (which effected great economy in overhead charges); and the manufacture of the Avline aeroplane stabiliser.

Mr. F. L. Wade, O.B.E. (joint managing director), seconded the chairman's motion, and said that since the end of the year under review the position had improved considerably. Liabilities had been met and trade creditors reduced by nearly £100,000. In spite of the continued depression, the business was on a solid foundation.

The report of the directors of this French **La Société Industrielle des Téléphones.** company states that only certain of the manufacturing departments suffered in the second half of the financial year 1920-21 from the commercial and industrial crisis. On the other hand, the other departments derived benefit from a large volume of orders which had not been executed by the end of June, 1920. The company partially completed the installation of its works in Paris, Bezons, and Levallois out of its own resources. The profits realised in 1920-21 were considerably greater at 7,014,000 fr. than in the previous year. An addition of 1,750,000 fr. was made to the contingency fund, which was thereby increased to 7,000,000 fr. This fund would permit of the company's continuing its programme without, for the present, having recourse to the augmentation in the share capital which was authorised in September, 1920. At the recent meeting a dividend at the rate of 40 fr. per share, less tax, was approved, and the sum of 37,000 fr. carried forward. As to the question of the suggested leasing of the French telephone service to a company, the chairman stated, in reply to questions, that he was very sceptical on the matter, and that

it was necessary to await the conclusions of the discussions which were to take place in the Chamber on the subject. The matter, however, was of little importance to the company, which was a manufacturing undertaking, and it was necessary to be very diligent to have a full order book.

Barbados Electric Supply Corporation, Ltd.

The trading profit for the year ended June, 1921, amounted to £5,272, as compared with £4,618 for the previous year, and £3,600 for 1919. After charging general expenditure in London, debenture and loan interest and Corporation Profits Tax, the total amount remaining at the credit of profit and loss account (including £2,767 brought forward) is £6,084. Of this amount £5,000 has been transferred to depreciation reserve account, leaving £1,084 to carry forward. £1,481 has been charged against trading for repairs and renewals as compared with £1,128 in the previous year. Capital expenditure during the year amounted to £7,657, consisting of further payments made on account of the new 225-kW set referred to in the last report and the cost of additional house connections and mains.

	Consumers connected at June 30th	25 c. p. equivalent connected at June 30th
1919	1,646	23,034
1920	1,783	23,903
1921	2,087	25,796

Colonel Leese visited Barbados during the year, and his report will be of great value in dealing with the future development of the undertaking. Meeting: London, December 30th.

German Companies.

The *Vogel A.G.*, of Berlin, makers of insulated electrical conductors, proposes to pay a dividend and bonus at the rate of 35 per cent. for 1920-21, being the same as in the preceding year. It is now proposed to increase the share capital from 26,000,000 to 52,000,000 marks.

The directors of the *Poege Elektrizitäts A.G.*, of Chemnitz, recommend a dividend at the rate of 12 per cent. for 1920-21, against 17 per cent. in the preceding year on a smaller share capital. It is intended to raise the share capital from 46,000,000 to 56,000,000 marks.

The *A.G. für Elektrizitäts Anlagen*, of Berlin, which is an investment company, records net profits and balance forward of 850,000 marks for 1920-21, as contrasted with 650,000 marks in the preceding year. The rate of dividend rises from 6 per cent. in 1919-20 to 8 per cent. last year.

The *Elektrische Licht und Kraftanlagen A.G.*, of Berlin, reports gross receipts amounting to 21,800,000 marks from interest charges and investments, as compared with 93,000,000 marks in 1919-20. Including the balance forward, the net profits in 1920-21 were 9,998,000 marks, as against 3,645,000 marks, and the dividend is at the rate of 15 per cent., or 5 per cent. higher than in 1919-20.

The *Rheinische Elektrizitäts Gesellschaft A.G.*, of Mannheim, reports net profits and balance forward amounting to 4,607,000 marks for 1920-21, as compared with 2,031,000 marks in the preceding year. It is intended to pay a dividend at the rate of 15 per cent., as against 10 per cent., and to make a fresh issue of ordinary shares to the amount of 18,000,000 marks.

At the general meeting of the *A.E.G.*, held at Berlin on December 20th, a dividend of 16 per cent., as against 14 per cent. last year, was declared on the ordinary shares of the company. The capital of the company has been increased by 250,000,000 marks to 1,100,000,000 marks.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Stock Exchange Committee under Rule 148a:—

Llanely and District Electric Lighting and Traction.—£125,000 seven-and-a-half per cent. debenture stock, issued at 94 per cent., partly and fully paid.

Reading Electric Supply.—£100,000 seven-and-a-half per cent. first mortgage debenture stock, issued at 95 per cent., partly and fully paid.

Metropolitan Electric Supply.—£178,400 5 per cent. extension debentures, 1917, within Nos. 1 to 2,500 (£100).

Telephone Manufacturing Co. (1920).—£300,000 guaranteed 8 per cent. cumulative income bonds (registered), issued at 96 per cent., partly and fully paid, in bonds of £10, £50 and £100.

The undermentioned have been ordered to be officially quoted:—

General Electric Co.—£3,500,000 seven per cent. mortgage debenture stock.

Applications have been made to the Committee to allow the following to be officially quoted:—

Monterey Railway, Light and Power.—\$2,996,562 five per cent. "A" first mortgage debenture stock; \$2,996,562 five per cent. "B" cumulative income charge debenture stock; and \$2,674,962 "C" sinking fund debenture stock.

Guanajuato Power & Electric Co.—The bondholders of the Guanajuato Power & Electric Co., the Michoacan Power Co., and the Central Mexico Light & Power Co., have been notified of the proposed payment on January 1st, 1922, of the first coupon in default upon the bonds of each of the three companies.—*Financial Times*.

Provincial Cinematograph Theatres, Ltd.—The trading results for the year to date, says *The Times*, do not justify the payment of the dividend for the last half of the year on the 10 per cent. cumulative preferred ordinary shares.

Alldays & Onions, Ltd.—According to the *Financial Times*, the accounts for the year to July 31st, 1921, show a loss, including interest on debentures, of £108,303. The greater part of the loss consists of depreciated value of stock owing to fall in prices. The company also suffered considerably from the miners' strike. Deducting £5,248 brought forward, there remains a deficit of £103,055.

Reduction of Capital.—*FELLES UNITED ELECTRIC WORKS, LTD.*, AND REDUCED.—A petition for confirming the proposed reduction of the capital from £500,000 to £378,794 has been presented to the High Court, Chancery Division, and will be heard in London by Mr. Justice Russell on January 17th.

Crompton & Co., Ltd.—Interim dividend at the rate of 7 per cent. per annum on the preference shares for the six months ended September 30th, 1921.

Vulcanite, Ltd. Dividends on the ordinary shares of 7½ per cent. for the year, less tax, carrying forward £7,555.

Shawinigan Water & Power Co.—Dividend of 1½ per cent. on common stock for quarter ending December 31st.

STOCKS AND SHARES.

WEDNESDAY MORNING

THE week which intervenes between Christmas Day and New Year's Eve is not usually a busy one for the Stock Exchange. It brings a good many orders of the "clearing-up" type, some people want to sell in order to increase their bank balances, others like to round-off uneven holdings by the purchase of more stock before making-up their accounts for the year. New issues loom large in the immediate future, and this induces a waiting policy on the part of prospective investors. There are other reasons for financial lassitude this week, but those just cited are sufficiently potent to exercise a restraining influence upon Stock Exchange business, and therefore to make for small fluctuations in price-lists.

Several of the newly-issued debentures are distinctly better. Reading Electric 7½ per cent. debenture, offered at 95, has jumped to 34 premium. Llanely & District Electric Lighting debenture stock, which came out at 94, went to 10s. discount at first, but promptly rose to 15s. premium. Midland Counties 7½ per cent. debenture, at 96½, is 15s. above the issue-price. All these three have the advantage of being obtainable in "scrip" shape, thus saving the buyer from the expense of the Government stamp-duty which is one per cent. upon registered stock. The Newcastle-on-Tyne 6 per cent. second debenture remains at a small premium above the price at which it was offered, 95½, and can also be bought free of stamp-duty.

Shropshire, Worcestershire, & Staffordshire 7½ per cent. debenture stock has taken a sharp turn for the better, and is up to 102, with very little stock offering. This particular issue took rather longer than usual to get permanently placed, but it would seem to be very well held now, and there are more buyers than sellers. British Thomson-Houston 7 per cent. mortgage debenture advanced to 2 premium, at which price stock came to market, and the price slipped back a little. There is still a small amount of Anglo-Argentine Tramways 5 per cent. debenture stock in the market at 64 ex dividend; the yield at this price is a trifle over 7½ per cent. on the money. Both classes of the company's preference shares are better on the week, and, with Argentine Rails, also commanding better figures, the prospect of a steady advance to 70 in Anglo-Argentine 5 per cent. debentures should not be overlooked when investment stocks are under discussion.

County of London 7 per cent. debenture is firm at 101, English Electric 8 per cent. notes are on offer at 99½ cumulative dividend, and General Electric 7 per cent. debenture remains a good market at 98. A thousand or so of the company's 6½ per cent. "A" preference, recently on offer at 1½s. bid, have been taken. Clyde Valley Electrical second preference shares, of £10 each, are a shade better at 3/16 premium.

Charles Cross ordinary and Kensington ordinary are each 2s. 6d. higher, the approach of dividend time serving to quicken interest in electricity supply shares. It is expected that the companies will be able to report lower working-costs in respect of the current six months, with the anticipation of further reductions in the near future. South London had a sudden spurt to 22 bid, with buyers ready to pay more if they could obtain the offer of shares. Curiosity promptly arose as to the possible reason for this passing demand.

The manufacturing group is practically untroubled. British Aluminiums are sixpence harder. The Telegraph manufacturing list is equally quiet, and there are no changes to record on the week.

Mareonis at 38s. 9d. soon lost the improvement scored on the declaration of the 5 per cent. interim dividend. Canadian Mareonis have weakened to 4s. 6d. On the other hand, Radio Corporations firmed up to 10s., the preferred keeping

at 9s. 3d. United River Plate Telephones at 5½ are nominally 3/16 higher. Actually they are not much better than they were a week ago. It may be that a previous advance was overlooked. Eastern Telegraph ordinary has gained 2½, and rises are shown by Eastern Extensions, Westerns & Globe preference. These recoveries underline the recent surmise that the heaviness apparent in the market earlier this month was due to causes other than any apprehension of wireless systems "cutting-out" the submarine cables, as some are fond of arguing will be the case. Experience has demonstrated that there is plenty of scope and plenty of business for both.

The boomlet in Underground Railway stocks suffered a check on profit-taking in advance of the Christmas holidays. Underground income bonds, having put on ten points in the previous fortnight, cannot be called flat on a reaction of 1½. Districts are unchanged at 21; Central London maintain their strength, and Metropolitan Consolidated at 26½ is the fraction better. All the prior-charge stocks in this list are up from one to three points, the preferences showing particular strength. Indeed, the market has been swept almost bare of the pre-ordinary issues by the remarkable revival of demand for such securities.

Brazilian Traction is 2 down at 31. Mexican Utilities are without alteration. British Columbia preferred is 1 up. Reference has been already made to the rises in Anglo-Argentine Tramways first and second preference shares. The rubber share market is passive, although rubber itself exhibits a faint, a very faint, tendency to harden. Armament shares are steadier without attracting any particular business. The Vickers meeting produced a mild protest from some of the ordinary shareholders disappointed at the results achieved last year. Babcock & Wilcox, with other engineering descriptions, maintain their ground.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend.	Price	Rise or	Yield
	1919, 1920.	Dec. 29, 1921.	fall.	p.c.
Brompton Ordinary	12	12	—	£9 4 8
Charing Cross Ordinary ..	12	12	—	8 13 8
do. do. 44 Pref.	4½	4½	—	7 4 4
Chelsea	4	4	—	9 4 8
City of London	13	14	—	9 14 10
do. do. 6 per cent. Pref. ..	6	6	—	6 13 4
County of London	8	8	—	9 2 10
do. do. 5 per cent. Pref. ..	6	6	—	7 10 0
Kensington Ordinary	7	9	—	8 10 6
London Electric	2½	2½	—	7 10 0
do. do. 6 per cent. Pref. ..	6	6	—	9 12 0
Metropolitan	6	7	—	9 6 8
do. do. 4½ per cent. Pref. ..	4½	4½	—	7 13 2
St. James' and Pall Mall ..	12	12	—	8 17 10
South London	6	7	—	10 9 0
South Metropolitan Pref. ..	7	7	—	8 10 0
Westminster Ordinary	10	10	—	8 10 2

TELEGRAPH AND TELEPHONE.

Anglo-Am. Tel. Pref.	6	6	84½	—	7 2 4
do. do. Def.	1½	1½	12½	—	8 2 2
Chile Telephone	6	6	5½	—	5 17 8
Cuba Sub. Ord.	7	7	—	—	10 0 0
Eastern Extension	10	10	16½	—	6 1 2
Eastern Tel. Ord.	10	10	166	—	6 1 0
Globe Tel. and T. Ord. ..	10	10	162½	—	6 8 1
do. do. Pref.	6	6	26½	—	6 5 6
Great Northern Tel.	22	22	26½	—	9 0 6
Indo European	10	10	27½	—	9 2 0
Marconi	25	15	1	—	8 13 0
Transatlantic Telephone Ord.	18	12	2	—	*6 10 2
United B. Plate Tel.	8	8	6½	—	*6 16 2
West India and Panama ..	Nil	Nil	5	—	Nil
Western Telegraph	10	10	16½	—	*6 1 2

HOME RATES.

Central London Ord. Assented	4	4	5½	—	7 15 4
Metropolitan	14	14	29½	—	5 16 3
do. District	Nil	Nil	21	—	Nil
Underground Electric Ordinary	Nil	Nil	2	—	Nil
do. do. "A"	Nil	Nil	7½	—	Nil
do. do. Income	4	2	70	—	*8 19 0

FOREIGN TRAMS & RY.

Anglo-Arg. Trams, First Pref. ..	5½	12½	—	—	10 7 6
do. do. 2nd Pref.	Nil	5½	—	—	10 7 3
do. do. 5 per cent. Deb. ..	5	5	63½	—	7 17 6
Brazil Traction	Nil	Nil	31	—	2
British Columbia Elec. Ry. Pref. ..	5	5	58	—	8 12 4
do. do. Preferred	5	5	38½	—	6 1 2
do. do. Deb.	3	12½	57½	—	*10 17 0
do. do. Deb.	4½	4½	61½	—	6 18 3
Mexico Trams, 5 per cent. Bonds ..	Nil	Nil	55½	—	Nil
do. do. 6 per cent. Bonds ..	Nil	Nil	27½	—	Nil
Moscow Light Common	Nil	Nil	18	—	Nil
do. Pref.	Nil	Nil	27	—	Nil
do. 1st Bonds	Nil	5	61½	—	8 2 8

MANUFACTURING COMPANIES.

Babcock & Wilcox	15	15	2½	—	6 11 9
British Aluminium Ord. ..	10	10	157	—	6d.
British Traction Ord.	15	15	14	—	10 0 0
Callenders	15	15	18	—	10 8 2
do. Pref.	6½	6½	189	—	6 18 8
Crompton Ord.	15	15	139	—	14 11 0
Edison Swan	10	10	—	—	—
do. do. 5 per cent. Deb. ..	5	5	61	—	7 16 3
Electric Construction	10	10	183	—	10 19 2
English Electric	10	8	27½	—	10 0 0
do. Pref.	6	6	120	—	9 12 8
Gen. Elec. Pref.	6½	6½	177	—	7 13 0
do. Ord.	10	10	188	—	10 19 2
Hawley	15	15	27½	—	10 5 7
do. 44 Pref.	14	14	38	—	6 2 2
India Rubber	10	10	—	—	9 2 10
Mos. Vickers Pref.	8	8	15	—	*9 8 3
Siemens Ord.	10	10	11½	—	*9 8 3
Telegraph Con.	20	20	14	—	*6 11 9

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, December 28th.

CHEMICALS. &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	8½d.
a Ammoniac Sal	per ton	265
a Ammonia, Murate (large crystal)	.. ..	268
a Bisulphide of Carbon .. ..	.. ..	481
a Borax .. ..	.. ..	220
a Copper Sulphate	per lb.	6d.
a Potash, Chlorate	per lb.	6d.
a Perchlorate	per wt.	216 11s.
a Shellac .. ..	.. ..	214 10s.
a Sulphur, Sublimed Flowers ..	.. ..	213 10s.
a Lump .. ..	.. ..	8½d.
a Soda, Chlorate	per lb.	27
a Crystals	per ton	27
a Sodium Dichromate, casks ..	per lb.	.. ..

METALS. &c.

p Babcock's Metal and Anti-friction Metal	.. ..	per ton net	4180	..
Grade I .. ..	.. ..	.. ..	4113	..
Grade II .. ..	.. ..	.. ..	471	..
Grade III .. ..	.. ..	.. ..	102½	..
c Brass (rolled metal 2" to 12" base)	.. ..	per lb.	1/0½ to 1/0½	..
c " Tubes (solid drawn) ..	.. ..	.. ..	11½d.	..
c " Wire, basis .. ..	.. ..	.. ..	12½	..
c Copper Tubes (solid drawn) ..	.. ..	.. ..	23 dec.	..
c " Bars (best selected) ..	.. ..	per ton	495	23 dec.
c " Sheet .. ..	.. ..	.. ..	298	23 dec.
c " Rod .. ..	.. ..	.. ..	275 5s.	..
d " (Electrolytic) Bars .. ..	.. ..	.. ..	214 10s.	..
d " " Sheets .. ..	.. ..	.. ..	291 5s.	..
d " " Wire Rods .. ..	.. ..	.. ..	11 d.	..
d " " H.C. Wire .. ..	.. ..	per lb.	8/6	..
f Ebonite Rod .. ..	.. ..	.. ..	2/9	..
f Sheet .. ..	.. ..	.. ..	2/9	..
f German Silver Wire .. ..	.. ..	.. ..	12/6	..
h Gutta-percha, fine .. ..	.. ..	.. ..	12/6	..
h India-rubber, Para fine .. ..	.. ..	.. ..	227	..
h Iron Pig (Cleveland Warrens) ..	.. ..	per ton	226	£1 dec.
l Lead, English Pig .. ..	.. ..	.. ..	110 7/6 to 110 10s.	..
g Mercury .. ..	.. ..	per lb.	4½ to 8½	..
g Mica (in original cases) small ..	.. ..	.. ..	10½ to 20½ & up	..
g " " medium .. ..	.. ..	.. ..	1/2	..
g " " large .. ..	.. ..	.. ..	1/4	..
g Phosphor Bronze, plain castings ..	.. ..	.. ..	1/5	..
p " " drawn bars and rods ..	.. ..	.. ..	1/4	..
p " " rolled strip & sheet ..	.. ..	.. ..	1/5	..
p " Wire .. ..	.. ..	.. ..	12½	..
p Silicon Bronze Wire .. ..	.. ..	per lb.	1/5	..
p Steel, Magnet, in bars .. ..	.. ..	.. ..	217½ to 217½ 10s. £3 to £3 10s. in.	..
p Tin, Block (English) .. ..	.. ..	per ton	8/6	..
a " Wire, Nos. 1 to 16 .. ..	.. ..	.. ..	.. ..	..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespear.
c Thos. Bolton & Sons, Ltd.	h Edward Tilt & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	j Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	k P. Ormiston & Sons.
g Telegraph Works Co., Ltd.	p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.	

Smoke Abatement.—The Committee on Smoke and Noxious Vapours Abatement appointed by the Ministry of Health, has presented its final report (H.M. Stationery Office, price 6d. net.). The examination of numerous witnesses has satisfied the Committee that means for heating, cooking, &c., which produce little or no smoke are available. The use of electricity is hygienic and labour saving, but in view of the high prices charged at present its adoption is retarded. The cheapening of electricity will no doubt lead to its inclusion in the design of the cooking and heating arrangements of houses. Subject to this, the Committee thinks that wherever gas is available it should be employed in lieu of the old-fashioned coal range, which is condemned as wasteful of fuel and labour, and productive of smoke. For a supply of hot water a coke-fired boiler is recommended. It is considered that the present situation regarding housing, presents an excellent opportunity for the constructive reform of heating and cooking systems, as it has been urged that it is impracticable to attempt smoke abatement by altering existing arrangements forming a part of old-fashioned houses. The Committee is not in the position to recommend the universal adoption of any particular scheme, but is of the opinion that in most instances it will be quite practicable to adopt some arrangement which will obviate the production of smoke. The Committee recommends that every facility should be given to gas and electricity suppliers to increase and cheapen their commodities, and it condemns the practice of some local authorities which charge unnecessarily high rates for gas and electricity for the purpose of contributing sums to rate-relief.

A Magnetic Survey.—The magnetic survey yacht, *Carnegie*, returned to Washington on November 10th, 1921, after completing her two years' world cruise. Although a considerable amount of rough weather was encountered, *Science* records that it was found possible with the special apparatus on board to make satisfactory magnetic and electrical observations daily.

AUSTRALIA'S FUTURE AS A MANUFACTURER.

Of the recently-issued report on the economic situation of Australia, by H.M. Senior Trade Commissioner (Mr. S. W. B. McGregor), probably the most interesting portion to engineering readers is that dealing with the question of developing Australian manufacturing industries.

There is, Mr. McGregor says, much exaggeration in the utterances of public men and in the Press as to the enormous developments of manufacturing industries in Australia, which are alleged to have taken place in the last few years, and the ease with which new industries might be established or existing occupations stimulated so as to cater for the whole of Australian requirements."

On the other hand, the Australian has the inherited British manufacturing instinct and quality of enterprise.

Labour Factor.

In addition, Australia possesses all the raw material necessary for manufacture, an almost unlimited supply of economical power, and a healthy temperate climate.

An important, if not determining, factor in the successful exploitation of Australian manufacturing enterprises is the attitude of organised labour. Mr. McGregor adds:—

"Without emphasising this point, one may say that, assuming the co-operation of labour, a very high degree of organising ability will be required to enable labour to enjoy that high standard of living which it rightly demands, and, at the same time, to permit goods to be produced at a reasonable, if not competitive price."

It is fairly obvious that manufacturing industries in Australia cannot extend much further without the introduction from overseas of capital, labour, and not least, men with specialised knowledge and organising ability. A number of British manufacturers have already established branches, contemplate establishing branches, or have linked up in some way with established manufacturing interests.

Summarising the situation, the Senior Trade Commissioner says that there is apparently an immense field for the natural development of manufacturing industries in Australia, although that development may not be so rapid as many desire.

The Government stimulus to manufacturing industries consists in (a) a highly protective Customs Tariff; (b) the activities of the Institute of Science and Industry and the Bureau of Commerce and Industry.

State Assistance.

On the subject of effecting the much-needed increase of population in Australia, H.M. Trade Commissioner admits that the only way is to develop the secondary or manufacturing industries. Of the different phases of the Australian Government's policy, its immigration scheme is viewed more favourably in this country than the highly protectionist tariff which is to be enforced. The Government also assists both primary and secondary industries by means of the Bureau of Commerce and Industry and the Institute of Science and Industry. The former is developing into a permanent Department of State. Latterly its activities have been more particularly directed to the preparation of schemes for fostering and organising the secondary or manufacturing industries with a view to local consumption and overseas export. The Bureau lends its support to co-operative methods, and is endeavouring to promote associations of manufacturers and merchants for purposes of combined action in making, buying, and selling arrangements.

Mention should here be made of the Australian Producers' Wholesale Co-operative Federation, Ltd., which has opened offices in London to sell produce and purchase machinery, stores, &c., to the best possible advantage.

Before passing from questions of co-operation, it may be stated that the Australian Association of British Manufacturers and their representatives has during the year successfully dealt with many important matters. Its members now number 321 representatives in Australia, and 462 manufacturers in the United Kingdom.

Engineering Standardisation.

The formation of an Australian Engineering Standards Association has been the subject of a conference between the Institute of Science and Industry and the Institute of Engineers, Australia, whereby the general scheme of organisation, as set out in a pamphlet issued by the Institute of Science and Industry, was approved, and it was decided that a recommendation be made to the Commonwealth Government urging the formation of an Engineering Standards Association, and the early appointment by the Government of a main committee.

It was also recommended that the headquarters of the Association be located in Sydney at the headquarters of the Institution of Engineers, Australia, whose secretary should also be secretary of the Association, and that while the Institution is prepared to assist with funds and secretarial work, the Government be asked to supply such additional funds as may be necessary to carry out the work efficiently. Mr. Knibbs has since been appointed secretary.

Hydro-Electric Development.

Australia as a whole offers, at present, a field of hydro-electric development. Various schemes have been proposed in New South Wales and Victoria, and have not yet reached the preliminary stage. What is known as the Kiewit River scheme, in Victoria, recently received careful consideration from the State Legislative Council, and it is stated that the scheme must be deferred for the present.

Presently, work in connection with the Snowy Mountains scheme in New South Wales is well in hand. The Snowy River scheme proposed to commence with 24,000 kW, increasing to 150,000 kW. Information with regard to the Glenelg River scheme indicates that some strong help is being given to it.

In Tasmania, the Hydro-electric Department of the Tasmanian Government continues general extensions and survey work. The power at present available is 15,000 h.p., but the plant is capable of generating 18,000 h.p., given sufficient water supply. It is intended that work shall now proceed continually until the full 57,000 to 66,000 h.p. is made available. The total cost is estimated at £2,500,000, of which £1,200,000 had been spent by June, 1920, and £554,000 voted for the year 1920-21.

Each month sees large quantities of machinery and equipment landed at Hobart for the extension of the scheme of the Hydro-Electric Department, and the general manager recently returned to Tasmania after visiting England and America to investigate the question of supplies and to place orders for plant and material. Construction work is progressing well all the time. The financial position, as revealed by the accounts for the past departmental year, is entirely satisfactory, and there is no doubt that the bold policy of the Tasmanian Government in harnessing the State's water power is more than ever justifying itself now that the promoters of so many new industries have been induced to make Tasmania their sphere of operation.

During the year 1920 the Electrolytic Zinc Co., at Risdon, near Hobart, recovered from the ore treated 5,809 tons of zinc, valued at £251,130, and employed an average of 970 men. This company is hurrying through with its big construction programme, and expects to start producing in December (this month) from 80 to 100 tons of electrolytic zinc per day. Owing to the price of spelter falling below the actual cost of production on the 15-ton-per-day unit, the plant was closed in February, and no further zinc will be produced until the big unit is in commission. The closing down of the spelter plant necessarily stopped the production of zinc oxides, leaded zinc oxides and rolled zinc sheets, but these subsidiary production plants will start up again in due course. The end of the year should see the Electrolytic Zinc Co. producing on a very large scale. The importance of this undertaking from an all-Tasmanian point of view will be realised when consideration is given to the amount which the Government has spent in extending its hydro-electric scheme, primarily to provide power for this and other industries which have been started.

Morwell Scheme.

It may be recalled that the total estimated cost of the Morwell electric scheme for developing the brown coal deposits of Victoria is just under £3,000,000. Various details have appeared already in these columns. The preparatory work on the new power house at Morwell (80 miles east of Melbourne) is well in hand. Tenders have been accepted for the plant, and the station is expected to be in operation before the end of 1923. The estimated selling price of electricity in the metropolitan area of Melbourne is 43d. per unit.

In addition to the transmission of electricity direct to the Metropolis, provision has been made for a separate transmission line, carrying energy at a pressure of 20,000 volts, to be erected alongside the main transmission line. From this lower voltage line it is intended that electricity shall be made available to the various towns and villages en route.

The whole of the designs for the power-station plant and transmission lines were prepared by Mr. H. R. Harper, chief engineer to the Electricity Commissioners, and his staff.

Schemes are also under consideration for transmission of energy from Morwell to country centres, such as Ballarat, Bendigo, and Geelong.

Since the first appointment of the Commissioners, the Melbourne demand has grown to such an extent that it is necessary to make arrangements for a station of 15,000 kW capacity to be erected within the metropolitan area at Newport. This station will supply the demand in excess of the capacity of existing generating stations in Melbourne until the Morwell power house is in operation. Thereafter it is intended that this station shall be used to carry the "peak" loads only, the more constant demand being met by the Morwell station.

The plans of the Commissioners include providing the necessary equipment to link up the Morwell station, the Railway Department's power station at Newport, and the Commissioner's proposed Newport station, so that all these stations and any future extensions can be operated as one scheme. This arrangement not only ensures economic working, but greatly reduces the risk of any interruption of supply.

THE FARADAY SOCIETY.

SOME CURIOS PROPERTIES OF COMMERCIAL CADMIUM.

At the November meeting of the Faraday Society, Mr. J. NEILL, LUTHERWOOD, read a paper entitled "The Effect of Cold Work on Commercial Cadmium." Preliminary researches on the mechanical properties of this metal have produced some curious anomalous results. Most metals become hardened when cold work is done upon them, but this metal (which consists of 99.75 per cent. cadmium and 0.25 per cent. lead) is harder when cast than when the cast metal is hammered. Moreover, while the worked metal continues to soften very appreciably for some days after hammering (unlike other metals, which first become harder on standing, and then gradually soften), in the unworked cast metal a very slow softening takes place. It is concluded that chill cast cadmium undergoes a spontaneous change from a harder to a softer state, and this transformation is greatly accelerated by deformation in the cold. Microscopic examination confirmed this supposition, and showed that cadmium spontaneously anneals after cold working, and, as usual, the growth of the new crystals is most rapid in the initial stages. This spontaneous recrystallisation takes place at ordinary temperatures; at 20 degs. C. it is complete in about 12 days.

The explanation offered for this behaviour is that two different allotropic forms of cadmium are being dealt with, and that the transformation from one to the other, which is shown to take place at about 60 degs. C., is suppressed by the quick cooling in chill casting, so that the metal is in a metastable condition. The explanation is in harmony with the well-known views of Ernst Cohen on allotropy in cadmium, based on quite different considerations.

THE SYNTHETIC PRODUCTION OF AMMONIA.

The remarkable success of the Haber process in Germany, and, it would appear, of the more recent Claude process in France, for the fixation of nitrogen by its direct combination with hydrogen, gives a special interest to all experimental work bearing on this synthesis, even if the results turn out to be negative. This is the case with experiments planned by Mr. J. N. PRING and Mr. E. O. RANSON, and described before the Faraday Society, to discover whether recently-formed cathodic hydrogen, which may be presumed to be in an abnormally active state, may be made to combine with nitrogen under high pressures at normal temperatures. There is reason to believe that when hydrogen is formed electrolytically at a cathode, not only is it at first in the atomic condition, but it accumulates at very high pressures within the surface of the electrode. Such conditions should, therefore, be most favourable for the N-H synthesis. In the apparatus described in the paper it was possible to carry out the electrolytic production of hydrogen in an atmosphere of nitrogen at pressures up to 500 atmospheres. Nevertheless, no reaction took place between the gases at the cathode. This conclusion lends support to the view that the powerful reducing effects brought about by hydrogen under these conditions of high over-voltage are caused by ionic interchanges rather than through secondary chemical reaction with free hydrogen. The inertness of nitrogen under these conditions may thus be attributed to absence of ionisation at the low prevailing temperatures. The results are further in accordance with the view that the transition from hydrogen ions to the gas under a state of high pressure takes place in the inner layers of the metal, and not on the outside surface.

THE PROPERTIES OF EMULSIONS.

A newly-discovered property of an emulsion was described by Mr. T. C. NUGENT. The emulsion concerned was a fairly concentrated one of benzene in water, containing gelatin or gum arabic as "stabiliser." A convenient method of making these emulsions is given in the paper. It was observed that the addition of caustic soda to such an emulsion caused separation of the benzene to begin at once, provided the soda were added to a freshly-made emulsion. This separating effect of caustic soda is thought to be due to the transformation of the gelatin into some less colloidal condition and the consequent breaking down of the protecting gelatin layers round the emulsoid particles. If, however, an emulsion is produced and left much turbid for some time, and then caustic soda was added, it was found that the separation of the benzene was retarded or "inhibited" for some time. The suggested cause of this phenomenon is, that after an emulsion is produced, the gelatin is slowly forming protecting layers about the benzene particles, and therefore the stability of an emulsion increases with its age. Before the benzene particles can be caused to coalesce these protecting layers must be removed by the caustic soda. As the strength and number of these protecting layers are increased so much the time required for their removal or destruction by the caustic soda be increased.

A COMPLEX LEAD NITRATE ANION.

Mr. T. H. JEFFERY has been investigating the electrolysis of aqueous solutions of alkaline nitrates, using various anodes for the purpose. In the experiments now described lead was the anode, and it was found to go into solution, forming a complex which gave a bright orange colour to the anolyte.

The complex lead anion was derived from divalent lead, and was thought to be $(\text{Pb}(\text{NO}_3)_2)^+$ for small concentrations of lead in alkali nitrate solutions. In the author's view this complex is probably the only one formed.

The solid in equilibrium with solutions obtained from anolytes of certain concentrations is lead nitrate crystals $\text{Pb}(\text{NO}_3)_2 \cdot \text{H}_2\text{O}$. The colour of these crystals is approximately the same as that of the solutions from which they are derived, showing that the plumbo-nitrate complex probably maintains its identity in the crystals. A direct way of testing this hypothesis would be by an X-ray analysis of the crystals; the $(\text{Pb}(\text{NO}_3)_2)^+$ group should form a pattern regularly repeated in three dimensions relative to the cubic Pb atoms.

NEGATIVE CATALYSIS.

A suggestive paper by Dr. N. R. DHAR and Mr. N. N. MITTAL, sent in from India, pointed out that in oxidation reactions negative catalysis takes place when the catalyst is readily oxidisable. The well-known theory of intermediate compounds is utilised to explain the reactions described. Experimental evidence was put forward to support the view that generally one chemical change will promote or induce another of the same type, and the remarkable fact was observed that this effect is particularly noticeable in those reactions which are very sensitive to light.

At the conclusion of the meeting Dr. S. JUDD LEWIS and Miss F. M. WOOD exhibited an improved form of sensitive thermostat, specially designed to operate at all temperatures between 0 deg. and 100 degs. C.

TELEPHONE LINE WORK IN THE UNITED STATES.

DISCUSSION AT LEEDS.

At a meeting of the North Midland Centre of the INSTITUTION OF ELECTRICAL ENGINEERS on November 29th Mr. E. S. BYNG read his paper on the above subject (an account of which appeared in our issue of November 25th). The paper was illustrated by means of lantern slides and samples of telephone apparatus used in America.

Mr. JOHNSON (Leeds), who opened the discussion, observed that America, being the best telephone country in the world, could show them a great deal, and he hoped that much would be learned. However, it did not follow because a thing was done in America they should necessarily do the same thing in England. The conditions were very different. He would like to see some of the appliances illustrated and methods described carried out in an old English city, say, like York, with narrow streets, both cramped and tortuous, with the ground full of pipes of various kinds, including old pipes that had been allowed to remain to block up the place. Cities in America were separated from each other by spaces which were out of comparison with the smaller spaces in England. In England they could show something considerably better than the American staff organisation, which the author described.

In connection with motor transport and the use of motor cycles, it was said that 250 men were engaged on the maintenance and repair of 1,000 vehicles, an average of one man to four vehicles, which struck one as being very excessive, and yet whilst there were all sorts of engineers they did not employ a motor engineer.

In the use of mechanical appliances the Americans had gone far ahead. Roads were being made more costly and substantial, and consequently much more costly to tear up. If, when streets were being widened or re-made, they could build subways for gas, water, and power mains, telegraph and telephone cables, &c., the lot of all engineers would be lightened considerably, and it would be a good investment for the towns that carried out such work in the long run. In England it was absolutely true that any position in the Post Office engineering system was open to anyone who became qualified for it. They had a living proof of that in the fact that the present engineer of the Post Office started life as a telephone messenger in Aberdeen and, without any outside influence, attained by the force of his own character and ability the position he now held.

Mr. SLAVEY (Sheffield) said that a serious number of propositions with regard to subways had been put forward from time to time, particularly with regard to London, and ultimately he thought the matter would mature very considerably. If they had to consider how to bury a batch of cables from any of the proposed super-station sites into the heart of London they would have a very serious problem to consider. In one case the most feasible way seemed to actually bring the cables through the main sewer. That might sound a little bit humorous, but it was practically saying, "Use existing subways." Their American friends had specialised to a very considerable extent in their big cities, but their main problems had been to connect rival metropolises, between which was practically virgin country. If property laws in America were very much the same as those in England, how could they drive their caterpillar tractor and plough over somebody's land without any regard to anything but the shortest distance between the two points? Every English

engineer knew what would happen to him if he tried to find the shortest distance between two points it could not be done. He did not see how they would gain much by using aerial cables.

A main point of the paper was that open wiring was condemned, and they were fast reaching that position in this country. In this country the atmosphere was very acid, and aerial cables would have to be regarded from exactly the same point of view as a bridge. What kept bridges standing?—not steel, but paint, and if they used aerial cables they would only be preserved provided their coverings were continuously renewed. The other great lesson of the paper was that of replacing labour.

Mr. F. E. GIBBINS (Leeds) said that the greatest objection in this country to the use of aerial cables along country roads was the great difficulty they experienced in dealing with trees. In the Leeds district a number of aerial cables which were used for junction circuits between adjacent towns were rapidly being placed underground. They wanted to see the last of the aerial cables, as they had given endless trouble. Clamping the suspension wire to the pole, he thought, was infinitely preferable to their method of dead ending it. They had tried the patent stays advocated in Mr. Byng's paper, but they had not found them satisfactory. They adhered to the method of using wood blocks. Instead of their stay-splicing methods, clamps were used and the stay tighteners, which in England were found so useful, were not used, but it seemed to him that the English method was preferable to the American method. In America it would be possible to stay any pole, but in this country it was a great difficulty. In the great majority of cases they had to fix their pole, not where they would like, but where they could; English road margins were much narrower and their roads, too, were narrower. That to some extent would account for the fact that they were behind the Americans in the use of labour-saving devices. The method of binding wires on the insulators which they discarded in this country twenty-five years ago was still in use in America, *i.e.*, binding the wire to the insulator with soft wire of the same material. The tape and binder were much more effective than the old method. To space the arms on the poles 24 in. instead of 12 in., as in this country, seemed to be an extravagant use of pole space. Possibly more than 12 in. would be necessary in America; he could not see, however, why it should be as much as 24 in. The American cross brace was not sufficiently strong to support a ten-wire arm which was not balanced and which had not the same weight of wire on the one as the other. In this country they braced the arms together, an effective method where they had more than three or four arms. With two arms it was not effective; in this case the method did not seem to be as good mechanically as the English one.

Mr. E. H. FARRAND remarked that, generally speaking, the impression one got from the paper was that the conditions in America were far more favourable to telephone engineers than anything they had in this country, both as regarded overhead line and underground construction. The use of a mechanical excavator appeared to be absolutely ruled out of court in England. The types of conduit that Mr. Byng described were pretty much on the lines of Post Office practice in this country, with the exception that of late years they had done away with the square ducts; the hole in the duct was made round, because they found it easier to align those ducts, to get round bends and corners with them, and to keep them joined together in a manner that excluded water and other interference. Lines of square ducts fixed together with dowels could only be adopted where they got straight lines. That was a thing they could never get in England, except in a country line; in a town a straight line was almost an impossible thing. One firm of contractors did boil out cable joints with wax, but the bulk of the contractors who laid cables in England did not. As against its disadvantages, no doubt the waxing of a joint did prevent to some extent damage accruing from defective plumbing spreading rapidly in a cable and throwing it out of action in a short time. However, that object was attained much better by the English method, which showed not only defects in the plumber's wire, but any defect in the sheath. They had finished a main cable from Leeds to Harrogate, and the results showed from 10,000 to 50,000 megohms per mile. He had never seen a waxed cable that was as good, and he was very doubtful whether that could be bettered. The rates of jointing given by Mr. Byng were exceedingly high. For instance, every one of those wire joints in England consisted of six separate operations, so that six times three hundred in one hour was indeed a nimble operation for a man's fingers. Of course, if the mate was doing a large part of the work, then there were two men employed, and if that was so, then they had men in Leeds who could do the same. Had the speed of pulling a cable through a duct in America of 50 ft. per minute any ill-effect on the sheathing of the cable? The average of most of the big contractors in England was only from 20 to 30 ft. per minute. They had not, however, all the mechanical appliances which they had in America.

Mr. LONGMAN was of the opinion that the large lead-covered cables would last longer and have a much longer life than the small lead-covered suspended wires which they had been using in this country. When they got up to 2 or 2½ in. diameter they experienced much less trouble due to the

fracturing of the lead. In the Birmingham to Leeds case, where they had coke ovens, by-product plant, &c., the atmosphere was not particularly bad, but for the most part the best construction of any description. In America they were practically free from such effects.

Mr. G. H. HOBBS, though he tried some of the American looked very rough work. The subject of easements and rights-of-way to an English engineer was most interesting. Lump sums were made in final settlement in America, and there were undoubtedly big advantages in that arrangement. There was also a great saving in overhead lines, but in England the power of the dollar did not equal the power of property owners. In England the small motor cycle and side-car had been found to be useful, and he could not understand why those machines had not been found more useful in America.

Mr. E. S. BYNG, in replying to the discussion, said that in 1917 he had been loaned to the French Government for a short time to advise with regard to its long routes. The latest practice as developed in this country and in America was the underground route with a heavy-sized cable, and for three or four long-distance routes he had suggested a similar arrangement. The contracts were about to be placed when a deputation of Frenchmen came back from America and said they must stay their hand, and urged aerial lines and light conductors. As a result of his study in the U.S.A. his own outlook had been considerably broadened, but the position had to be weighed up. If they knew only one side they could not arbitrate fairly. Americans had placed their utmost confidence in the stability of the aerial cable, but it was not the right thing in this country. In France all the cables were taken through the main sewers; they could drive a carriage and pair through the various sewers. The suggestion that they should adopt sub-ways in the main streets of England if they were reserved for the utility services, telephone, telegraph, electricity, gas, and water mains would be a good solution of the congestion trouble. Regarding the preservation of the cable sheath, it contained 1 per cent. antimony, but it was not coated with paint or any means to prevent corrosion. Aerial cables were run in Pittsburgh, which resembled Sheffield very much; the same amount of soft coal was used there, and it was just as dirty as Sheffield. Regarding manholes, not even in London had he seen conditions so bad as they were in New York, where they had some serious difficulties to contend with. In the U.S.A. the number of cross arms that tilted were surprisingly few. As to the speed in pulling in cables, the 50 ft. he mentioned was about the normal speed from several tests he made. The limit which they must not exceed was 200 ft., and in places similar to Oxford Street he saw them pulling in twelve and thirteen drums a day without any trouble. On a country road he watched the men at various points pulling in from twenty to twenty-five every day. Though he did not see the four miles pulled in he had no difficulty in believing it, as he knew it was a definite fact. Not only was the speed in pulling the cable in rapid, but it was rapid in moving from one manhole to another. They had three or four motors, so that the men did not walk. That was where they cut out the waste of time.

THE DEVELOPMENT COMMISSION.

ANNUAL REPORT.

THE important advances in the distribution of electricity to outlying rural districts in the Hereford area are covered in a broader manner in the report of the Development Commissioners for the year ended March 31st last.*

It is to be understood that the Hereford scheme was in the nature of an experiment, as no little uncertainty existed as to whether agriculturists would use electricity if a supply were available. It was the very essence of such a scheme that it should be free from any element of subsidy or favoured treatment, and that it should be conducted in an area displaying average features—neither favourable nor unfavourable to the work. In the opinion of the Commissioners these provisos were observed in the Hereford experiment. A 4,000-kW power station was built at Hereford for war purposes, and when the war ended the station would have been scrapped but for the institution of the rural electricity supply project. The Corporation arranged favourable terms for its purchase, and commenced its operations by taking power to Breinton, in which district farms were numerous and agriculture was highly developed. This first part of the scheme cost £13,000. In December last the Treasury approved a further loan of £19,857 for the distribution of power to the Leominster, Weobley and Kingston areas. In January the Corporation put forward an urgent request for sanction to the expenditure of a further £34,750 to furnish a transmission line and equipment to Ross and Lydbrook; for the Rotherwas sub-station; and for two-thirds of the low-pressure distribution cables. This sanction was given, and a loan advanced subject to the deduction of any amount received from the

* H.M. Stationery Office. Price 3s. net.

employment Grants Committee. The expenditure, therefore, amounted to £7,607 up to the end of the year covered by the report. To complete the scheme further sections are required for the Ledbury and the Frome Valley area at a cost of £14,000, for Pontilias and the Golden Valley area at a cost of £7,100, and for a third of the low pressure distributors, costing £5,000. Owing to the present financial stringency it has been decided to defer this part of the scheme. It is considered that the work already done will serve to prove the success of the scheme. In recommending loans the Commissioners stipulate that the net profits derived from consumers on the lines provided by means of such loans shall, unless otherwise approved by the Commissioners, be applied to further extensions of the scheme, and that the scale of charges to consumers connected to these lines shall be subject to the approval of the Commissioners, who will see that no loss is incurred by the Corporation. Summing up the financial position, it is seen that, whilst the rural communities get power and light, the revenue received gives the city the use of modern plant and equipment, together with a lower selling price for electricity. The cost of the plant, if the scheme is successful, will not fall upon the ratepayers or consumers, but will be defrayed by the general revenue, the greater part of which will come from outside the city boundaries. Thus the city ratepayers possess a reasonable prospect of becoming the owners of a valuable plant within 20 years without any call upon the rates. The Commissioners say that although it is too early to form precise conclusions as to the success of the scheme on its financial side, the experiment has gone far enough to remove all doubts as to the readiness of the rural population to use electricity for light and power when once it is made available. The authorities have many applications for priority of treatment from owners, farmers, and all kinds of industries, in every area served by a transmission line. The preliminary canvass shows that non-

users will be a negligible minority in every district. Apart from the advantages obtained by its use, electricity in the area is no dearer than is usual in most urban areas. The Commissioners were impressed by the numerous uses to which electricity is put. They found it being used, *inter alia*, for corn grinding, chaff cutting, cake breaking, pulping roots, milking, sawing and pumping. Farm houses, farm buildings, and cottages are electrically lighted, and electric ironing has become popular. Power is also used in cider making—an important local industry—sheep shearing, stacking, thrashing and cleaning grain, and in churning and milk separating. So far no steps have been taken to introduce appliances for ploughing and draining, but a scheme has been considered under which mole drainage and ploughing tackle would be hired out to farmers, and electric winches taking the place of steam winders. Power would be supplied to the fields by overhead distributors carried on Callender's collapsible steel poles, and to the winches by c.t.s. cable wound on spring drums. Some figures regarding the larger undertakings using electricity in the area are given in the report. There are two sawmills employing 80 people; two wheelwrights and blacksmiths with 20 employees; two flour mills with 90 hands; two cider works employing 100; two laundries (35); and an ironworks (35). Applications have also been received from a wire works and a timber moulding mill employing 1,000 and 100 men respectively.

The electro-culture investigations at the Imperial College of Science and Technology are briefly reported upon. The Electro-Culture Advisory Committee of the Ministry of Agriculture and Fisheries has come to the conclusion that electrification of crops by an overhead discharge is capable of bringing about increased growth and yield. Further research into the best conditions for bringing this about was to have been undertaken during 1921 and the Commissioners recommended a grant of £1,365 for this purpose.

ELECTRICAL APPARATUS IN THE HOME.

The second of the series of Salesmanship Conferences organised by the British Electrical Development Association was held in the rooms of the Chartered Institute of Patent Agents, London, on December 16th. Mr. J. W. Beauchamp (Director of the E.D.A.) presided, in the absence of Mr. S. T. Allen (President of the I.M.E.A., and Chief Electrical Engineer at Wolverhampton).

A paper on "The Selling of Domestic Electrical Motor-Driven Appliances" was read by Mr. E. R. Morton, who pointed out that in endeavouring to sell these appliances the salesman had at least one great advantage over the heating and cooking salesman, because the current consumption of the appliances was so small that it very rarely happened that any material saving in running costs could be effected by installing a power circuit. Another important asset was that every one of these appliances could, if necessary, be operated from any lamp socket. There was no vital objection to this course, except where the appliance was used in a building having a floor giving a good earth. However, it was usually so easy to fix up a socket with earth connections that in the majority of cases the progressive contractor would throw in this if he could secure the order for the appliance. The flexible supplied by most makers was suitable for ordinary use, but where conditions were likely to be severe it was sometimes desirable to fit a length of c.t.s. or tough rubber-sheathed cable.

The difference between success and failure in selling lay between a thorough knowledge of the appliances, their application and use, and a want of that knowledge. All the electrical appliances for the home were simple in design and construction, and a reasonable understanding of their fundamental principles should not be beyond the grasp of any individual possessed of average intelligence, even if he had not the advantages of an electrical or mechanical training. Fortunately, most makers of domestic appliances were only too anxious to give the fullest possible information and instruction as regarded their product; the salesman should take advantage of this.

Having become thoroughly familiar with the appliances he was going to sell, he would find it very necessary to know something of competing machines. In the few main appliances available to-day, vacuum cleaners and clothes washers, there were many varieties, and he must be able tactfully to dispose of his competitors' claims to superiority. In doing so, however, it was vital that he must not suggest that the competing electrical appliance was no good at all; if he could not make his own appliances on its merits he should not foster any idea in the mind of the general public that anything electrical did not fulfil its function. If a salesman were asked why his appliance was better than a steam machine he should have no difficulty in explaining, because he was selling, not only an appliance, but an investment, which normally would not require replacing for a good many years. It is possible to find that price differences between competing machines are of greater rather than of importance. These appliances needed attention from time to time, such as oiling

and minor adjustments; he should, therefore, make a point of calling a few weeks after the sale to see that the user was not only thoroughly familiar with its operation, but was also keeping it in order. When making these calls he would usually be able to obtain the names of the buyer's friends who might be interested.

Advertising should be the first step in the selling of apparatus. Probably the cheapest form (apart from getting the maker or wholesale distributor to do it) was to use type-written letters of an individual character, written so as to arouse interest, but without implying any sense of obligation. After a few days a call could be made. The door-to-door method, quite apart from loss of dignity was, he believed, unfertile. Pamphlets could be included with the letter, but every piece of advertising matter should clearly give an open invitation to see the appliances under actual working conditions—in the home itself. Once the prospective purchaser had used an appliance she was interested in, she was, nine times out of ten, loth to part with it. Results from advertising in local papers, the showing of films in cinemas, *salon* positions on good hoardings, &c., varied much in different districts, and should be carefully watched. The best advertising medium was a good show window.

On account of the weight and bulk of washing machines it was desirable to arrange for the initial demonstration to take place in the contractor's or dealer's showrooms, and later, it could be arranged to do an actual week's washing in the home. Even where there was quite a small family the salesman need have no hesitation in putting his figures either against the laundry bills or the washerwoman's fee.

With regard to ironing machines, while the roller was rotated either by coupling to a washing machine, or with a self-contained motor, the shoe was almost invariably gas heated. As the average length of the shoe to be heated was 3 ft. 9 in., the electrical method presented difficulties. Demonstration was necessary, and the salesman who had experience of washing machines would not have any difficulty in adding this line to his repertory.

Other machines mentioned by Mr. Morton were the dish-washer, a sewing machine equipped with an electric motor and foot control, electric fans, &c. The first principle in selling these appliances was to get interest aroused before stating prices. Good business would only be done with the help of a hire-purchase system, no matter at what prices appliances were sold. Too little attention had been given to the possibilities of hire-purchase systems by electrical traders. The quality of mind necessary to effect sales was enthusiasm, which was difficult to acquire unless one had an intimate and first-hand knowledge of the appliances to be sold. A salesman would be better able to sell if he had electrical appliances in his own house, and could speak with increased authority and confidence.

The central station engineer too often assumed that the load was so slight that it was not worth his while to cultivate it. That was a short-sighted policy. Possibly most dealers could cite instances of new consumers being converted to

electric light because it was a necessary preliminary to having labour-saving appliances.

Finally, Mr. Morton urged all salesmen and dealers to educate the public, and foster and encourage the all-electric home, and the time would come all the more quickly when the public would come to the dealer.

In a subsequent discussion Mr. Noms suggested the use of a schedule of prices, as published by laundries, and a comparison between those prices and the cost of doing the washing at home, pointing out also the various advantages. With regard to cost, the electrical washer was much more costly than the power-driven washer used in steam laundries, and he did not think it was all due to the motor. He did not see why it should cost more. The speaker also advocated a number of improvements to existing types of electric washing machines, such as the addition of hydro-extractors and larger wringers.

With regard to vacuum cleaners, he suggested the preparation of a schedule of savings effected by using a vacuum cleaner, compared with the cost of extra servants.

Mr. J. G. WHITE said he had made inquiries of a British manufacturer about the price of a certain washing machine, who had given him a considered estimate of what it would cost him to make 50 of those machines, now sold at about £60. The price to a contractor was £35 each. Was not the margin between the cost of production and the actual selling price now too high?

Mr. ROBERTS urged contractors to institute a system of maintenance for machines, because there was a feeling amongst the public generally that anything to do with electricity did not need attention. With a washing machine in his own home he saved from 15s. to 18s. per week on laundry bills.

Mr. W. E. WARMILOW said the cost of a washing machine had a great deal to do with slow sales. Another disadvantage was the noise it made in operation. These conferences had thrown into the boldest possible relief the necessity for something more than merely individual effort. He had noticed that at Felixstowe a public wash-house had been fitted up where the public could do washing with electrical machines. As to the vacuum cleaner, was it not time that they had a standard machine?

Mr. YOUNG said the only way, to his mind, to sell electrical appliances to the public was for the manufacturers to advertise in the daily Press first. Salesmen should think of methods of educating servants. The only way to get washing machines into a house was by the hire-purchase system. As to high prices, he did not blame manufacturers entirely, because they had to do a great deal of experimental work, and if they got no return for that he was afraid there would be no inducement to try. Something might be done to reduce the noise of vacuum cleaners. Reductions in the price of electricity were necessary, and would lead to much business.

Mr. PRENTICE, speaking with regard to the noise of vacuum cleaners, suggested their installation in the cellars of houses, and plugs in each room, to which vacuum cleaners could be attached, so that the noise of the motor would be in the cellar and the weight would be reduced. As to the extensive use of washing machines in America, he had been told that they were used a great deal in factories for washing bolts and nuts, so that the domestic side was not the only outlet.

Mr. NOBBS did not consider the central dust removal plant scheme would be practicable except in such places as hotels and other large buildings. He did not think the noise was a serious disadvantage.

Mr. PARK supported the view that the big stores should be asked to help in bringing the value of electrical machines to the notice of the public. Once the demand was created the price would go down. The noise of the vacuum cleaner was a matter of the design of the motor, and directly the design was improved the cost would go up.

Mr. POOLEY urged the necessity for getting the architect and the builder to lay out a part of a house where all domestic duties could be performed, and where electric labour-saving appliances could be fitted up. There could be electric motors, and the whole of the apparatus could be driven from a short length of line shafting.

Mr. HARRISON, an American, dealing with the extensive use of washing machines in America, said the modern machine did not make much noise. It was extensively used in apartment houses in America, and the only noise was the hum of the motor, which was very small. A good many of the apartment houses in the United States were equipped with washing machines by the owners before the tenants moved in. With regard to methods of selling, when dealers were enthusiastic they would get busy; a dealer or salesman who had not sufficient faith in the apparatus he was selling to use it in his own home could not be successful.

Mr. PALMER urged that the supply authorities should do more to give a supply of electricity, and not keep people waiting for an indefinite period.

Mr. MORTON, in reply to the discussion, said he did not agree with the provision of drying apparatus with washers. Artificial drying made the clothes grey, unless bleaching powders, which were destructive of clothes, were used. The present day wringer was sufficiently large to his mind, because it would take the largest blanket that could be bought. With regard to prices, the £60 washing machine, he pointed out that the propaganda work had to be done mainly by manufacturers at the present time. As to maintenance

of washing machines, he suggested that free maintenance should be given for a time. Advertising was very necessary, but the biggest advertising campaign in the world would fail unless the general public could walk into a dealer's shop and see the goods. Many a dealer had not even a vacuum cleaner in his showroom, much less a washing machine. He did not favour the idea of going to the big stores. The contractors could get into more intimate touch with their customers than could the big stores. Although he agreed that the architect and the builder should be educated, they wanted to get electrical appliances into the houses already built. Whilst also agreeing that it was difficult to obtain connections for electricity, Mr. Beauchamp had told him that there were nearly a million houses electrically equipped in the country, so that if only a small proportion of those were supplied with appliances there would be a good return.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Benjamin" Lightmeter.

That there is a growing recognition of the vital importance of correct lighting in industry is evidenced by the many enterprising concerns which have entirely remodelled their lighting installations. In making these improvements it is necessary to decide how much light is needed for various industrial processes, and to have a means of verifying the results by actual measurement.

A little device recently perfected—the "Benjamin" lightmeter, fig. 1—meets these requirements. It consists of a compact and well-finished lightproof box, utilising inside a small lamp of known candle power which illuminates a graduated standard surface against which the actual illumination at any point can be compared. No technical knowledge is required to use the instrument effectively, and it can be carried about as easily as a small camera. It can be connected to any 4-volt (2-cell) accumulator or dry battery, and a certificate is supplied with each instrument by the manu-

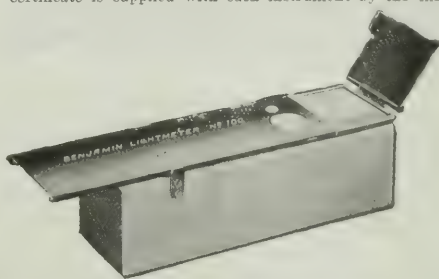


FIG. 1. THE "BENJAMIN" LIGHTMETER.

facturers showing the battery voltage and current used in the calibration of the scale. Photometric balance is obtained by moving the top screen backwards and forwards until the grease spot in the centre attains the same degree of luminosity as the comparison screen surrounding it. The illumination in foot-candles is then indicated in the opening immediately above. To measure candle power, the instrument is held at a definite distance in feet from the light source to be measured, with the screen directly facing it. The reading in foot-candles when multiplied by the distance squared will

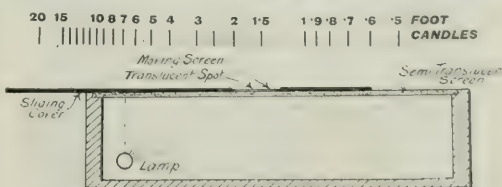


FIG. 2. INTERIOR OF LIGHTMETER, AND SCALE.

give the candle power of the source. The range of the standard instrument is from 0.5 to 20 foot-candles, but this can, of course, be varied for special purposes if desired. A section showing the interior is given in fig. 2, which also shows the graduation of the scale.

The lightmeter is made by BENJAMIN ELECTRIC, Ltd., Brentwood Works, Tottenham, N.17. The inventor and patentee is Mr. Haydn T. Harrison.

An Electric Siren.

Fig. 3 illustrates an electrically-driven siren, one of a number of types designed by Messrs. GARD & CO., LTD., Parady W. A., Leicester. This is a "two rotor" machine,

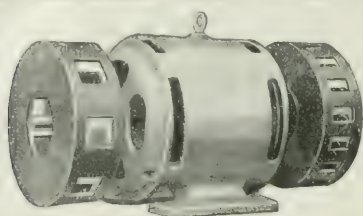


FIG. 3. A "TWO-ROTOR" SIREN.

one rotor having eight "voices" or vents, and the other sixteen. As many as eight rotors giving different tones can be supplied. An adjustable programming contact maker, for use with sirens is shown in fig. 4. This apparatus is driven by a variable clock movement, and contains an aluminium wheel, 12 in. in diameter, provided with 288 holes,

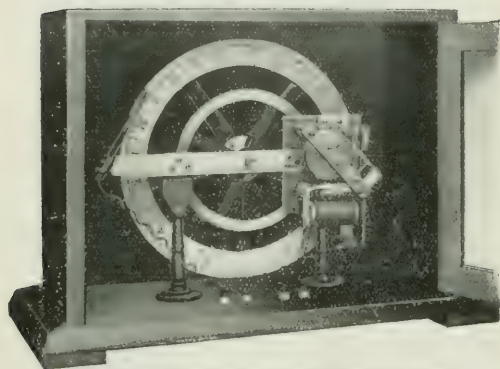


FIG. 4. ADJUSTABLE PROGRAMME CONTACT-MAKER.

representing every five minutes for 24 hours. By inserting pins into selected holes, any programme of times may be fixed. These pins make contact by pressing two springs together for a few minutes before the signal is required, and when the actual moment arrives, another pair of contacts is made, completing the circuit of a relay which cuts in the power to the siren.

A Pulpit Lighting Fitting.

THE LORAIN FITTINGS CO., LTD., 57, Abchurch Road, Aston, Birmingham, the patented and sole manufacturer of the "Classic" pulpit or desk fitting described in the *ELECTRICAL REVIEW* some time ago (17/12/20, p. 799), has introduced a less expensive fitting on the same lines. The diameter of the reflector is 12 in. and its length 6 in. One lamp only is fitted, adjustment is made by the movement of the swivelled legs. The fitting has been named the "Classic Junior."

Electricity for Collieries.—In a paper on "Public v. Private Supply from a Colliery Standpoint," recently read before the Yorkshire branch of the Association of Mining Electrical Engineers, Mr. Robert Nelson sums up as follows: In mines where no electrical plant exists, and where it is desired to supplant steam winders, &c., there is no question but that a supply from a public undertaking is to be preferred. This, not only on account of the initial cost of an installation, but also because of the intermittent nature of a colliery load, which necessitates the putting down of a large plant, which will have to give a light output for long periods. In the case of collieries which already have some generating plant of moderate efficiency, the author considers that a change from private to public supply will almost always be found beneficial, mainly for the same reason—high peaks of short duration. Public supply authorities, who, at first, were dubious about accepting a colliery load, can be approached that the possibility of making a better use of their own plant, to generate power, and to sell the surplus to the public, is a task they are therefore now generally agreeable to supply on specially-arranged terms. Where a colliery has a large surplus of coke-oven gas, it is possible to utilize this as a source of power, with a view to the production of electricity. The author's remarks when excess energy is available.

HIGH TAXATION: ITS CRUSHING EFFECT ON INDUSTRY.

The following is a copy of a letter which was forwarded on December 19th to Sir Robert Horne, the Chancellor of the Exchequer, by Col. O. C. Armstrong, the President of the Federation of British Industries. The mass of evidence collected by the Federation from the chief industrial centres of England, Scotland, and Wales shows that the present burden of taxation is crippling the efforts of manufacturers to recover and extend their foreign markets, and is stifling the possibility of a trade revival, which is so urgent if an alleviation of the present unemployment position is to be brought about.

The Federation in this communication warns the Government of the certain consequences that will result if taxation on industry is maintained at its present high level. As already stated in the *ELECTRICAL REVIEW*, the organisation is pressing the Chancellor of the Exchequer for a reduction of the Income Tax and the abolition of the Corporation Profits Tax.

[CONT.]

To The Rt. Hon. Sir Robert S. Horne, G.B.E., K.C., M.P.,
The Treasury,
Whitehall, S.W.1.

SIR,

The Federation of British Industries has just completed its annual investigation into the effects of the past year's taxation, and the views of industry as to the future. In the course of this investigation general meetings were held at Sheffield, Nottingham, Bristol, Swansea, Leicester, Dundee, Edinburgh, Glasgow, Newcastle, Northampton, Birmingham, Liverpool, Manchester, Bradford, and Leeds, at which unanimous resolutions in the most emphatic terms were passed demanding the abolition of the Corporation Profits Tax and an immediate and substantial reduction in the rate of the Income Tax.

The fall of prices and values during the past year has been unprecedented both in extent and rapidity, with the result that the effects of taxation have been felt by industry with peculiar severity.

The capital resources of many industries have already been strained to the utmost by the need for larger working capital to meet post-war conditions of production, and the operations of the Excess Profits Duty have prevented the accumulation of reserves sufficient to meet so serious a crisis, while enormous local taxation and the Corporation Profits Tax still further depleted the available resources of industry during the year.

Under these circumstances the burden of Income Tax at a high rate, assessed upon the average of the three years which included the greatest industrial boom in history, has assumed crushing proportions, and many firms have already been driven to impair their future productive capacity by paying the current year's taxation out of capital or by loan.

It is fully realised that high taxation has only been one among the many contributory causes of the present depression. It is, however, the only one of these causes which can be mitigated promptly by the independent action of His Majesty's Government.

The chaotic condition of the exchanges, the adverse financial and political conditions prevailing in many of our principal markets, and the general disorganisation of the world's commercial system are all susceptible of remedy, but the remedy will take time, and most of these factors will still be in operation to restrict trade and hamper production during the forthcoming year.

Under these circumstances it was the unanimous opinion of the District General Meetings that any attempt to maintain taxation at its present level during the forthcoming year must at best seriously retard any industrial recovery, and at the worst may involve a permanent diminution in the productive capacity of the country.

The evidence brought forward at these meetings by speakers from all industries showed that the present rate of taxation is stifling initiative, postponing development, and crippling the efforts of manufacturers to recover and extend the foreign markets, which are now of such vital importance to the welfare of the country.

The Federation warned the Government last year that industry anticipated the most serious results from a continuance of high taxation. The meetings of this year afford overwhelming evidence that this warning was fully justified, and have disclosed the gravest alarm as to the future if the present level of taxation is maintained.

The Federation desire to urge you most earnestly to consider the grave danger to the economic position of the country which will be involved by disregarding this warning a second time, and to realise that the question is not now one of mere hardship or even of possible disaster to individual firms, but whether the whole industrial life of the country can possibly withstand any prolongation of the strain to which it has been subjected.

They feel that it is outside their province to suggest to you the means by which a sufficient reduction of taxation could be rendered possible. They wish, however, to place on record their conviction that under the present circumstances Government activities must be reduced substantially below their pre-

war level. They are fully aware that such a reduction will involve the sacrifices of many activities admirable in themselves and valuable to the country, but it is, in their opinion, better to face these sacrifices now when so doing may avert still more serious consequences, than to postpone them to a future date, when the ruin of industry and a dwindling revenue will force them upon the country.

They trust that the Committee which has been sitting under the chairmanship of Sir Eric Geddes will be able to suggest to you economies sufficient to enable the necessary reduction in taxation to be effected immediately, since they are convinced that such a reduction would have a psychological effect both at home and abroad which would be of the utmost value at the present moment in restoring confidence and enterprise, and indeed might of itself alone provide a sufficient stimulus to start the revival of trade which is so urgently needed.

They are firmly convinced that a substantial reduction of taxation would in a short time so increase the general volume of trade as to yield a larger revenue than could possibly be hoped from its maintenance at a higher level.

The Federation feel that they would fail in their duty as the responsible and representative organisation of industry in this country if they did not use their utmost endeavours to impress upon you and upon His Majesty's Government their firm conviction that any step, however bold, is preferable to the certain consequences of the maintenance of taxation at its present level.

I am, Sir,

Your obedient servant,

O. C. ARMSTRONG,

President.

December 19th, 1921.

THE DUNDEE SYSTEM OF HEAVY-DUTY HOUSE WIRING.

MAJOR H. RICHARDSON, electrical engineer to the Corporation of Dundee, who is one of the most prominent supporters of reform in methods of charging for electricity, hold also that in the lay-out and erection of "all electric" house installations the methods of wiring on the multiple distribution or central distribution systems, generally used are much too costly and cumbersome, if it is the intention to use electricity for heating and cooking purposes or for any of the other uses to which it may be put. "All-electric" houses, so far as the wiring goes, would appear to be an effort to reinforce the walls of the house by means of cables, or conduit, culminating in long rows of

supply is being given on the two-part rate of charge for all purposes). Metallic sheathed surface wiring is used throughout. From the street service connection, at which point there is the usual d.p. switch and fuses, a main lead wire of suitable capacity (not less than 7/020) is taken round the passages, landings or corridors of each floor of the house. Depending on the style, shape, and size of the house, it may often be possible to run one "arterial" main for the whole building and, where necessary, make a "ring" main of it. The main wires are kept at the height of the architecture of the doors. All possible advantage, of course, being taken of existing mouldings to hide the presence of the cable, to which any of the present day surface wiring systems admirably lend themselves. Over each doorway is placed a d.p. porcelain bridge (see Fig. 1), comprising two bridge fuses, 6d and not less than 25 A capacity) into which the "arterial" main is looped as it runs from doorway to doorway. From each set of fuses another "arterial" main (not less than 3/000) is run round each room at about the height of the door or picture-rail, and can, if required, also be completed as a "ring" main. From these auxiliary mains and fuses controlling the respective rooms are then taken the necessary lamp leads and heating and cooking plugs. The lighting of the living rooms and bedrooms has been carried out by bracket fittings on the walls (figs. 2 and 3), the whole of the lights and power plugs in the respective rooms being controlled by a s.p. master switch placed at a convenient height on the wall at the door. Each bracket is given a projection of about 18 in., and is fitted with an inverted type shade giving an indirect effect from the ceiling. An extra switch lampholder is shown fitted to the elbow of some of the brackets, for connecting up small auxiliary apparatus, such as kettles, toasters, irons, &c., but in practice these were not found satisfactory, and it has been decided to substitute a two-pin 5-A socket and plug mounted on the base block of the bracket light. Each bracket light has a switch lampholder fitted with "chain-pull" action. It should be the endeavour to place these bracket fittings from 2 ft. to 2 ft. 6 in. from the ceiling, and they should be placed on opposite walls in equal numbers, depending on the size of the room to be lit. The wall sockets and plugs with the control switches are brought down and fixed on the wall within easy reach (generally at a height of 4 ft. 6 in.) at whichever part of the room the heating or cooking apparatus is required. As a rule, the lighting brackets are kept at about the height of the main wire running round the room.

The chief advantages claimed for such a method of wiring are that there is always at hand a heavy main to each room, which can be conveniently and easily tapped for extensions; fusing devices are cut down to a minimum; separate systems and central distribution boards are unnecessary; expensive



FIG. 1.—THE HALL, SHOWING D.P. FUSES OVER DOORWAYS.



FIG. 2.—THE DRAWING ROOM, SHOWING INVERTED REFLECTOR.



FIG. 3.—A BEDROOM. BOWLE-FIRE PLUGGED INTO SWITCH-BOX.

distribution fuses fitted in glass cases, in perhaps three or four parts of the house, and finishing up at the meter with elaborate porcelain handle fuses and d.p. main switches needing only a switchboard attendant for operation and maintenance to complete the picture.

We have only to watch our gas competitors pipe and fit up a similar house to realise that if electricity is to make any headway at all existing methods of wiring must be altered and brought down to the level of the common gas main, run all over the house and tapped off as required for lighting, cooking, or heating. Gas has all along offered a single medium for lighting, heating and cooking, and electricity can now do likewise through the introduction of the multi-part tariff, so far as the rates of charge are concerned.

With this purpose in view the Dundee Corporation Electricity Supply Department recently drew up a special lay-out in wiring and fitted up a seven-roomed house, including the usual scullery, kitchen, and bathroom. Briefly, the method of wiring adopted is as follows (it being assumed that a bulk

ceiling fittings or electroliers are done away with; a complete installation for lighting, heating, and cooking can be carried out quickly and expeditiously in houses at present using other methods, without a great deal of preliminary work and with a minimum of trouble and annoyance to the tenant; and the installation can be added to with ease on the rare occasions when this would be necessary.

It might, of course, be argued that switching has been reduced much below requirements, and that the installation generally is crude and old-fashioned, being laid out somewhat on the lines of the old "tree" distribution system. To a certain degree that may be so, but the average house installation is generally only fitted up to meet existing needs, consequently, when it is the wish to add one or two radiators or a small cooking stove, the workmen have to be called in to run a special circuit right back to the service connection, the existing installation in nearly every case being much too weak to carry any of the present day apparatus for heating and cooking.

exceed that for which the locomotive was designed, the work done may, for short periods, be greatly in excess of the average. The result of this is that the speed, when climbing a gradient, can be much greater with an electric locomotive than with a steam locomotive of the same nominal horsepower, because the extra work done by the former is compensated for by the light duty during periods of running on the level and on falling gradients when the motors have time to cool down.

The limitation of boiler capacity in the case of a steam engine combined with the different characteristics of steam and electric locomotives, gives the latter an additional advantage in the question of speed on gradients. As the governing factor in the power of a steam engine is the capacity of the boiler, which is practically a fixed quantity, the horse-power output of the locomotive is approximately constant over a wide range of speed. In other words one maximum pull of an electric locomotive can be maintained until a certain definite pre-arranged speed is attained; whereas a steam locomotive can only exert its maximum pull at the moment of starting, after which the pull is reduced as the speed increases. Thus the speed of the train falls to a marked extent whenever the train has to climb a gradient. This reduction of speed on a gradient is not nearly so marked in the case of the electric locomotive, for there being no similar limitation to the amount of power available, the relation between speed and tractive effort is quite different, and the demand for greater tractive effort is supplied by a higher output from the power supply system. Thus, when determining the initial characteristics of an electric locomotive for a given service, the speed up the ruling gradient can be fixed at any desired value; and since the efficiency is practically constant over a wide range of load, the speed on the level can be maintained at the same value, if desired, without loss of efficiency. In comparison with steam engine working, where the speed is greatly reduced on a gradient, this enables a much higher average speed to be maintained over the whole line; which is equivalent to saying that with electric working the general average speed can be considerably increased without any increase in the maximum speed.

If other factors, such as drawgear and braking facilities permit, this characteristic of electric locomotive operation would allow goods trains to travel at an average speed more nearly approaching that of passenger traffic. The result of this would be a more regular flow of traffic over the line, and the necessity for side-tracking the goods trains to allow passenger trains to pass would be reduced. It is a fact that a higher general average speed of travel increases the total capacity of the line.

In certain cases, owing to this characteristic alone, where a line is being worked at its maximum capacity under steam operation, and is yet unable to deal with the required traffic, a substitution of electric for steam engine working would avoid the necessity for incurring large capital outlay in doubling or quadrupling the track and providing additional passing places, &c., which would have to be undertaken in order to work the traffic without gaining the additional advantage obtained by electrification.

A further advantage which can be obtained owing to this increased average speed of travel is better traffic working. In dealing with the traffic carried a greater number of trains can be run, and these trains complete their journeys in less time than with steam working, thus enabling better use to be made of the available rolling stock. This is particularly true in the case of goods wagons. The percentage increase in the speed will be greater in the case of the goods than in the case of the passenger trains, and so the saving in wagons, due to the increased mileage which wagons will be able to work annually, will be particularly striking.

As an example of the savings which may be effected in certain cases directly due to the advantage of electric locomotive operation as just stated, the following data may be given. These data refer to a length of single track on an existing steam railway. The data have been worked out, as it has now been decided to make a start with the electrification of this section. It should be stated that the case cited is one particularly favourable to electrification, and it must not be assumed that the advantages and gains expected from its electrification could be obtained in other less favourable cases. The length of the line is some 250 miles, mainly single track, and containing in many places exceptionally steep gradients, reverse gradients, and sharp curves.

The total goods traffic under the conditions obtaining in 1918 was some 13,000 tons per day dispatched in the direction of falling grades, but the traffic is rapidly increasing and the estimates are worked out for an assumed traffic 50 per cent. in excess of this. In order to carry this traffic it was estimated by the Railway Company that it would have to make deviations, &c., which practically amounted to providing double track for some 200 miles and building a new line over lighter grades in parts.

Electrification will obviate the greater part of this expenditure. The line as worked under steam conditions is divided up into six sections, and the train load differs for each section. With electric operation this frequent breaking-up of trains would be unnecessary, and the full-weight trains would be hauled right through, without alteration.

This re-organisation was calculated to effect a reduction in the annual train mileage of through goods trains, of about

25 per cent. for the same total ton mileage. At the same time the average speed of travel would be increased, the total time for the double journey being reduced from about 56 hours to 26. The saving in new wagons due to this acceleration of service was estimated to amount to approximately 423 40-ton wagons, or the equivalent.

Partly as a result of the increased average speed and partly as a result of the longer time that electric locomotives can be kept in service as compared with steam engines, a considerable saving can be effected by electrification in the total number of engines that is required to deal with any given volume of traffic. On the Chicago, Milwaukee and St. Paul Railway, 45 electric locomotives have replaced 112 steam locomotives.

Electrification has enabled about 30 per cent. more tonnage to be dealt with in about 80 per cent. of the time formerly required under steam operation, which means an effective increase in the capacity of the line due to electrification of 32.5 per cent.

Due to its uniform turning efforts, the electric locomotive has a further advantage when starting trains. In the case of the electric engine the increase of the effort at starting above the normal effort is greater than in the case of the steam engine, and can be kept up for a longer time. For example, take the case of the passenger locomotive whose average or continuous rating is 1,400 b.h.p. If such an electric engine started with a pull of 17 tons, it could maintain this pull up to a speed of 45 m.p.h. At this point the b.h.p. exerted is about 1,900. If necessary when accelerating up a steep grade, this locomotive can produce as much as 3,000 b.h.p.

The result of this is that trains started by electric locomotives can get away quicker than if started by steam engines of equivalent average rating. The advantage of this is chiefly apparent in the case of stopping passenger trains, when by increasing the acceleration, the average speed can be considerably raised, and goods trains when starting from intermediate stations, and especially when coming out of refuge sidings after a passenger train has passed. If an electric engine stands for an hour on an up grade there is no reduction in its maximum pull. When a steam engine stands for some time the cylinders are cooled, and the engine cannot exert its maximum pull until they are heated to about the temperature of the entering steam. It has been observed that this reduction of pull due to cool cylinders is as much as 25 per cent.

As there is no necessity for taking in water for electric locomotives—with the exception of the small quantity that may be required to steam-heat existing passenger stock in certain cases—it is unnecessary to provide either water columns or troughs on lines designed for electric operation. Similarly, there is no need to provide coaling stations, coaling plant or ashpits for electric operation. When an existing line changes over from steam to electric working, the delays caused by taking in water or fuel and raking out ashes are eliminated. Again, electric locomotives are designed for double end driving, and there is no need for turntables or the delays in turning engines; thus in these items, time can again be saved and added to the useful working time that the engine is in service. Further, because the electric locomotive requires no attention whatever whilst lying by, a saving can be effected in the crew's time, since it is unnecessary for an electric locomotive to be in charge of the crew while it is lying over. It can be locked and left in a safe place. In the case of a steam engine the time occupied in ineffective locomotive duties is over 25 per cent. of the total enginemaster's time.

A very serious disadvantage of steam operation is that the steam engine radiates heat and uses coal all the time that steam is up, that is during many hours when it is doing no work, and either standing by or coasting. On the other hand, the electric locomotive uses no power whatever (except for lighting and heating the cab) unless actually running and doing work. This saving in fuel consumption, rendered possible by the adoption of electric working, is becoming increasingly important as the high price of coal suitable for steam locomotive firing is more and more pronounced. But the main fuel saving which can be introduced by electric operation, is due to the very much more efficient combustion of fuel in power stations, than on individual engines. This is one of the greatest advantages to be obtained by electrification.

On the Chicago, Milwaukee and St. Paul Railway, one unit of electrical energy does the work of between 6 and 7 lb. of coal on steam locomotives. With an up-to-date power station, a unit of electricity is produced with less than 2 lb. of coal.

(To be concluded.)

The British Industries Fair (Birmingham).—There is an entry of 500 exhibitors, and many of the exhibits will be much larger in bulk than previously. On January 1st the work of equipping the three great aerodrome sheds at Castle Bromwich will be commenced. This section of the fair will again be under the joint organisation of the Birmingham Municipality and the Chamber of Commerce. The president is the Lord Mayor of Birmingham, and Mr. H. O. Worrall (Worrall & Co., Ltd., leather manufacturers) is the chairman of the council.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STRATHANS, Chartered Patent Agents, 285, High Holborn, London, W.C.1.

- 32,968. "Electric motor drives for calculating machines." Optische Anstalt Dr. Giese, Vgl. Ges., December 8th. (Germany, December 11th, 1920.)
 32,971. "Automatic induction coil for transmitting and receiving circuits." G. H. Meely, December 8th. (United States, December 14th, 1920.)
 32,976. "Oscillation generators." Western Electric Co., Ltd. December 8th. (United States, December 22nd, 1920.)
 32,977. "Telephone systems." Western Electric Co., Ltd. (Western Electric Co. Inc.) December 8th. (United States, December 14th, 1920.)
 32,981. "Motor-operated sound-producing letters for motor vehicles." Hages and H. Lages, December 8th. (Germany, December 8th, 1920.)
 32,982. "Incandescent electric lamp holders." J. R. Sibbs, December 8th. (United States, December 14th, 1920.)
 32,987. "Transmission of soundings to computers in dynamo-electric machines." W. B. Sayers, December 8th. (United States, December 14th, 1920.)
 32,997. "Devices for registering telephone calls." J. Hutcheson and J. Hutcheson & Co., December 8th. (United States, December 14th, 1920.)
 32,999. "High-frequency telephony." Ges. fur Drahtlose Telegraphie und H. Gewecke, December 8th. (Germany, January 26th.)
 33,011. "Cross current recouling installations." C. Kohler, December 8th. (Switzerland, December 31st, 1920.)
 33,033. "Apparatus for reducing interference of atmospheric, &c., disturbances during the reception of wireless telegraphic signals." J. K. Hele, December 9th. (United States, December 14th, 1920.)
 33,042. "Emergency portable signalling apparatus for mines." T. Hall, December 9th. (United States, December 14th, 1920.)
 33,047. "Railway or tramway rail joints." E. C. Strong, December 9th. (United States, December 14th, 1920.)
 33,051. "Electrical switches and operating gear therefor." W. G. Pipkin and Verity's, Ltd., December 9th. (United States, December 14th, 1920.)
 33,060. "Electric fuse boards." Cable Accessories Co., Ltd., A. Crawford, and F. H. Reeves, December 9th. (United States, December 14th, 1920.)
 33,098. "Electric feeder connectors for contact rails on electric railways." Callender's Cable & Construction Co., Ltd., P. V. Hunter, and J. Mather, December 9th. (United States, December 14th, 1920.)
 33,099. "Supports for electric cables, pipes, &c." Callender's Cable and Construction Co., Ltd., R. A. D. Macalister, and J. S. McCallum, December 9th. (United States, December 14th, 1920.)
 33,119. "Means for mounting and driving magneto-electric machines." J. W. Temple, December 9th. (United States, December 14th, 1920.)
 33,121. "Spark plug." J. E. Temple, December 9th. (United States, December 14th, 1920.)
 33,128. "Multi-pole sparking plug." F. L. Eldridge, December 9th. (United States, December 14th, 1920.)
 33,129. "Machine switching telephone exchange systems." Coventry Automatic Telephones, Ltd. (F. R. McBERT) and Peel-Conton Telephone Works (McBERT), December 9th. (United States, December 14th, 1920.)
 33,132. "Process for increasing frequency." H. Sefton-Jones (Lorenz Akt. Ges.), December 9th. (United States, December 14th, 1920.)
 33,135. "Apparatus for production of high-tension unidirectional electric currents." H. E. Donithorne, December 9th. (United States, December 14th, 1920.)
 33,137. "Electric heating systems." G. E. Fox and H. G. Hayes, December 9th. (United States, December 14th, 1920.)
 33,151. "Apparatus for electrically precipitating suspended particles from fluids." Siemens Schuckertwerke, December 9th. (Germany, January 14th.)
 33,153. "Electricity meters." W. Cross (Morley), December 9th. (United States, December 14th, 1920.)
 33,154. "Appliances for electric arc welding." A. P. Strohmer, December 9th. (United States, December 14th, 1920.)
 33,160. "Transformers." E. Vedovelli, December 9th. (United States, December 14th, 1920.)
 33,171. "Apparatus for electrically precipitating suspended particles from fluids." Siemens Schuckertwerke, December 9th. (Germany, January 26th.)
 33,196. "Electrical floor and tile tale for carburetors of internal-combustion engines." T. Cockerill, December 10th. (United States, December 14th, 1920.)
 33,212. "Boards for charging torch accumulators." W. E. Pollard, December 10th. (United States, December 14th, 1920.)
 33,221. "Electrically-heated kettle, &c." A. L. Large, December 10th. (United States, December 14th, 1920.)
 33,229. "Intermittently operating electrically actuated devices." Magneta Time Co., Ltd. and B. Schaeffer, December 10th. (United States, December 14th, 1920.)
 33,234. "Combination couplings for electric conductors." L. M. Waterhouse, December 12th. (United States, December 14th, 1920.)
 33,288. "Electrolytic rectifiers." H. W. Richards, December 12th. (United States, December 14th, 1920.)
 33,306. "Process for manufacture of commutators for electric generators and motors." O. D. Miller, December 12th. (United States, December 14th, 1920.)
 33,349. "Drying means for electric mechanical pocket, &c., lamps." A. O. French-Brewster, December 12th. (United States, December 14th, 1920.)
 33,353. "Means for obtaining telephonic modulation of high-frequency oscillations." O. D. Miller, December 12th. (United States, December 14th, 1920.)
 33,354. "Oil-brake switch with resistance." Maschinenfabrik Oerlikon, December 12th. (Switzerland, December 10th, 1920.)
 33,368. "Interrupter for metal-vapour apparatus ignited by high-tension impulses." J. C. F. Rine, December 12th. (Austria, December 11th, 1920.)
 33,372. "Electrically-operated clocks." C. F. Johnston, December 12th. (United States, December 14th, 1920.)
 33,386. "High-tension condensers." E. Pfiffer, December 12th. (Germany, January 5th.)
 33,404. "Cutting-device for travelling threads or filaments." W. Pool and Vickers, Ltd., December 12th. (United States, December 14th, 1920.)
 33,419. "Aerials for wireless signalling." H. T. Ellis, December 13th. (United States, December 14th, 1920.)
 33,420. "Magneto-electric devices." R. Bosch Akt-Ges., December 13th. (Germany, December 13th, 1920.)
 33,422. "Electric switches." R. H. Hancock and G. A. Russell, December 13th. (United States, December 14th, 1920.)
 33,424. "Electric lighting plants for motor-vehicles, &c." E. B. Colinhham & C. J. A. Owen, December 13th. (United States, December 14th, 1920.)
 33,428. "Electric cable sheathed insulated wires and cables for electric wiring systems." E. J. Clarke, December 13th. (United States, December 14th, 1920.)
 33,434. "Device for locking electric-lamp bulbs to sockets." H. F. D. Jacob, December 13th. (United States, December 14th, 1920.)
 33,435. "Electric switches." C. C. Garrard, A. E. McColi & A. H. Railing, December 13th. (United States, December 14th, 1920.)
 33,442. "Electric resistances." L. E. Hopkins, December 13th. (United States, December 14th, 1920.)
 33,445. "Numbering-machine for telephone calls." C. Paul, December 13th. (United States, December 14th, 1920.)
 33,466. "Auto transformer." A. Della Riccia, December 13th. (Germany, December 14th, 1920.)
 33,470. "Automatic electric cut-outs or interrupters." L. Kahn, December 13th. (Germany, December 13th, 1920.)
 33,473. "Electromagnetic wave-receiving and amplifying systems." F. J. Jones, December 13th. (United States, December 14th, 1920.)
 33,476. "Electric clocks, time recorders, &c." J. W. Miles & J. S. Powell, December 13th. (United States, December 14th, 1920.)
 33,480. "High-temperature electric furnaces." Westinghouse Lamp Co., December 13th. (United States, December 14th, 1920.)
 33,533. "Insulator for high-pressure electric lines." A. Renaudin, December 13th. (United States, December 14th, 1920.)
 33,534. "Electrical measuring of sounds or mechanical vibrations." J. R. Jordan & Hoffmann Manufacturing Co., December 13th. (United States, December 14th, 1920.)
 33,536. "Cleaning or regenerating plants of accumulators." R. G. Reid, December 13th. (United States, December 14th, 1920.)
 33,549. "Thermionic valve relays." E. Pollock, December 13th. (United States, December 14th, 1920.)
 33,550. "Valves for controlling supply of current to node of valve of continuous wave transmitter." A. Onwood, December 14th. (United States, December 14th, 1920.)
 33,556. "Slip rings for electrical generators." R. Bosch Akt-Ges., December 14th. (Germany, December 14th, 1920.)
 33,559. "Telephone call cutting, registering, and recording apparatus." T. G. Anderson and G. H. Harrison, December 14th. (United States, December 14th, 1920.)
 33,561. "Means for mounting and driving magneto-electric machines." J. Davies and Co., December 14th. (United States, December 14th, 1920.)

- 33,567. "Electric heating of tools of edge-setting, &c., machines." British United Shoe Machinery Co., Ltd. (United Shoe Machinery Corporation), December 14th. (United States, December 14th, 1920.)
 33,569. "Model electric motor." L. Myne, December 14th. (United States, December 14th, 1920.)
 33,580. "Connections for electric cables, &c." E. W. Hill, December 14th. (United States, December 14th, 1920.)
 33,591. "Electric traction motors." J. W. Hanson, December 14th. (United States, December 14th, 1920.)
 33,614. "Apparatus for registering telephone calls." D. Rosen, December 14th. (United States, December 14th, 1920.)
 33,619. "Means for preventing removal, &c., of electric lamps, &c., from their sockets." A. S. Dorsey, December 14th. (United States, December 14th, 1920.)
 33,634. "Coin-collecting means for telephones." F. W. Hall, December 14th. (United States, December 14th, 1920.)
 33,635. "Meter registers and control devices for telephones." F. W. Hall, December 14th. (United States, December 14th, 1920.)
 33,647. "Electric-motor control systems." Westinghouse Electric and Manufacturing Co., December 14th. (United States, December 14th, 1920.)
 33,649. "Incandescent lamps." British Thomson-Houston Co., Ltd. December 14th. (United States, January 18th.)
 33,654. "Electrical connecting-devices and lamp-holders." C. J. Marshall, December 14th. (United States, December 14th, 1920.)
 33,657. "Armatures of electrical machines." G. H. Fletcher & Metropolitan-Vickers Electrical Co., Ltd. December 14th. (United States, December 14th, 1920.)
 33,663. "Electric device for destroying rats." D. Marshall, December 14th. (United States, December 14th, 1920.)
 33,701. "Safety vents for electric motor cases, switchboxes, junction boxes, &c." F. W. Close and Electric Construction Co., Ltd. December 15th. (United States, December 15th, 1920.)
 33,706. "Marking and identifying conductors of multi-conductor electric cables, &c." E. T. Williams, December 15th. (United States, December 15th, 1920.)
 33,717. "Electric resistances." R. Amberton, December 15th. (United States, December 15th, 1920.)
 33,726. "Thermo-dynamic apparatus." J. F. J. Malone, December 15th. (United States, December 15th, 1920.)
 33,731. "Ignition coil and sparking plug tester." I. Buckley, December 15th. (United States, December 15th, 1920.)
 33,733. "Bringing into and out of electric circuit an inductive resistance or choke." W. Langdon-Davies and A. Soames, December 15th. (United States, December 15th, 1920.)
 33,747. "Electric drive for talking-machines." F. C. Ker & A. McGregor, December 15th. (United States, December 15th, 1920.)
 33,762. "Apparatus for localisation of faults in cables and insulated conductors." V. Planer, December 15th. (Germany, December 3rd.)
 33,779. "Electric fuses." W. Clark, December 15th. (United States, December 15th, 1920.)
 33,785. "Fusible devices for protecting electric circuits." Metropolitan-Vickers Electrical Co., Ltd. December 15th. (United States, January 25th.)
 33,794. "Thermionic generators." H. J. Round, December 15th. (United States, December 15th, 1920.)
 33,792. "Electrical adapters, plugs, &c." A. E. Morgan and J. Saynor, December 15th. (United States, December 15th, 1920.)
 33,796. "Electric lamps." J. W. Jones & Thor Electric Safety Lamp Co., Ltd. December 15th. (United States, December 15th, 1920.)
 33,807. "Electric couplings." W. J. Lovell & S. B. Pratley, December 15th. (United States, December 15th, 1920.)

PUBLISHED SPECIFICATIONS.

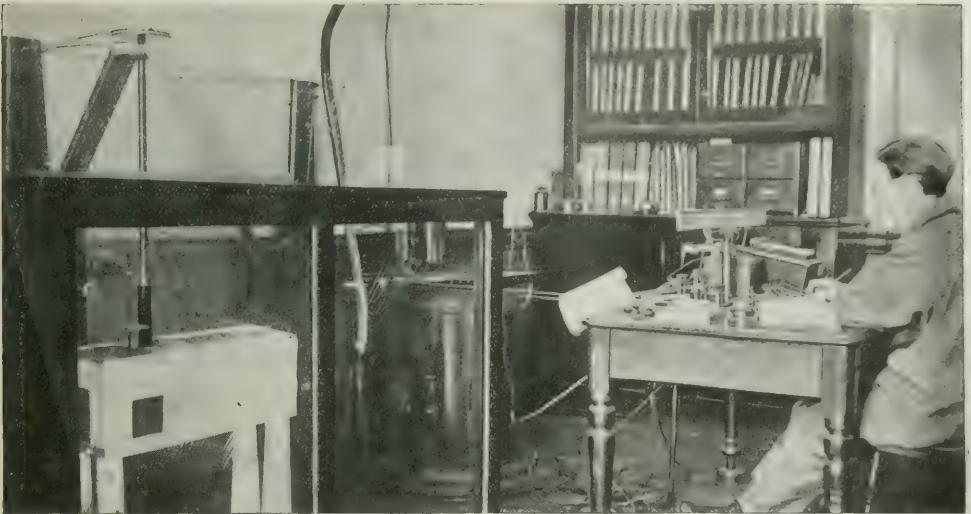
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

- 14,093. "Electric heaters for heating liquids." E. C. R. Marks (Langguth and Haug), May 21st, 1920. (172,066.)
 15,075. "Electromagnetic relays." Creed & Co., Ltd., & T. Lenaghan, June 3rd, 1920. (172,041.)
 18,277. "Automatic switch for distant control." L. L. E. Chauveau, April 3rd, 1919. (146,336.)
 25,084. "Electric current regulating devices." W. H. Glaser & W. H. Glaser, Ltd., July 23rd, 1920. (Cognate application 35,650/20.) (173,055.)
 33,126. "Spark-plugs for internal-combustion engines." L. Gillette, August 6th, 1920. (172,069.)
 24,435. "Apparatus for utilising the energy of waves." A. Beldimano, August 23rd, 1920. (172,478.)
 34,593. "Electrically-driven motor wheels for automobiles and other road vehicles." G. A. Bishop & R. A. Chadwick, August 25th, 1920. (172,088.)
 24,554. "Insulating chain for electric transport lines." E. L. Gely, August 25th, 1920. (172,091.)
 24,835. "Electric discharge lamps." H. Filippo, D. Lely, Jun., & Naamloze Vennootschap Philips' Gloeilampenfabriek, August 27th, 1919. (150,692.)
 34,839. "Electric arc-welding systems." Wilson Welder & Metals Co., Inc., June 26th, 1920. (165,760.)
 24,975. "Electric switches and enclosure boxes therefor." Simplex Conduits, Ltd., & H. F. McLoughlin, August 30th, 1920. (172,102.)
 25,023. "Electric heater." R. J. Frost, August 30th, 1920. (172,104.)
 25,033. "Telegraphic-receiving and transmitting apparatus." E. C. R. Marks (J. A. L. Horn), August 30th, 1920. (172,105.)
 25,125. "Means for limiting change of speed in alternating-current generators." T. F. Wall, August 31st, 1920. (Cognate application 13,971/21.) (172,112.)
 25,264. "Stopping or slowing of electric motors." E. M. Medway, E. C. Smith, & A. S. Medway, September 1st, 1920. (172,122.)
 25,390. "Valve transmitters and receivers for wireless telegraphy and telephony." A. K. Macrorie, H. Morris-Airey, and G. Shearing, September 2nd, 1920. (172,127.)
 25,464. "Automatic electric sub-station systems." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric & Manufacturing Co.), September 3rd, 1920. (172,131.)
 25,477. "Electrolytic rectifier cell." J. Kremenzky (firm of), March 14th, 1918. (150,388.)
 26,419. "Electrical turning-gear for starting internal-combustion engines." F. H. Royce, September 13th, 1920. (172,153.)
 27,333. "Starting and holding system for use on motor vehicles." Soc. Anon. des Anciens Etablissements Hotchkiss et Cie., and H. M. Ainsworth, September 26th, 1920. (172,167.)
 27,558. "Electrical switchgear." D. R. Davies & Metropolitan-Vickers Electrical Co., Ltd., September 28th, 1920. (172,170.)
 29,085. "Spark-plugs." A. J. H. Elverson, October 14th, 1920. (172,185.)
 29,189. "Automatic and semi-automatic telephone instruments." Siemens Bros. & Co., Ltd., & Siemens, October 15th, 1920. (172,186.)
 29,383. "Electric indicator boards and the like." E. G. Eriksson & K. G. Jonsson, October 18th, 1920. (172,187.)
 29,891. "Spark-plugs." O. Meissner, June 11th, 1920. (164,705.)
 30,135. "Electrically-driven planers and the like." L. Miller & Metropolitan-Vickers Electrical Co., Ltd., October 26th, 1920. (172,192.)
 34,847. "Attachment or fastening-device for supporting gas and electrical fittings, pendants, and the like." G. H. Tonks, December 10th, 1920. (172,223.)

1921.

- 1,422. "Braking-systems for electrically-driven vehicles." British Thomson-Houston Co., Ltd., March 25th, 1918. (157,721.)
 6,452. "Electrolytic device for increasing the speed of ships." E. Duteil, March 16th, 1920. (160,459.)
 31,135. "Arrangement of neutral point resistances for electric high-tension transmission system." Allmann Svenska Elektriska Aktiebolaget, April 16th, 1920. (161,555.)
 17,399. "Electro-magnetic wave-receiving arrangements." Soc. Francaise R.-E.-Electrique, November 3rd, 1916. (Dividend application on 146,304.) (165,428.)
 29,491. "Incandescent electric lamps." E. A. Hailwood, August 25th, 1920. (Dividend application on 24,597/20.) (172,267.)



HENLEY RESEARCH

No. 5.

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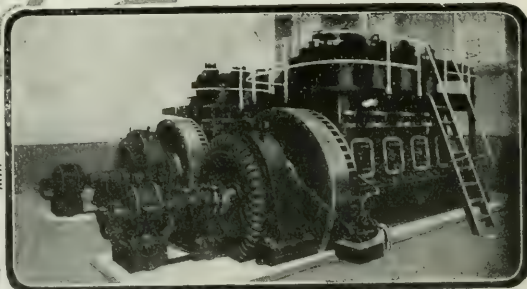
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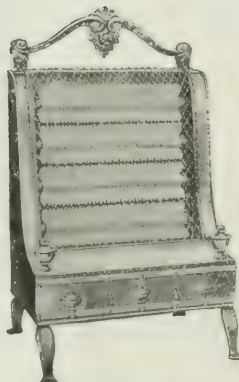
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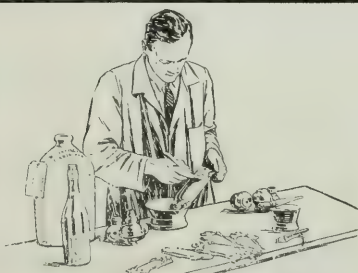
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[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

AYR.—Premises for Dockie, Paterson & Reddick, 22-26, Wallace Street.

BLAUBURN.—Reconstruction of Bolton Road and Lister Road (£15,000), for T. Fox, Wellington Street (St. John's).

BOWNESS-ON-SOLWAY.—Waterside Rectory; architect.

BURTON-ON-TRENT.—Adaptation of brewery premises for use as market borough surveyor.

CHELMSFORD.—Institute in connection with Baddow Road Congregational Church; Rev. W. H. Pace, pastor.

EXETER.—Baptist Church, Newall Street; J. A. Lucas, architect.

FIFESHIRE.—School at Anstruther (£12,000); clerk, Fife Education Authority, Kirkcaldy.

FOURSTONE.—Renovation of Baptist church; pastor.

GREENOCK.—120 houses, for Corporation; burgh surveyor.

HAMILTON.—Extension work at hospital, for Town Council (£15,000); burgh surveyor. Alterations to 29, Cadzow Street, for Boots, Ltd., chemists and druggists, Nottingham.

INVERNESS.—Renovation of West Parish Church; the minister, Bacon factory, for the local syndicate; James G. Ramsay, secretary.

LANGLEY (Eton).—Extensions to the Actors' Orphanage; the secretary.

LEEDS.—Alterations to fire-engine house, fire brigade station; W. T. Lancashire, city engineer, Municipal Buildings.

LITTLE WOODCOTE.—School for Surrey E.C.; W. Finney, secretary.

LIVERPOOL.—Kinema, Kensington, for James Leslie Greene, 53, Trinity Road, Bootle.

MANCHESTER.—Sewage disposal works for R.D.C.; Thomas and Morgan & Partners, Engineers, 24, Grosvenor Road, Pontypridd.

LONDON (BARNES, S.W.).—Bank, Elm Grove Road and Church Road, for the London Joint City & Midland Bank, Ltd.

(MONTPELIER, S.W.).—Rebuilding the "Jolly Gardeners," for T. G. Lashmar (£7,000 to £8,000); Mr. Humphries, architect.

(WIMBLEDON, S.W.).—Secondary school for girls, for Surrey E.C.; W. W. Finney, secretary (£28,500).

MAGHERAFELT (CO. LONDONDERRY).—Premises and residence, for the Belfast Banking Co.

OLDHAM.—Alterations, "Red Lion Hotel," Bottom-o'-th'-Moor, for Wilson's Brewery (£3,000).

OLD HILL (STAFFS.).—Premises, Plant Street, for Mark Round & Sons, timber merchants.

RAMSGATE.—Conversion of premises, Chatham Street, as boys' secondary school, for Kent E.C.; W. H. Robinson, architect, Sessions House, Maidstone.

RICHMOND-ON-THAMES.—54 houses, for the T.C. Surveyor stores and offices, Water Lane, for the Richmond Lime & Cement Co.

ROCHESTER.—Stores and garage, Charles Street, for West Bros. Alterations, 2 & 4, St. Margaret Street, for S. T. Downs. Machine shop, Blue Bone foundry, for James Hall & Son, Ltd.

ROTHERHAM.—120 houses, for the T.C.; C. A. Broadhead, architect, St. George's Hall.

SHEFFIELD.—50 houses, Stubbin Estate, Firth Park; F. E. P. Edwards, city architect, Town Hall.

STAFFORD.—Alterations at "Coach and Horses Inn," Mill Bank, for Eley's Brewery, Ltd.

WESTON-SUPER-MARE.—20 houses, for the U.D.C.; H. A. Brown, surveyor.

WYOMOUTH.—Alterations to children's quarters, for the B.G.; G. A. Andrews, architect. Extensions to post office, for H.M. Office of Works.



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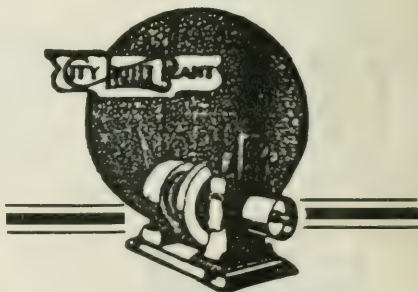
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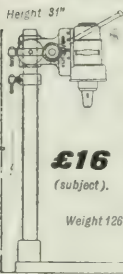
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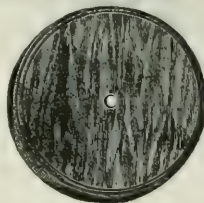
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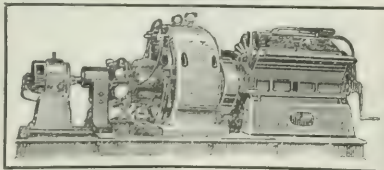
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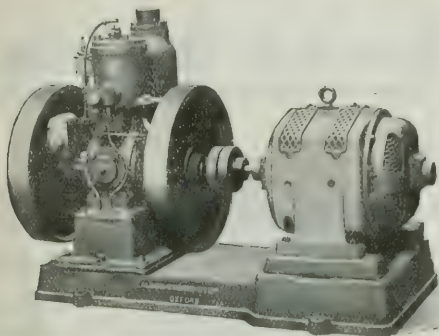
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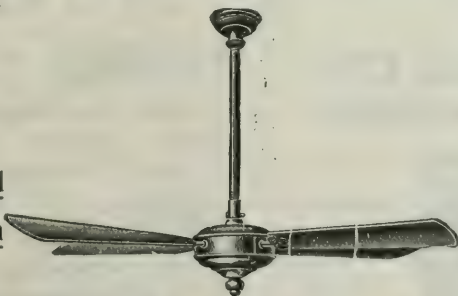
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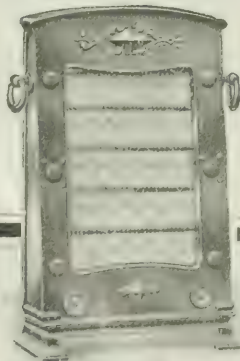
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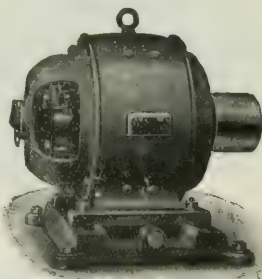
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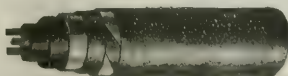
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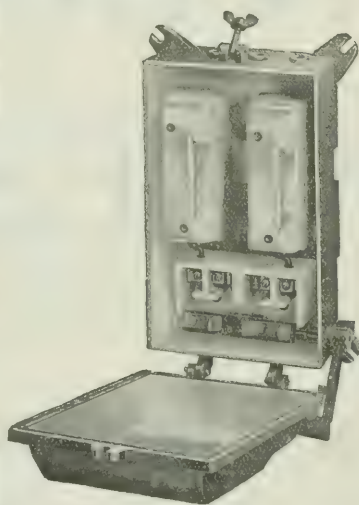
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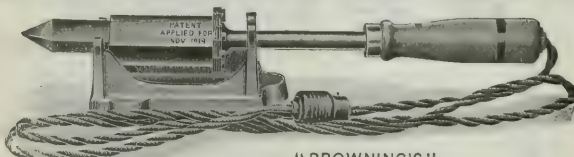
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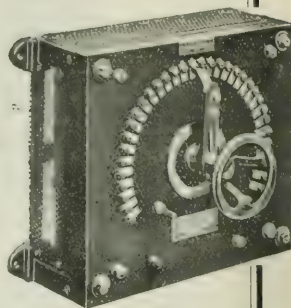
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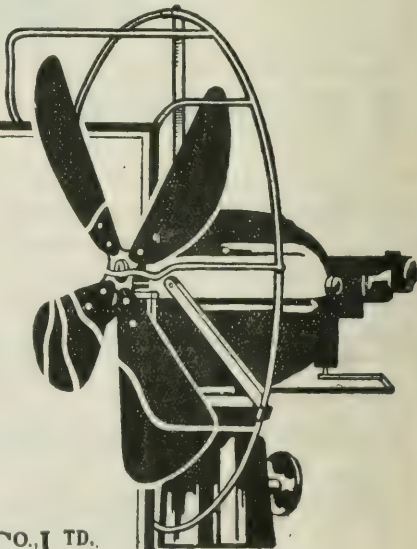
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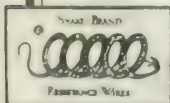


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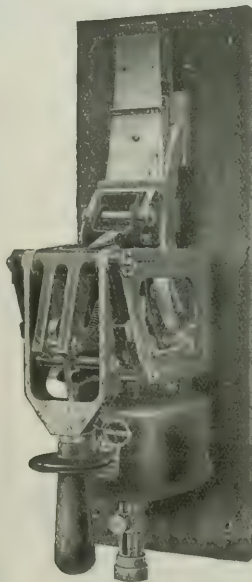
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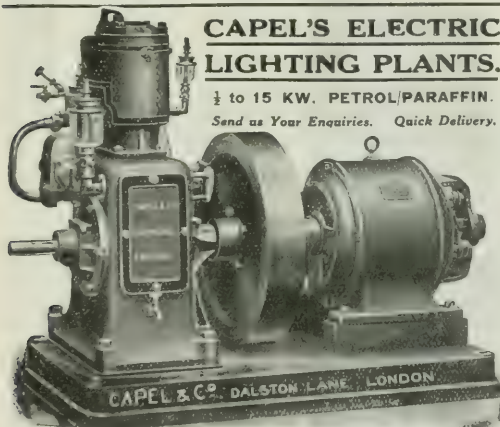
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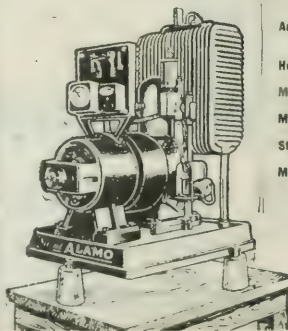
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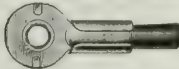
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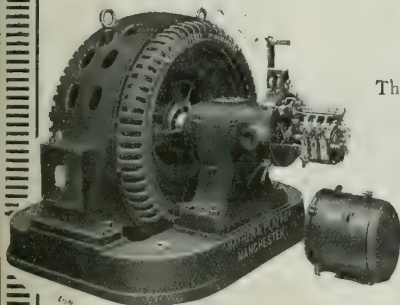
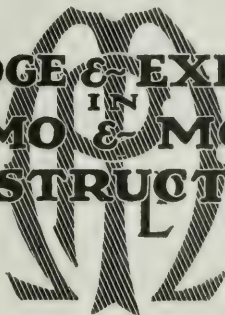
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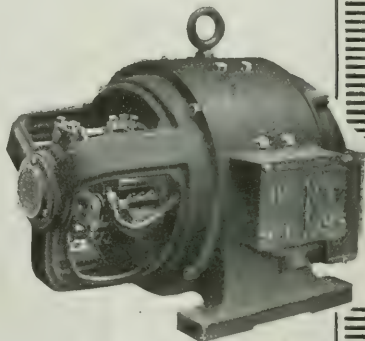
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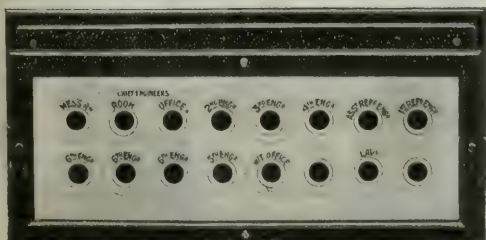
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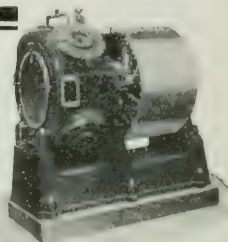
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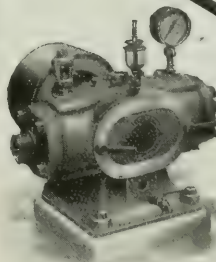
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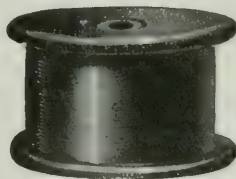
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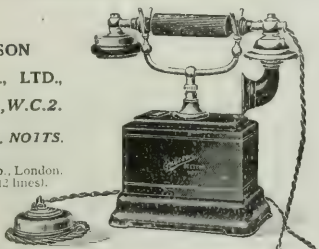
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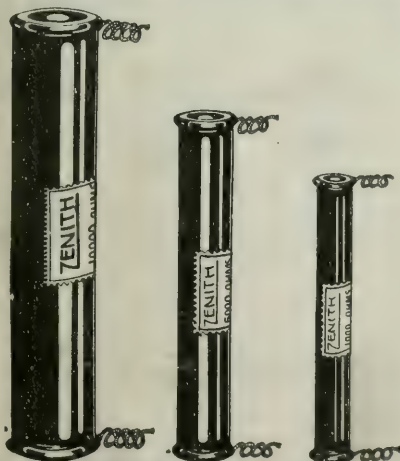
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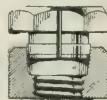
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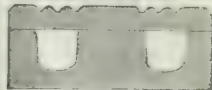
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